LOWER HUDSON
PARTNERSHIP FOR REGIONAL INVASIVE SPECIES MANAGEMENT

2021 ANNUAL REPORT

NEW YORK - NEW JERSEY TRAIL CONFERENCE

LOWER HUDSON PRISM

NEW YORK STATE INVASIVE SPECIES MANAGEMENT

Lower Hudson Partnership for Regional Invasive Species Management

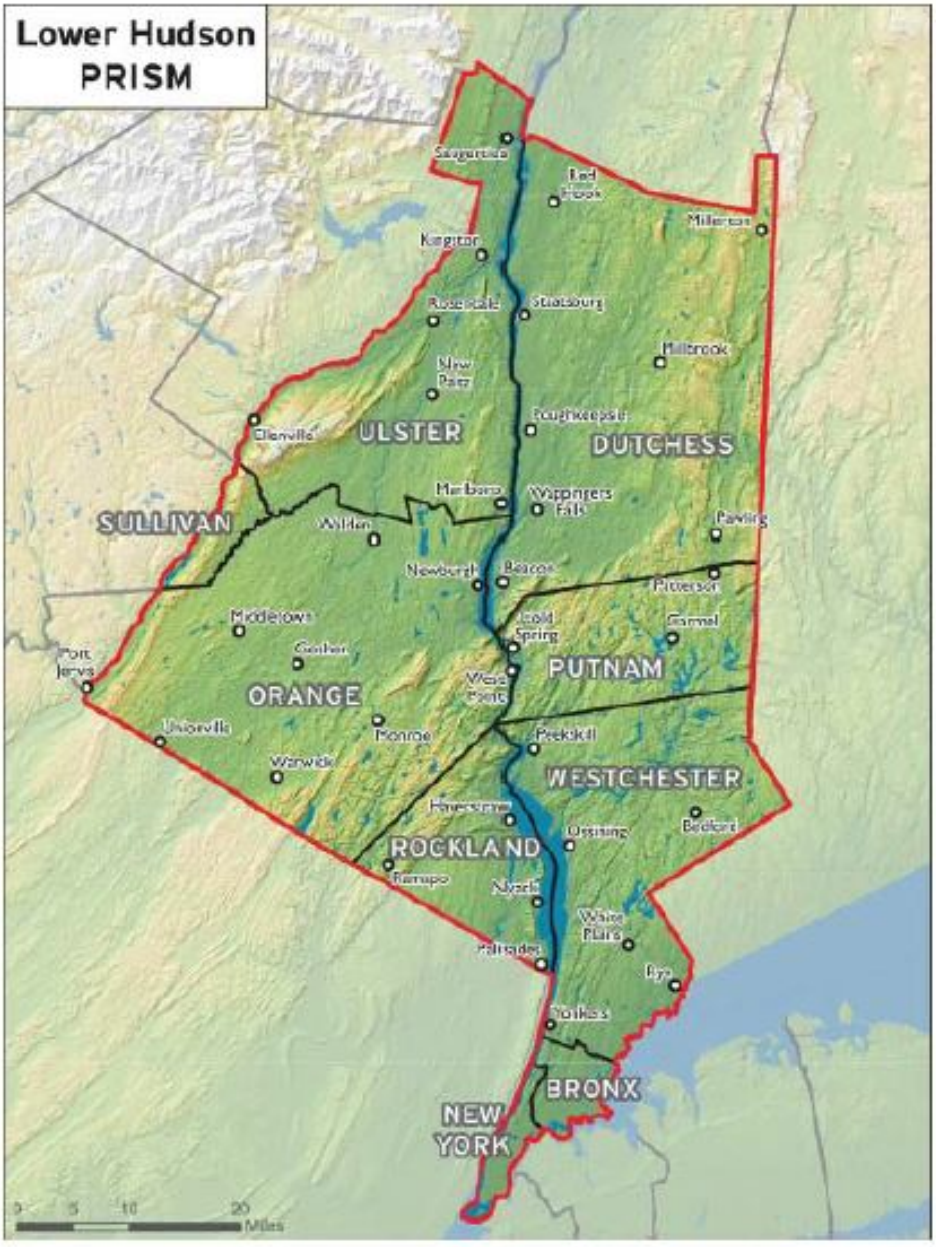
2021 Annual Report

Prepared by:

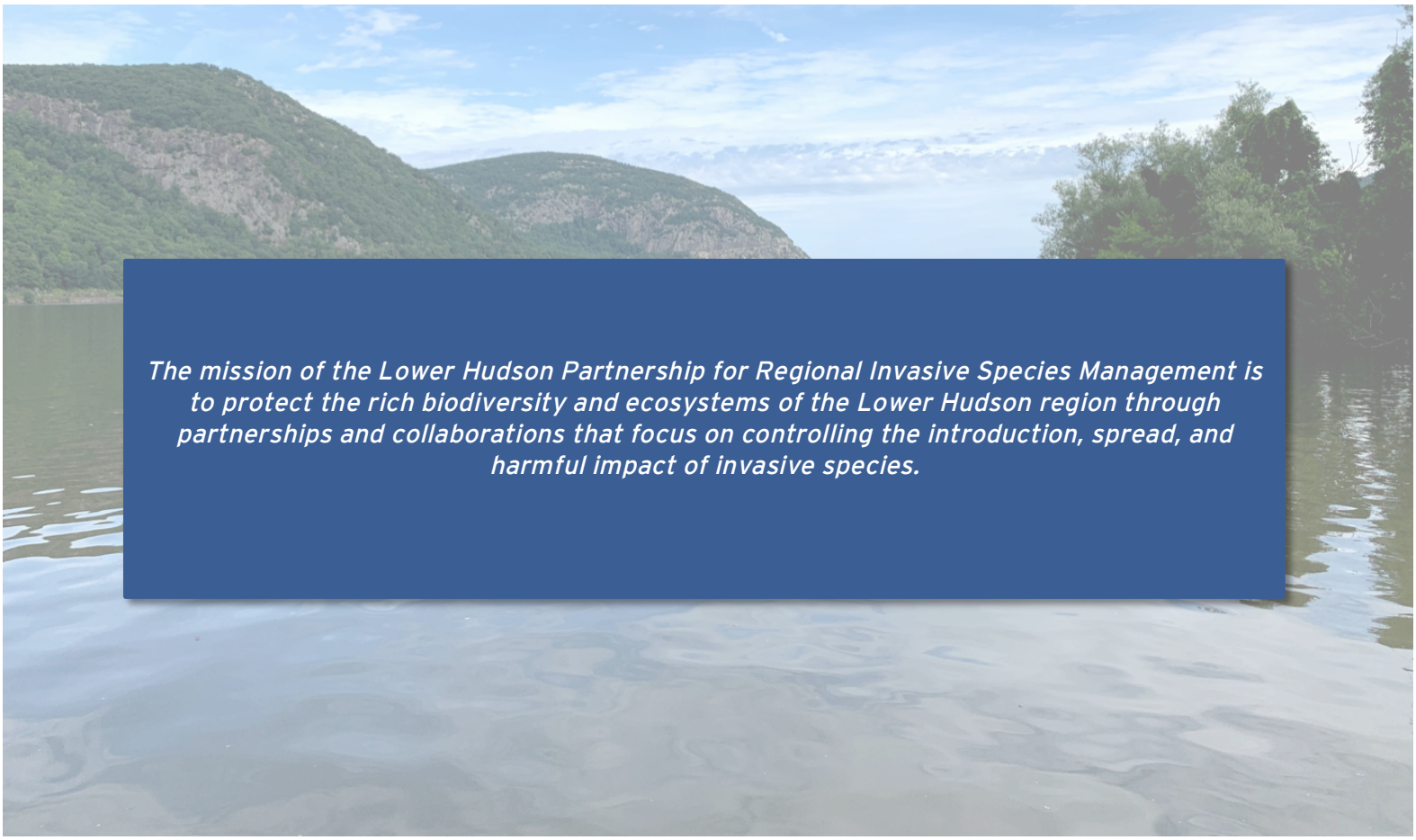
Brent Boscarino _____ Lower Hudson PRISM Coordinator

Ryan Goolic _____ Terrestrial Invasive Species Project Manager

Lindsay Yoder _____ Aquatic Invasive Species Program Coordinator



The Lower Hudson Partnership for Regional Invasive Species Management is hosted by the New York – New Jersey Trail Conference using funds from the Environmental Protection Fund as administered by the New York State Department of Environmental Conservation.



The mission of the Lower Hudson Partnership for Regional Invasive Species Management is to protect the rich biodiversity and ecosystems of the Lower Hudson region through partnerships and collaborations that focus on controlling the introduction, spread, and harmful impact of invasive species.

2021 Steering Committee

Matt Aiello-Lammens, Pace University

Michael Fargione, Cary Institute for Ecosystem Studies

Taro Ietaka, Westchester County Parks

Jennifer Lerner, Cornell Cooperative Extension- Putnam County

Tom Lewis, Trillium Invasive Species Management INC

Linda Rohleder, New York - New Jersey Trail Conference

Keri VanCamp, Vassar College

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SUMMARY OF ACCOMPLISHMENTS

The Lower Hudson PRISM (LH PRISM) network achieved many significant milestones in 2021. As we continued to shift to digital engagement educational initiatives, our LH PRISM YouTube channel received a record number of views (20,000+), more than doubling the previous record set in 2020. While our capacity to deliver high quality digital invasive species educational content significantly increased in 2021, LH PRISM's hands-on volunteer hours of service (17,500+ hours) also nearly doubled this past year relative to 2020. This growth highlights our PRISM-wide efforts to not only educate community members in invasive species issues but to inspire action to protect our region's natural areas.

The Trail Conference's Invasives Strike Force (ISF) set the bar high in 2021 in terms of invasive species surveying, monitoring and management. The Terrestrial ISF Crew removed 101,000 plants across 114 acres of land, all the while engaging 248 volunteers over 11 volunteer workdays. The Aquatic ISF Crew conducted 40 surveys in 30 waterbodies, recording over 1,700 observations of presence, absence, and species density data points. They also removed almost 121,000 water chestnut plants as part of their management program. The crew also participated in the Watercraft Inspection Steward Program, educating ~800 boaters and anglers while performing just under 400 voluntary inspections. The ISF Survey Program not only met the lofty data production standards of the record-breaking invasive plant survey numbers of 2020, but also added a new spotted lanternfly early detection and rapid response initiative to the citizen science survey program offerings in 2021.

Nine LH PRISM subcontracts were awarded in 2021 with specific focus on prioritizing conservation targets, Tier 2 emerging invasive species, spotted lanternfly and spread prevention and education initiatives. Collaborative projects that inspire a shared sense of responsibility in protecting our region's natural areas will continue to shape our programming into 2022 and beyond.

over
20,000
views on LHPRISM YouTube content

196 removal projects on **904** acres

428
workshops, presentations, & outreach events educating over
11,000
people about invasive species

2,608
volunteers who provided
17,541
hours of service

INVASIVES STRIKE FORCE (ISF) PROGRAM REPORTS

ISF Annual Work Summary 1 *Terrestrial Invasives Strike Force Crew*

Boots on the Ground: The Invasives Strike Force Pushes Back Against a Wave of Invaders

The Lower Hudson PRISM's Invasive Strike Force (ISF), hosted by the New York-New Jersey Trail Conference's (NYNJTC) Trail Conference Conservation Corps (TCCC), is an early detection, rapid response crew tasked with protecting terrestrial natural areas through invasive species management. The crew's work is carried out through a variety of means including regional prioritization of management and monitoring of emerging invasive species, protection of conservation targets from the threat of invasive species encroachment, and public engagement to raise awareness of invasive species ecology, management and the value of native habitats. These efforts are coordinated by the Terrestrial Invasive Species Project Manager and made possible by support from fellow staff members, input from project partners, efforts of volunteers, and of course the dedication of the ISF crew. In 2021, the Terrestrial ISF crew completed 35 projects across the Lower Hudson Valley working with 39 different species, of which 18 were Tier 2 (emerging), 9 were Tier 3 (established), 11 were Tier 4 (widespread), and 1 was Tier 5 (watch).

Change is not Always Good: Targeting New Invaders

When a new invasive species is introduced to an area, rapid response measures are critical to management success. The goal of projects working with emerging invasive species is regional eradication so that they do not have the opportunity to become established and widespread as other common invasive species like Japanese barberry, Asiatic bittersweet, and burning bush. The crew worked on management of the following Tier 2 emerging invasives in 2021: hardy kiwi, Scotch broom, incised fumewort, chocolate vine, sycamore maple, paper mulberry, Chinese bushclover, sticky sage, giant hogweed, sapphireberry, pale swallowwort, cutleaf blackberry, kudzu, Japanese snowball, Chinese fountaingrass,

ISF Crew members Joe Radigan and Christian Cifuentes proudly showing off the waste pile of a huge hardy kiwi plant at Vassar Farms. Photo by K. Robinson

small carpetgrass, and spotted lanternfly. Across the 35 total projects taken on in 2021, the ISF crew surveyed 412 acres, managed 114 acres, and removed over 101,000 invasive species.

One particular focal species for the crew in 2021 was invasive sticky sage in Dover, NY. This species has only a handful of known occurrences in the entire United States. Sticky sage has sticky seeds that grow on a tall stalk and are easily transported around by hikers and animals. What makes the infestation in Dover, NY especially troublesome is that the Appalachian Trail runs through it. This historic trail can therefore act as a pathway for invasion to new areas and states up and down the east coast. The ISF crew spent three weeks of their season managing this large 100+ acre infestation, contributing 483 hours to surveying 130 acres, treating 63 acres, and removing over 46,000 sticky sage plants. These efforts were greatly enhanced by the assistance of the Trail Conference's Conservation Dogs team (see page 16), who helped survey for boundaries and find plants in less dense areas.

Is it Really Gone? Monitoring to Ensure Success

Invasive species management requires long-term commitment due to invasive species' ability to overcome adversity and stress as well as recover populations from the seed bank. The Lower Hudson PRISM considers a population locally eradicated once there are no plants found after a minimum of three consecutive visits over a minimum of three years. The ISF crew typically visits sites once a year and monitors the last year's success; if there are plants remaining, they get right to work with management. Though all sites that the crew works at include post-treatment monitoring, there were no plants found at 64 sites that were previously treated in 2021.

Two projects in particular have shown notable success after management. The ISF partners with the New York State Department of Environmental Conservation (DEC) each year to manage giant hogweed and kudzu, two emerging invasive species. Giant hogweed is a dangerous plant; if sap gets on one's skin and then exposed to sunlight, it can produce severe burns. Therefore, management of this species is imperative not only for ecological integrity but also for human health. In 2021, 13 populations were visited and eight had no plants following management (61.5%). Overall, of the 41 known giant hogweed populations in the Lower Hudson Valley, 26 have had no extant hogweed plants reported for at least one year (63%).

Kudzu, known as the vine that ate the south, is notorious for growing extremely quickly in open areas such as forest edges. 35 populations were visited in 2021 and 16 had no plants found (45.7%). Overall, of the 60 known populations in the Lower Hudson Valley, 28 have had no kudzu plants reported for at least one year (46.7%). Invasives management can seem like an uphill battle, but consistent and persistent management utilizing best management practices is the recipe for success.

Protecting the Valuable and Vulnerable: Prioritizing Uninvaded Areas and Conservation Targets

Members of the ISF Crew joined with a group of volunteers to remove invasive plants and to install a boot brush station at a trailhead at Black Rock Forest. Photo: Ryan Goolic.

Though a lot of the effort of the ISF crew is focused on emerging invasive species, they also work to protect healthy native ecosystems, threatened species and critical habitat. Invasive species can swiftly take these areas over if allowed to gain a foothold. The ISF crew worked in the relatively uninvaded areas of Black Rock Forest, Schunnemunk Mountain State Park, and Storm King State Park. The crew helped to install a boot brush station at Black Rock Forest to curb the spread of invasive seeds and fragments in hikers' boots. They also worked to protect threatened species such as the golden northern bumblebee at Croton Point Park, New England cottontail at the Great Swamp, pink lady slipper at Three Arrows Cooperative Society, Virginia bluebells along the Old Croton Aqueduct Trail, and Torrey's mountain mint at High Tor State Park. As native habitats are bombarded by threats from invasive species, development, pollution and other stressors, protecting these valuable and vulnerable species and habitats becomes increasingly important.

In 2021, our Invasives Strike Force also added emphasis on ecological restoration and native plant reintroduction. With the help of volunteers, 23 different species of native plants were grown to be introduced into strategically targeted natural areas. As a result, 1,276 native species were planted at 4 different restoration sites. Three of those sites were in Harriman State Park where a total of 892 native species were planted.

Terrestrial Invasives Strike Force Volunteer Removal Workdays

Once an invasive species arrives to an area and becomes established, an unchecked population can go through an exponential growth phase, leaving managers with dwindling hope for eradication. Management is also very time consuming, labor intensive, and costly. Prevention is the most efficient and effective way to stop the spread of invasive species. Spreading awareness of invasive species issues is a key step towards prevention, which the ISF accomplishes by hosting volunteer workdays. At these workdays, ISF members lead the public in lessons about invasives ecology and management, as well as the importance of healthy native habitats. The workdays also serve to inspire individuals to take action to host their own volunteer workdays in their local communities. Throughout the season, the ISF hosted 11 volunteer workdays in which 248 volunteers contributed over 3,000 hours towards invasives management. With a problem as widespread as invasive species, an all hands on deck approach makes seemingly insurmountable tasks manageable.

The ISF Crew and a group of dedicated volunteers combined forces to remove invasive species at the Great Swamp in Dutchess County, N.Y. Photo credit: Christian Cifuentes.

Corps Member Experience: Training the Next Generation of Environmental Leaders

At the crux of any AmeriCorps program is a great experience for Corps members' personal and professional growth. Our members are trained in a variety of different topics, from invasives ecology and management, to plant identification, data management, mapping, report writing, volunteer management, wilderness first aid, and Leave No Trace. They express their goals one on one with their manager at the beginning of the season and check in for mid and end of season evaluations to discuss progress on these goals, highlight strengths, and acknowledge areas of growth. Cross training is promoted within the Trail Conference Conservation Corps to spark new interests and ideas, and Corps members are encouraged to spend a few days with other Corps teams at the Trail Conference managing aquatic invasives, promoting hiker safety and etiquette, or building sustainable trails. Events like professional development days, one on one resume workshops, and biweekly environmental webinars further boost their development. And no AmeriCorps season is complete without a little fun! Members note their accomplishments and camaraderie at mid and end of season celebrations, filled with crafting and competitive activities. Being a member of the Trail Conference Conservation Corps leaves members with amazing memories and sets them up for success to become environmental leaders in their future endeavors!

ISF Annual Work Summary 2

Aquatic Invasives Strike Force Crew

A Year on the Water with the Aquatic Invasive Species Program

AISF Crew members performing rake toss surveying in Lower Twin Lake, N.Y.

The Lower Hudson PRISM Aquatic Invasive Species Program, hosted by Teatown Lake Reservation, is dedicated to protecting New York's waters through early detection monitoring of aquatic invasive plants and animals, rapid response manual control projects of priority species, and spread prevention through outreach to boaters and anglers with the Watercraft Inspection Steward Program. In 2021, these efforts were led by our AIS Program Coordinator and made possible by the extraordinary teamwork of the seasonal Aquatic Invasives Strike Force (AISF), who each season trade in their land legs for canoes and launch into lakes, ponds, and rivers across the Hudson Valley. In 2021, this powerhouse of a crew made exceptional headway into documenting the distribution of 15 target species, removing thousands of pounds of invasive water chestnut, and preventing the spread of AIS through interceptions at highly trafficked Hudson River launches. In addition, our AIS Program Coordinator partnered on collaborative projects to expand the capacity of the PRISM and participated in regional and statewide working groups to ensure the Lower Hudson region is a critical component in meeting the broader goals of AIS management and yield a more cohesive effort across New York state.

Bridging the Knowledge Gap through Monitoring

From May to September, the Aquatic Invasives Strike Force performs point-intercept vegetation surveys across waterbodies, assessing both invasive and native plant density utilizing the rake-toss method employed by programs throughout the state. Target species include common invaders like Eurasian watermilfoil (*Myriophyllum spicatum),* water chestnut (*Trapa natans*), and curly-leaf pondweed (*Potamogeton crispus*), as well as emerging species like fanwort (*Caroliniana cabomba*), European frog-bit (*Hydrocharis morsus-ranae*), and the dreaded hydrilla (*Hydrilla verticillata*). In 2021, the Aquatic Invasives Strike Force conducted 40 surveys in 30 waterbodies, monitoring over 2,300 acres and recording just under 1,800 observations. They found 11 aquatic invasive species, including several new inland populations of water chestnut. This has important implications for future control projects, as water chestnut can be eradicated if caught early.

In addition to plants, the crew also searches for invertebrates, like zooplankton, clams, crayfish, and snails, and mussels. The crew found numerous previously unrecorded populations of banded mystery snail, as well as one inland zebra mussel infestation, furthering our understanding of the current status of these animals to assist with species categorization in the future. Our AIS coordinator also presented research done in 2020 on Hudson River invertebrates at the 2021 New York Invasive Species Summit.

Righting Wrongs through Management

Water chestnut is a prolific aquatic invader that spreads rapidly once introduced. It forms dense surface mats that reduce sunlight penetration through the water column, shading out submersed aquatic plants, and poses significant risks and challenges for recreational users. It was introduced to New York in the 1800s through the ornamental trade, and by the 1950s the species had made significant headway to being well-established in the Hudson Valley, particularly in the Hudson River estuary. While the Aquatic Invasives Strike Force could never eradicate water chestnut from the region completely, strategic management dictated by two goals, individual population suppression or eradication, can significantly improve the ecosystem function of distinct habitats and provide necessary access for recreational users.

The Aquatic Invasives Strike Force (AISF) Crew had an incredibly productive month of July including removing invasive water chestnut plants from various waterbodies across New York State. Please note that the above numbers represent the July numbers of the overall total of water chestnut removed in 2021 and are reported in wet weight (~5,000 lbs in dry weight).

In 2021, the AISF spent 21 days throughout July manually pulling water chestnut, with the help of more than 40 volunteers. Nearly 500 hours were spent removing a record number (121,000) of rosettes (~5,000 pounds) from 13 sites (11 in July), for a total area of 23 acres managed. Of these 13 sites, five have the goal of eradication due to the size and age of the infestation and potential for complete management. Two of these sites, Putnam County Veterans Memorial Park and Junior Lake, have been managed since 2019 and are predicted to have zero to trace regrowth in 2022 following multiple successful seasons and declines in regrowth in following years. Crew Leader Maya Thompson presented a poster at the 2021 New York Invasive Species Summit on the AISF's water chestnut management efforts and success stories.

Protecting our Resources through Spread Prevention

The LH PRISM Watercraft Inspection Steward Program was initiated in 2015 as an effort to prevent the spread of AIS by boaters and anglers in response to NYCRR Part 576 Aquatic Invasive Species Spread Prevention, a law that mandates that recreational users take "reasonable precautions" to clean, drain, and treat any equipment that comes into contact with public waters in New York. AISF members were stationed at three boat launches on the Hudson River: Sleightsburg Park in Esopus, NY, Riverfront Green Park in Peekskill, NY, and Haverstraw Bay County Park in Haverstraw, NY. They spent 51 days educating 793 users on spread prevention practices using the "Clean, Drain, Dry" slogan adopted by most national programs, and inspected 393 watercraft for AIS. They intercepted invasive species during 11 inspections, including water chestnut, Eurasian watermilfoil, and brittle naiad. Overall, 89% of boaters participated in inspections, with 87% of users committing to inspect their own boats for AIS when a boat steward is not present. One of the most encouraging responses from boaters was their habits regarding taking spread prevention measures prior to launching. In 2021, nearly 90% of boaters stated that they had taken preventative measures, which is up from 46% in 2020. This highlights that Hudson River boaters understand their responsibility for stewardship of New York's waters and that the watercraft inspection steward programs across the state may have been a major contributor.

AISF Crew leader, Sudha Petluri, performing one of 393 watercraft inspections that were completed in 2021.

Aquatic Invasives Strike Force Education and Outreach

Educating the public on the impacts of aquatic invasive species and encouraging community science participation through species identification training is essential to strengthening our collective effect on AIS management throughout the region. In addition to AISF Crew's video series "Species in 60 Seconds" (which has nearly 2,000 views on Instagram), our AIS Program Coordinator hosted presentations for environmental clubs, lake associations, and Teatown community members, informing 78 participants of AIS impacts and identification. The AIS Program also collaborated with the American Canoe Association, Adirondack Mountain Club, and Appalachian Mountain Club group camps at Lake Sebago in Harriman State Park to establish a strategy for how

their community can better assist with AIS management on their home lake, which hosts a public boat launch. Through a management strategy session, volunteer survey training, and a pilot Watercraft Inspection Steward Program, the LHPRISM and Lake Sebago stakeholders were able to lay the critical groundwork for long-term management initiatives.

During the pilot program, trained volunteers surveyed boaters and inspected 82 watercraft on a single day at Lake Sebago. Of those boaters, 66% had never encountered a steward before and only 51% took preventative measures against AIS. 4% of inspections resulted in AIS interceptions, specifically of the Tier 2 species, fanwort. This data highlighted the importance of expanding boat steward programs into inland lakes, where users are generally less experienced and less aware of AIS.

ISF Annual Work Summary 3 *Citizen Science, Education and Outreach*

Inspiring Stewardship through Citizen Science, Education and Outreach

The LH PRISM's Invasives Strike Force (ISF) citizen science program began as a way to survey, design and implement best management practices to control the rate of spread of invasive plants in natural areas of the Lower Hudson PRISM region. What started as an invasive plant survey initiative in 2013 has since grown into a robust volunteer engagement program with a wide variety of opportunities for community action. There are two main types of ISF citizen science volunteers: (1) surveying volunteers who survey trails and surrounding lands for invasive plants and, more recently, forest pests, and (2) removal volunteers who work to manually remove invasive species in these areas. Our Invasives Strike Force programs also engage the public in invasives species awareness and spread prevention messaging through hosting educational events, webinars and workshops.

Altogether, our LH PRISM staff engaged a total of 559 volunteers who dedicated close to 8,000 hours of work towards protecting our region's natural areas in 2021. This included running 39 workshops, webinars and other training events that reached over 1,700 live participants, collectively totaling more than 2,000 hours of volunteer training time in 2021. In addition, we also created 26 new educational videos that were produced as on-demand training videos that received over 20,000 views on YouTube in 2021 for an additional 2,000 hours of viewed content by our volunteers this past year.

The successes and synergies of our Invasives Strike Force (ISF) programs highlight the benefits of a community-based and early detection-focused approach to invasive species management towards improving the ecological integrity of our region's natural areas. The below subsections highlight some of the major volunteer initiatives the ISF took on in 2021 in addition to the education and outreach initiatives already outlined for the ISF and AISF Crews in Sections 1 and 2.

Spotted Lanternfly Early Detection and Rapid Response Efforts

The spotted lanternfly (SLF, *Lycorma delicatula*) is a colorful insect in the planthopper family that congregates in large numbers to feed on the sap of trees. SLF arrived in Pennsylvania in 2012, likely by hitchhiking on stone shipments from eastern Asia, and has since expanded its population range to portions of New Jersey and most recently New York State. SLF feeds on over 70 different species of plants, including some of New York's most iconic native trees and economically important agronomic crops such as hops, grapes and apple trees. Lower Hudson PRISM staff (in collaboration and consultation with New York State Department of Agriculture and Markets and other state agencies and partners) were very busy developing and implementing an SLF early detection and rapid response plan for the Lower Hudson PRISM region in 2021.

Volunteers Larry Vail and Lucy Jickling checking SLF traps in Orangeburg, N.Y.

In 2021, LH PRISM staff launched the "Spot the Spotted Lanternfly" Early Detection Survey Program which involved creating and running five, 1.5-hr. training workshop webinars and one other educational video as part of the Invasives Strike Force EcoQuest Challenge Program to train interested volunteers in SLF ecology, ID and reporting. These webinars were designed to supplement the ongoing digital training efforts by the iMapInvasives team, with guidance from the NYS Department of Environmental Conservation (NYS DEC) and Department of Agriculture and Markets (NYS DAM). Over 150 volunteers attended these training workshops in our region for a total of 204.5 volunteer hours dedicated towards digital training. These workshops were also uploaded to our LH PRISM YouTube channel and made available to interested volunteers as on-demand trainings, receiving an additional 481 views on YouTube for an additional watch time of 75 hours.

Trail Conference Conservation Corps members, LH PRISM staff and a group of dedicated volunteers and community partners were instrumental in obtaining treatment permissions from landowners and in helping to clear invasive plants and brush to make way for the installation of insect traps and more efficient ease of pesticide application. The Trail Conference's Conservation Dogs team helped delineate the borders of currently known infestations so that our treatment plan could move forward with greater accuracy. Altogether, LH PRISM staff, volunteers and community collaborators installed 166 circle traps in known infestation areas, held 12 SLF-specific volunteer work days, and employed 134 volunteers who dedicated 854 hours to surveying for SLF across 289 distinct locations in the greater metropolitan area. Between trap checking and reporting plus targeted squashing efforts, our volunteers and staff helped remove close to 9,000 adult and young spotted lanternflies and scraped over 700 egg masses in 2021. In addition, LH PRISM partner, Trillium Invasive Species Management, performed strategically targeted insecticide treatment of over 500 host trees across each of these sites to further curtail the population and prevent spread.

Invasives Strike Force Plant Survey Program

Invasives Strike Force volunteers help collect information on the diversity and abundance of invasive plants found along the trails in our region's forested parklands and surrounding natural areas. New surveyors learn to identify 14 common invasive species to identify and report (ISF-Standard Survey) while more experienced surveyors learn to identify a set of 11 emerging invasive species (ISF-Intermediate Survey). Most assigned trail sections are 1-2 miles in length and the surveyors have from the time they are trained until the end of October to submit their data to LH PRISM staff for processing.

ISF Survey volunteer, Claudia Esker, recording invasive plant survey data along a trail section in July 2021. Photo credit: Thea Landesberg

In 2021, 122 volunteers attended three live-streamed ISF Plant Survey workshops that were offered in addition to those who viewed the trainings on demand (1,145 views on our YouTube channel). Of the 150 volunteers who ended up taking on a survey assignment in 2021, 48 were new to our survey program. The total survey completion rate was 86% (142 out of 165 assignments). This equated to greater than 242 miles of trail surveyed, approximately the distance between New York City and Washington, D.C. One particular highlight of 2021 was how many of the volunteers laddered up to report not only the 14 common invasive species but also the Tier 2, emerging invasive species as part of the ISF-Intermediate survey (49 of the completed surveys included emerging species). These hours and committed efforts are on par with the record-breaking production of the 2020 survey season.

Volunteer surveyors also completed 54 block assignments in 2021 as part of our ISF-Blockbuster survey program (which targets an additional 10 emerging invasive species beyond the Intermediate-level focal species). This total annual block completion is the highest in the program's history and closed out all available blocks in Orange County. The Blockbuster survey is designed to help fill critical data gaps in our PRISM survey region not only by expanding the number of emerging invasives surveyed, but by targeting and comparing invasive species diversity and abundance in highly probable areas, trailheads and undisturbed natural areas. Data from the Intermediate and Blockbuster-level surveys help to drive the management decisions and priorities of our Terrestrial ISF Conservation Corps Crew and other early detection/rapid response-focused management initiatives throughout the LH PRISM region. It was inspiring to see such a large number of volunteers not only take on a survey assignment this past year but feel confident and enthusiastic enough to take on learning and reporting on emerging species, especially given the unique challenges of volunteering and training for the program during a pandemic. This is a testament not only to our volunteers' level of dedication to protecting the lands they love, but also the efforts we collectively put into recruiting, creating engaging digital educational resources and live-streamed training workshops, and generating a buzz for our citizen science programs in 2021.

Invasives Strike Force EcoQuest Challenge Survey Program and iMapInvasives Reporting

The growth and expansion of our ISF EcoQuest Challenge Survey Program was also particularly noteworthy and impressive in 2021. The EcoQuest Challenge is a monthly scavenger hunt-style survey program which encourages citizen science volunteers to utilize the mobile app, iNaturalist, to track the distribution of a focal invasive species in a given month in natural areas across our LH PRISM region. In 2021, we emphasized emerging invaders as our primary featured species and we strategically selected those species that showed distinctive phenology markers for that given month. There are currently 237 volunteers registered for the ISF EcoQuest Challenge. Each volunteer receives monthly field ID videos that are filmed and distributed by our staff and feature the focal species for the month. These videos continue to be popular on YouTube receiving 1456 views on our LH PRISM channel. Our volunteers posted 789 observations of our focal species in 2021, with yellow flag iris receiving the most posts last year (201 observations). iNaturalist observations contribute to our early detection efforts in areas not typically covered by our ISF Standard and Intermediate surveys such as in people's backyards or in open spaces that are not along our trail systems. In addition, these photographs provide important visual evidence of the timing of certain phenophases that we can continue to monitor from year to year. The iNaturalist posts from our EcoQuest ultimately get migrated over to iMapInvasives for bulk uploading once the full complement of months is curated and vetted. In 2021, close to 9,000 observations were submitted to iMapInvasives by Invasives Strike Force volunteers alone! See pages 18-19 for further iMapInvasives numbers posted by LH PRISM staff and partners.

ISF Annual Work Summary 4

Conservation Dogs Program

The New York-New Jersey Trail Conference Conservation Dogs Program (NYNJTC CDP) deploys highly trained dog and handler teams that help support Lower Hudson PRISM's Invasives Strike Force program in protecting the ecological integrity of Hudson Valley native habitats through invasive species detection and monitoring. The Conservation Dogs' year began with fieldwork as part of a collaborative research project with Cornell University, NYS DEC and Working Dogs for Conservation. The study's objective was to investigate whether dogs or humans are better at detecting spotted lanternfly egg masses in vineyards and in the surrounding natural areas as well as understand the factors that influence their occupancy within these sites. The results from this study will help invasive species managers choose the best early detection tools at their disposal

Conservation Dogs Program team members, Arden Blumenthal (in green), Josh Beese (in gray) and Fagen (Belgian Malinois) join forces with New York State Department of Agriculture and Markets inspector, Karen Wilson (in yellow) to survey for spotted lanternfly. Photo credit: Nyssa Calkin

which will optimize searches and rapid response treatments and delay negative impacts to forests and agriculture.

In spring, invasive species survey and management efforts continued for several of the invasive species that the program has worked on in the past two years as part of a three-year grant from NYS Department of Environmental Conservation. These species include Scotch broom, sticky sage, and kudzu. In addition to these species, program staff taught two dogs how to identify two new plant species: Asian bushclover and crested late-summer mint. In fall, the CDP Coordinator was able to add another working dog to the team. The addition of Labrador, Peat, was integral to reaching program goals because dog/handler teams could be deployed simultaneously on different projects. In total, the dogs surveyed 124 acres, traversed 60 miles, and helped remove 1,086 plants.

In addition to invasive plants, the Conservation Dogs Program has played a key role in the state's spotted lanternfly response which was partially funded by NYS Department of Agriculture and Markets (DAM). The team searched 20 sites over 26 days for 93 hours. The dogs made 312 positive detections, helped find egg masses left behind after removals, and delineated new infestation areas after reported sightings. Staff handlers have been a critical communication channel between the Trail Conference and DAM staff in the field and have led outreach events using the dogs as ambassadors.

Towards the end of the year, the program took a special training trip to Ithaca to brush up on their skills detecting oak wilt. They plan on using this maintenance training in 2022 to survey multiple sites in New Jersey and New York. In 2022, the program will continue spotted lanternfly egg mass surveys in partnership with NYS DAM, with the support of USDA APHIS. Thanks to private donations and small grants from various partners, the program has plans to expand the use of the conservation dogs to target native rare/threatened/endangered species to improve the specificity of habitat restoration and invasive species removals.

Conservation Dogs Program Coordinator, Arden Blumenthal, in training with Peat, the newest member of team. Photo credit: Nyssa Calkin

Partner Work Summary 1

LH PRISM Partner Metrics

LH PRISM Partners and Meetings

To maintain and grow our organizational structure during the pandemic, we put heightened attention on keeping our current partners active and engaged while working to reach out to prospective new partners and grow our membership. In 2020, we added a record number of new partners to our group (8) and in 2021 we added one new partner, Mohonk Preserve, to bring our total number of partners to 57. We held a total of 5 PRISM partner meetings in 2021 and over a dozen working group meetings to allow for detailed conversations and strategic planning on priority issues in our PRISM. Active working groups in 2021 included: Education and Outreach, Metrics, Trailhead/Bootbrush Station, Aquatics, Species Categorization, Priority Conservation Area, among others.

Partner Education and Outreach Metrics

In 2021, Lower Hudson PRISM partners found creative and innovative ways to engage volunteers and community members in education and outreach across multiple digital formats and through limited in person events. In addition to events led by LH PRISM staff that were reported in the previous sections of this Annual Report, LH PRISM partners held another 389 education and outreach oriented events in which invasive species were the primary focus. These events collectively reached over 8,700 participants, with over 2,000 additional participants who were trained as volunteers (either in surveying or removal work). Six of these trainings were specifically focused on iMapInvasives with 134 volunteers becoming iMap-trained in the Lower Hudson PRISM region in 2021. Altogether, our LH PRISM contributed over 12,500 iMap records in 2021, with 11 species confirmed as new to whatever county they were reported in. LH PRISM led the way with the total number of detected and not detected records in 2021 (7,981 total observations entered), more than doubling the contributions of any other PRISM with the exception of the Adirondacks partnership which posted just under 7,000 observations.

The inter-PRISM Education and Outreach Committee created a promotional video to launch New York State Invasive Species Awareness Week

Of special note in 2021 were LH PRISM's contributions to iMapInvasives' spotted lanternfly grid square reporting campaign. LH PRISM claimed 97 of the 281 claimed squares across the state (~1/3 of all claimed squares and more than triple those claimed by any other PRISM). This citizen science-led effort contributed 140 out of the 183 SLF detected records in the state as well as 226 not detected records. Our volunteers also submitted over 400 detected and not detected tree of heaven reports to iMap this year as part of this mapping project.

LH PRISM Facebook page engagement remained on level with previous years. We currently have 629 annual Facebook followers with our reach and total post impressions surpassing 10,000 each last year. In 2021, we posted 98 times to our Facebook account and received 97 daily new likes and garnered 854 engaged users. In addition to our Facebook presence, we also communicate with our volunteers about upcoming events, LH PRISM highlights and accomplishments through our monthly newsletters which are sent out in the first week of each month. This invasive species-focused newsletter has 2,781 subscribers who totaled 7,318 opened newsletters in 2021.

We also had a very successful New York Invasives Species Awareness (NYISAW) week this year. Invasive Species Citizen Science Program Coordinator, Brent Boscarino, served on the statewide inter-PRISM Education and Outreach Committee as well as the NYISAW Committee. These working groups consisted of education and outreach representatives from each PRISM and NYS DEC, New York Natural Heritage Program and other state agency and park representatives, among others. LH PRISM NYISAW messaging reached 997 Facebook followers leading to 107 engaged users. LH PRISM staff were responsible for leading 4 invasive species removal events with 43 volunteers and 3 educational events that had 50 participants. LH PRISM partners led 6 other in-person invasive species-related events in our area attended by close to 70 more participants.

Management and Monitoring Metrics

The LH PRISM supports and optimizes regional conservation through strategic invasive species management. The strategies for achieving this goal include prioritizing the management of Tier 2, emerging invasive species and those that threaten critical habitat and rare or endangered species, following an early detection and rapid response model. In addition to the Invasives Strike Force work projects outlined in previous sections of this Annual Report, LH PRISM partners engaged in at least 161 removal projects in 2021, 99 of which targeted Tier 2 species. This work was carried out across 768 acres of land and water. Additionally, LH PRISM partners monitored 634 acres of previously treated sites to evaluate management success. The Trail Conference's Invasives Strike Force Crew helped to assist partners in completing invasive species management projects with conservation targets and/or rare species: Great Swamp (New England cottontail), Mianus River Gorge (uninvaded wetlands), Old Croton Aqueduct (Virginia bluebells), Three Arrows Cooperative Society (pink ladyslipper). Some notable success stories from our partners are highlighted in the section below.

Partner Work Summary 2

LH PRISM Partner Success Stories

Teatown Lake Reservation

In 2020, Teatown Lake began an experimental restoration project on one of the most heavily invaded parcels on their reservation. The site is found along a road edge and had dense wisteria, honeysuckle and tree-of-heaven. Tree-of-heaven was cut and treated in 2020 but the bulk of the restoration work was done in 2021. Teatown staff, partners and volunteers helped remove and treat hundreds of wisteria vines and planted over 120 native oak saplings and over 3000 native groundcover plugs. This process involved many different volunteer groups and individuals that adopted the site. At the end of the 2021 season, Teatown hosted a walk-through of the site to share their successes with other PRISM partners. This site will be used as a model for other restoration work that Teatown plans at heavily invaded sites in the future.

Before (left) and after (right) photos of a restoration site at Teatown Lake Reservation. Photo credit: Rebecca Policello

Cary Institute

On June 2, 2021, Cary Institute of Ecosystem Studies hosted "Saving Our Trees: Preventing Imported Forest Pests", a virtual panel discussion moderated by journalist Gabriel Popkin that featured Faith Campbell from the Center for Invasive Species Prevention, Susan Frankel from the USDA Forest Service, and Gary Lovett from Cary Institute. During the panel discussion, listeners submitted questions that came up. Due to time constraints, not all were answered live. The panelists collaborated to address these questions; their helpful and informative responses can be found at: https://www.caryinstitute.org/news-insights/feature/imported-forest-pests-experts-answer-questions (see LH PRISM subcontracts section for more details).

Westchester Land Trust (WLT)

WLT's biggest success story was the mapping of 15 acres of beech stands across the Zofnass Family Preserve with the intention of proactively managing these areas as beech leaf disease spreads. Beech tree decline due to BLD is a worrisome issue in the Lower Hudson PRISM landscape and WLT is hopeful their efforts in proactive surveying and management will yield positive outcomes for forest recovery. This work involved WLT's two summer interns (with the work funded by LH PRISM) and was a good learning opportunity. The summer interns also created a video for the public, in which LH PRISM was tagged, explaining the threat of beech leaf disease. In 2022, WLT hopes to begin work removing invasive shrubs and promoting growth of native seedlings in these stands.

Greenburgh Nature Center (GNC)

Greenburgh Nature Center has been determining the types and population sizes of the many invasive species found on site. By engaging interns and Boys and Girl scouts, , small areas of the GNC property are being monitored after native planting has occurred. GNC has also been quantifying the rarer plants found on the property and are working on a way to combat the giant English Ivy "desert" that exists in the GNC's forested areas. Strides have been taken to create an invasive management plan for the organization that can begin being implemented in 2022.

North Salem Open Land Foundation (NSOLF)

One of the biggest success stories of the 2021 field season was the addition of a new restoration site on the preserve where NSOLF headquarters are located. This site is a wet meadow located between a pond and a large wetland that was becoming overwhelmed with invasive species. After surveying and preliminary control efforts, NSOLF installed over 40 native trees and shrubs to increase biodiversity at this site. NSOLF developed a management plan for the long-term success of this project and established a multi-year approach to continue rehabilitation and planting efforts as well.

Volunteers planting native shrubs and trees at the North Salem Open Land Foundation Weil Preserve Pond. Photo credit: Jocko McKean

Van Cortlandt Park Alliance

Van Cortlandt Park is a 1,146-acre NYC park located in the Bronx. Roughly 640 acres of this is park dedicated as a "Forever Wild Preserve", a designation in the city. During 2021, the team at Van Cortlandt Park Alliance embarked on the creation of a Forest Action Plan for the organization for 2022-2026. The Forest Action Plan provides the foundation for invasive species management within roughly 200 acres over the next five years of the 640 acre preserve and outline the worksites and project goals and objectives. It is a great step towards managing a healthy urban forest within Van Cortlandt Park.

Locust Grove Estate

Locust Grove Estate worked on integrating invasive species identification (and clarifying disposal methods) into their regular work with a volunteer gardening crew that typically focuses on the estate's ornamental and woodland gardens. Because Locust Grove is a historic garden with many ornamental shrubs and forbs planted in the early 1900's, they have a number of species that staff and volunteers are gradually removing and replacing with native plants. The biggest successes were preventing many invasive species from going to seed (or containing spreading patches) in 2021 through strategically timed weeding and cutting back of vines. Locust Grove staff documented this timing and are now better able to schedule and plan invasive plant removals for 2022. The organization now has a small group of volunteers with stronger plant ID skills and have learned to separate weeding projects that can be composted from those that cannot in order to focus on invasive plants more efficiently.

Friends of the Old Croton Aqueduct (FOCA)

Within the context of the pandemic, FOCA managed to host an expanded 9th annual I Love My Parks Day on the Old Croton Aqueduct by arranging to have eight separate locations from which volunteers could choose from spanning the Croton Dam in Croton-on-Hudson to Yonkers. FOCA recruited local community members to work at each site, provided experienced crew leaders and tools, and educated the volunteers who then enthusiastically attacked the invasive species with their newfound knowledge and also made a commitment to remove invasive plants and plant native species on their own properties. 169 volunteers participated during the May 1 event. A blog was posted about it on the Friends of the Old Croton Aqueduct website which thanks all the wonderful partners who helped contribute to the efforts in addition to highlighting the day's actiivites: https://aqueduct.org/news/i-love-my-park-day-may-1-2021-old-croton-aqueduct. A small native plant garden was established in the section of the Aqueduct trail which had previously been the target of significant invasive removal efforts. Trail walkers have been weeding and watering this area so that it continues to flourish.

Volunteers coming together to participate in I Love My Park Day with Friends of the Old Croton Aqueduct

Hudson Highlands Land Trust (HHLT)

Thanks to PRISM identification training, HHLT staff discovered beech leaf disease (BLD) on the Granite Mountain Preserve in Putnam Valley. This was the first observation of BLD in Putnam County. Two LH PRISM-supported interns were then able to map the extent of the BLD infestation along the 5-mile trail system at Granite Mountain. They created an educational video for the public and presented information to the Putnam Valley Committee for the Conservation of the Environment, while HHLT staff teamed up with PRISM staff to share information with a local journalist on how to share new observations of BLD with the Department of Environmental Conservation. Though never a positive experience to find a new invasive species, HHLT is proud to be a part of the research and education process that allows our community to contribute to scientific knowledge and management solutions (see LH PRISM subcontracts section).

Pound Ridge Land Conservancy (PRLC)

PRLC restored a half-acre area of property into a native meadow. This area had been a dense monoculture of Japanese barberry that PRLC removed the previous year. In its first year of growth, PRLC has inventoried 40 native plant species growing and continue to remove invasive species that re-emerge. With the help of volunteers and Trail Conference Invasives Strike Force, nine boot brush stations were at local trailheads to mitigate the spread of invasive species and to educate visitors. This boot brush station project was contracted by the LHPRISM and greatly increased the impact of community outreach in Pound Ridge (see LH PRISM subcontracts section).

NYC DEP

NYC DEP initiated a long-planned full-scale treatment program for hydrilla control in New Croton Reservoir. This was the first year of treatment of 250 acres of the shallow shoreline area of the reservoir, which is a terminal, filtered, water supply reservoir that serves portions of the City of New York and other communities in the Hudson Valley. The survey results indicate a decrease of hydrilla present from 40% to 30% of survey sites. Additionally, tubers were virtually absent in the shallow water shoreline areas where cores were surveyed. Project partners overcame many obstacles to get this project off the ground and are very happy to have these results despite a challenging start to the project.

Preparing for the treatment of hydrilla in the New Croton Reservoir. Photo credit: Meredith Taylor

NYC DEP Forestry program (Carmel, NY)

The most significant successes of 2021 were NYC-DEP's efforts to monitor and prevent spotted lanternfly on DEP land. The Forestry Program formed a partnership with NYS Department of Agriculture & Markets (facilitated by Meredith Taylor) to complete 13 survey blocks on DEP land in Westchester County, near to a confirmed population at Westchester County Airport. As part of efforts to reduce SLF habitat, project partners treated tree-of-heaven populations at 4 properties in Westchester County, and 1 property in Putnam County. These tree-of-heaven reduction efforts not only reduce SLF

host trees, but aid DEP efforts to improve the ecosystem health and productivity of the NYC watershed forest.

New York Restoration Project

After multiple tropical storms ripped through NYC in 2020, sections of the Highbridge Park forest were left with large canopy gaps. The steep, rocky forest floor was full of vine honeysuckle, multiflora rose, wineberry and other invasive species (amongst thousands of pounds of construction dumping and household garbage). In Winter of 2021, the New York Restoration Project decided to manage these invasives, limb the downed trees, remove the litter and reforest roughly 3 acres of this area. In Spring of 2021, with the assistance of a corporate volunteer partner, NYRP planted 186 native trees and shrubs (ranging over 13 species), administered a native steep-slope grass seed mixture with perennial wildflowers and spread mulch throughout the entire site. NYRP plans to continue managing the invasives and monitoring the health of the newly planted trees in this area, as well as all 53 acres of the Highbridge forest that NYRP oversees.

Mianus River Gorge (MRG)

For several years, the Mianus River Gorge has been trying to eradicate mile-a-minute (MAM) from several sites. One site in particular has three 1-acre fields, each infested with MAM. Over the past several years, MRG has had volunteers, interns, and staff members pulling invasives from the property, and while progress has been made on some species, the MAM has come back strong every year. This past year, MRG determined that the fields were so heavily infested with MAM that they decided to try a new approach and start over. In the winter time, an excavator was used to remove the remaining large invasive shrubs and dying trees. In the spring, once the fields were cleared from debris, LH-PRISM partner, Trillium Invasive Species Management, used ATV sprayers to spray glyphosate on the fields. After waiting a few weeks for the fields to die, a tractor was used to rake and harrow the fields for planting. A mixture of native grasses and oats were then spread into the fields. MRG was very pleased to find that the MAM was almost entirely eradicated from 2 of the 3 fields, with significantly less MAM in the 3rd field than in previous years. Additional seed was spread this winter in the patchy areas and the hope is to completely eradicate MAM from the fields in the next few years.

Mianus River Gorge (MRG) area overrun with mile-a-minute weed. After years of hand pulling, MRG used an excavator in the area and reseeded with native plants. Photo credits: Budd Veverka

Bronx River Parkway Reservation Conservancy (BRPRC)

BRPRC vinecutting volunteers concentrated on an area of the Bronx River Pathway from Fisher Lane in North White Plains to Virginia Rd. in Greenburgh, a half mile stretch encompassing 3 exits on the BR Parkway. Hundreds of volunteer hours over a dozen program volunteer days resulted in saving over 200 trees from invasive vines. Another effort involved surveying/monitoring a Tier 2 invasive, *Corydalis incisa* in conjunction with staff and students from Iona College. Approximately 2 acres were surveyed.

Mohonk Preserve

Vegetation Field Technician, Ralph Green, estimating percent cover of Spotted knapweed (Centaurea stoebe) within a transect quadrat in Mohonk Preserve grassland. Photo credit: Megan Napoli

Mohonk Preserve is just starting to plan on how to manage invasive species on their property. To start this journey, in 2021 Mohonk joined the Lower Hudson PRISM partnership. As monitoring almost always precedes management, Mohonk has commenced multiple surveys in an effort to record species composition, abundance, and frequency in the preserve's forests, grasslands/old-fields, and riparian areas. In the forests, through Mohonk's Forest Health monitoring project, staff have helped to establish 38 permanent 15x15 meter plots that are sampled every four years with the goal to measure species composition, structure and health; woody plant regeneration; and soil health over time. In the grasslands/old-fields, Mohonk has completed monitoring in five out of six areas by establishing transects to record species composition and percent cover. For riparian areas, Mohonk has established a Community Science program called Stream Watch, which utilizes volunteers to monitor water quality, aquatic invertebrate composition/abundance, and vegetation composition. Volunteers from one of the Stream Watch sites on the Coxing Kill have begun removing Japanese knotweed by hand-pulling. The first effort was in May 2021 and with the help of 15-20 volunteers they were able to remove all mature plants. This eradication effort will continue in 2022. Mohonk also has established projects through the iNaturalist platform to encourage all Preserve visitors to participate in species monitoring. Program staff gave an educational webinar on iNaturalist (how-to guide, importance, and relevance) in May 2021. Also, a Fall 2021 intern focused on how to make iNaturalist a more widely-used program for Preserve visitors. All of these monitoring efforts will inform the Preserve on what invasive species occur on Preserve land and provide a more informed view on their abundance and frequency. The goal is to eventually develop a management plan(s) to eradicate and/or slow the progress of invasive species on Preserve land.

Partner Work Summary 3 LH PRISM Subcontracted Projects

Spotted Lanternfly Outreach and Education in Rockland County

Horticulture Resource Educator Kristen Ossmann worked with two members of the Rockland Conservation Corps, Heather Hamann and Marcus Octaviano, to bring awareness and educate the public on the imposing threat of the invasive pest spotted lanternfly in Rockland County. This was done through LH PRISM subcontract work. Kristen, Heather, and Marcus engaged in over 80 hours of in person outreach and interacted directly with over 450 residents during their efforts. They created relevant, updated, and engaging educational materials to share with the public and help make their outreach efforts more successful and engaging. They delivered presentations and information packets to legislators and other environmentally focused organizations. SLF awareness and education was also provided through social media postings, radio broadcasts, online newsletters, and website posts. Informational flyers on SLF were physically distributed to all 17 public libraries, public parks, garden centers and other relevant businesses throughout Rockland County. In addition, they surveyed over 7 square kilometers for spotted lanternfly and their primary plant host, tree-of-heaven, documenting their findings on iMapInvasives. They were also part of an active effort in setting up and monitoring physical traps and hand-removing over hundreds of spotted lanternflies at an infestation site in Orangeburg, NY. A second 2021 CCE Rockland subcontract entitled "Invasive Species Training for Orangetown Parks and Rec" was granted an extension for completion by the end of March 2022.

Cornell Cooperative Extension- Rockland Coujnty interns Heather Hamann and Marcus Octaviano performing spotted lanternfly education and outreach at a local farmer's market. Photo credit: Kristen Ossmann.

Monitoring and Managing Ash in the Lower Hudson PRISM

The Ecological Research Institute's program, Monitoring and Managing Ash (MaMA), provides an innovative framework that promotes undertaking particular tasks at each stage of emerald ash borer (EAB) invasion in order to achieve EAB mitigation and, much more importantly, to advance long-term conservation of native ash by 1) searching systematically for lingering ash in the PRISM region and publicizing these searches to promote public participation in them; 2) coordinating ongoing participation in and

managing and validating of data from MaMA's citizen science projects; 3) updating the regional MaMA action map that prioritizes different tasks for different portions of the LHPRISM region based upon their emerald ash borer (EAB) detection history and infestation status and mortality levels; 4) publicizing the action maps and promoting implementation of MaMA in the LHPRISM region via the dedicated webpage on the www.MonitoringAsh.org website; and 5) ongoing communication with partners at the US Forest Service regarding the search for lingering ash.

In 2021, MaMa led two guided training walks and helped organize and validate data for surveys across 17 different sites in the Lower Hudson PRISM region. Overall, the MaMa program has been able to find over 20 lingering ash in the Hudson Valley, the first in New York or New England. These included 13 such trees detected through systematic searches for which funding was awarded by the Lower Hudson PRISM. Lingering ash have been shown by partners at the U.S. Forest Service's EAB-Resistance Breeding Program to often display some level of heritable resistance, which can be augmented through selective breeding, providing great hope for native ash conservation and restoration. ERI has continued to actively communicate with our partners at the US Forest Service regarding the search for lingering ash. This has included sharing with them our method of doing rapid mortality assessments in areas where EAB-induced ash mortality is not well-represented by established monitoring plots, a method which they agree is appropriate and greatly helpful in assessing the readiness of areas to be searched for EAB.

Surveyor Arden Blumenthal searching for lingering ash as part of the 2021 Managing and Monitoring Ash field season.

Land Management and Outreach Student Internships

In the summer of 2021, the Fresh Air Fund (FAF), Hudson Highlands Land Trust (HHLT), Louis Calder Center (LCC), and Vassar College (VC) engaged five student interns in a comprehensive internship program that focused on invasive species management, monitoring, and outreach. The interns implemented invasive species management plans, utilized best management practices, monitored the response of populations to management, educated the public about invasive species, and created outreach videos.

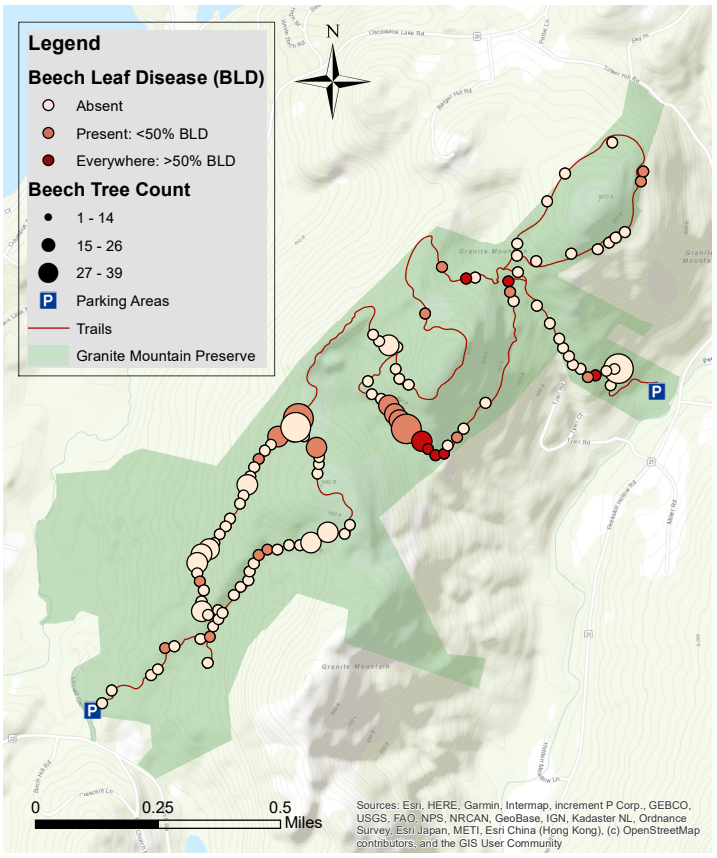
At Vassar College, the interns helped implement a Conservation Action Plan to protect the biodiversity of an ecologically significant open space. They worked toward the eradication of emerging invasive species, the containment of isolated invasive species, and removal of common invasive species from an area that contains a rare plant. The interns scouted for emerging invasive species in high probability areas and discovered new populations. The interns conducted regular monitoring for spotted lanternfly and

the response of populations to invasive species management efforts. They resurveyed Lingering Ash plots that were established in 2019.

At Fresh Air Fund, the interns worked to gather data to update an Invasive Species Management Plan for Sharpe Reservation. Both interns were able to use GPS to make more attractive maps and better organize data that will be to the benefit of future interns. The interns worked on four major areas including: 1) continued removal of water chestnut from Adele Pond 2) removal of leading edge of black swallowwort 3) resurveying lingering ash plot established in 2019 4) removal of pockets of mile-a-minute. Extensive signs of mile-a-minute weevil were evident in all populations.

At HHLT's Granite Mountain Preserve, the interns helped with three major projects: (1) mapping of a new invasive species in the area, Beech Leaf Disease; (2) the continuation of removal of a yellow archangel population, which has moved from a species on the LH-PRISM Tier 5 "Watch" list to Tier 2 "Eradication"; and (3) the continuation of removal of a high-priority trailside population of black swallowwort near the popular Lookout Point. The interns also conducted a top-14 invasive species monitoring visit on adjoining municipal lands to Granite Mountain Preserve, as HHLT has now been granted comanagement of most of those lands. In total, 100% of the trails were monitored for beech leaf disease, 90% of the yellow archangel population was removed and 95% of the black swallowwort within four feet of the hiking trail was removed.

Extent of Beech Leaf Disease amongst Beech Population: Trail Survey (June 2021)
Granite Mountain Preserve, Putnam Valley, NY



Source: Katie Cassidy and Adriana Buller, 7/29/2021

At Calder Center, the Environmental Management and Monitoring Alliance (EMMA) intern developed an invasive species phenology monitoring program with emphasis on Tier 2 (emerging) and Tier 5 (watch) species, which will serve as a template for other sites in the EMMA network. The intern engaged with the National Phenology Network (NPN) and acquired the information necessary to add emerging invasive species to the NPN platform. The intern created introductory training materials for the identification of Tier 2 and Tier 5 invasive species and an informational video on what is a phenology trail and how they work.

Although the outreach component was limited by Covid-19, the five interns were able to work collaboratively. The interns had regular meetings that allowed them to exchange

details of their work and learn from each other's experiences. This collaborative internship program also strengthened connections between partners and conservation organizations in the region. An example of their collaboration can be seen in the outreach videos that will be posted on HHLT's website. Currently, an introductory "Meet the Interns" video can be viewed here: https://www.youtube.com/watch?v=JFTtznQpTdA. The videos they created will be a valuable resource to the Lower Hudson PRISM.

Surveying for Spotted Lanternfly and Invasive Species Awareness in the Bronx

The Bronx is Blooming (BiB) has a proven track record of effectively engaging communities in environmental education and restoration projects and of making tangible change in underserved communities. In 2021, BiB engaged in a multifaceted effort at curbing the spread of invasive species in the Bronx that included education and outreach, active invasive species removals and native species rehabilitation and revegetation. The primary focus of this subcontract invasives work centered on spotted lanternfly education, outreach and surveying. After completing training on SLF identification, BiB interns found and caught SLF in Mullaly Park and learned that this report was the first Bronx sighting of 2021. This information was shared with partners at the NYC Parks Department who launched a wider search which yielded more evidence of SLF in the borough. Furthermore, interns and other community members that were trained by BiB reported additional sightings once the internship had ended, indicating strong transfer of knowledge and community action.

The Bronx is Blooming and community partners helped to remove invasive species from this plot in Claremont Park to help promote growth of native plants. Photo credit: Heather Lorusso

Other efforts undertaken by BiB involved invasives removal work with a focus on Soundview Park which comprises 203-acres of riparian habitat, including a boat launch. A NYS Protected Area and designated as of "Ecological Significance" and "High Risk of Spread" by NYS invasive species prioritization, the park hugs 1.5 miles of The Bronx River at the confluence with the East River. Here, BiB interns and participants in BiB's Program for Leaders Advancing their Community's Environment (PLACE) helped clear a meadow of mugwort and encouraged growth of native goldenrod. Altogether, the BiB interns and staff reached 364 community members at in-person events, 2,378 through social media and newsletters and removed 428 "wheelbarrows full" of invasive species!

Westchester Land Trust-Groundwork Hudson Valley Internship Partnership

Westchester Land Trust interns, Briana Marcano and Erick Rosa. Photo credit: John Zeiger.

During the summer of 2021, Westchester Land Trust (WLT) hired two summer interns, Briana Marcano and Erick Rosa. Briana and Erick are alumni of the Groundwork Hudson Valley's (GHV) "Green Team," an initiative that employs youth from Yonkers public schools to work as a team on environmental projects. The internship was 10-weeks long, with 30 hours of immersive work scheduled per week. As part of a partnership between WLT and GHV, the internship was advertised to Green Team alumni. In addition, WLT hired the Green Team for 4 days of fieldwork, and Briana and Erick had the opportunity to lead youth crews. During the internship, Briana and Erick also worked on various projects across WLT's properties, including mapping beech leaf disease, an emerging invasive forest pathogen in Pound Ridge, maintaining preserve trails from Mamaroneck to Lewisboro, removing invasive plants to improve the local ecology of preserves, leading volunteer days, and designing and implementing their own independent projects. At the end of the internship, the interns wrote a brief report on their experiences, and the WLT Preserve Manager conducted exit interviews. The interns were largely managed by the WLT Preserve Manager, John Zeiger.

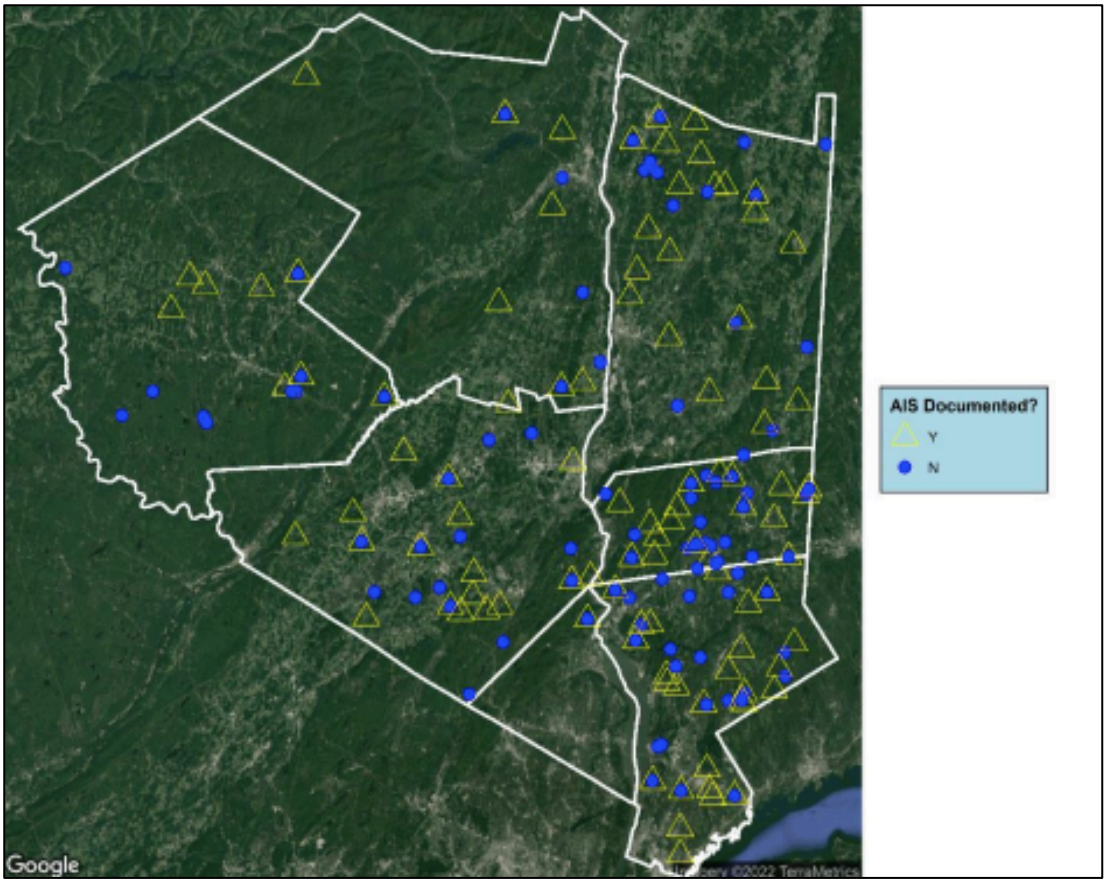
The WLT internship was a successful and transformative step towards building a more diverse professional conservation community. The interns specifically appreciated opportunities to lead events, learn professional communications skills, and understand the inner workings of a non-profit organization. WLT staff members benefited from the interns' perspective as residents of downtown Yonkers, as WLT is hoping to expand our urban conservation efforts and be more impactful in urban areas of southern Westchester. The interns accomplished all the deliverables expected while working with the GHV Green Team, including but not limited to building 115' of sturdy white oak bog bridge, enhancing 900' of deer fence, planting 20 native wildflowers, and removing 32,000 invasive mile a minute vines. Erick and Briana each creatively developed and implemented an independent project that fulfilled a real need at WLT. The interns and staff worked together to overcome the significant challenges of transportation access and restrictions caused by the Covid-19 pandemic.

Inventory of Grass Carp Stockings to Control Aquatic Invasive Species in the Lower Hudson PRISM

Northeast Aquatic Research received 2021 LH PRISM subcontract funding to examine grass carp stocking patterns across Region 3 (Dutchess, Putnam, Rockland, Sullivan, Ulster and Westchester Counties) of the New York State Department of Environmental Conservation (NYSDEC). The objective was to compile all of the grass carp stocking records from 1991 to 2020 to provide insight into the stocking history, practices,

distribution and types of vegetation controlled. NEAR also aimed to provide recommendations to improve stocking practices and permit evaluation for the Region 3 fisheries biologists.

Throughout this research analysis project, NEAR established region-wide trends in permits issued by Region 3 fisheries staff (7,885 triploid grass carp permits issued since 1991). The vast majority of these permits were filed for waterbodies less than 5 acres (most were found in Dutchess County) while the most large water body permits were found in Putnam County. Out of the stocking permits issued, 238 of them noted that they contained known AIS. The analysis also revealed that a total of 129,656 grass carp have been stocked since 1991, but little data is available on the effectiveness of the stocking. Out of the 177 lakes that have received grass carp stocking permits, only 23 waterbodies (13%) provided the DEC fisheries unit with supplemental maps or consulting reports on effectiveness of the stocking. The current DEC triploid grass carp stocking application does not ask for information regarding past management strategies or management strategies to be employed in the following year. Going forward, it would be prudent to require every landowner to disclose all plant management permits and management actions that take place on the waterbody.



Stocking permits that contained invasive species throughout Region 3 DEC. Points that overlap indicate single waterbodies with multiple applications that had different species listed.

Boot Brush Stations for Pound Ridge Nature Preserves

The Pound Ridge Land Conservancy (project lead), the town's Conservation Board, the Henry Morgenthau Preserve and The Invasives Project - Pound Ridge partnered in 2021 to design and install boot brush stations at nine Pound Ridge nature preserves including six PRLC preserves – Armstrong, Bye, Carolin's Grove, Clark, Halle Ravine and Richards; Henry Morgenthau Preserve; and two town owned preserves – Eastwoods and Lawther. Each station has a boot brush for hikers to use before and after entering the trails to help prevent the spread of invasive species to and from the preserves. These signs host a QR code directing visitors to the LH PRISM's website as the region's "go-to organization for reliable and current information on regional invasive species". The signs also promote PlayCleanGo and add encouragement to avoid transporting pests like beech leaf disease. The first five station installations were timed in conjunction with NYS ISAW in June and other related events occurring that week. These installs were promoted on our social media outlets and in our local newspaper. Three additional stations were built over the course of the summer by PRLC's Land Steward and summer interns whose stipends were partially supported by this subcontract. The last station was installed in November at the town's Lawther Preserve. In addition to the newspaper article, PRLC outreach for this project included two Zoom events totaling 70 live participants with numerous others viewing the recordings, social media posts reaching over 500 people, two community table events, and direct emails to the organizations' listservs. Installation instructions were created and submitted to the LHPRISM's Trailhead Boot Brush Working Group and a final presentation was made at the November 30th LH PRISM partner meeting.

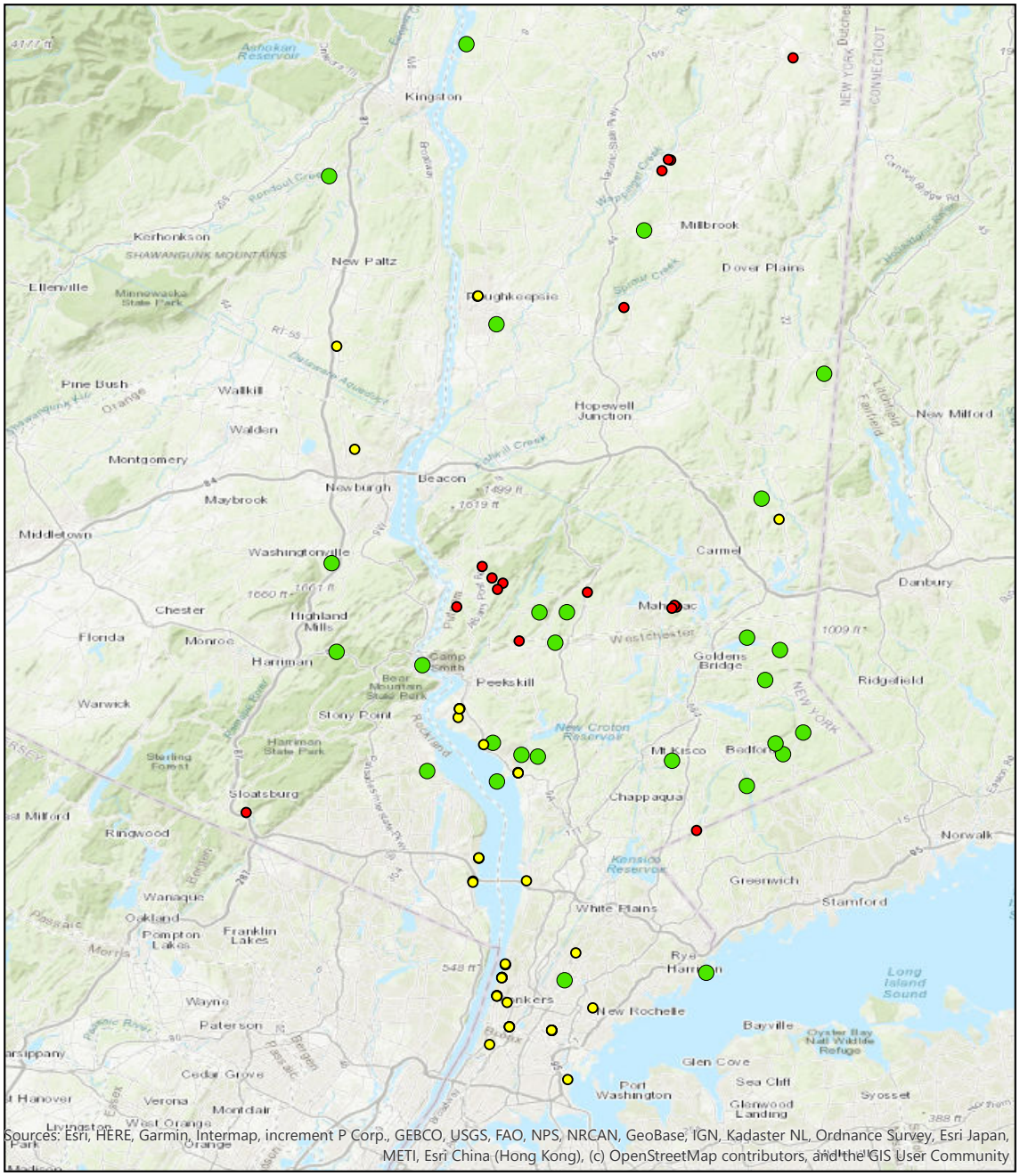
Pound Ridge Land Conservancy helped to install nine boot brush stations in 2021.

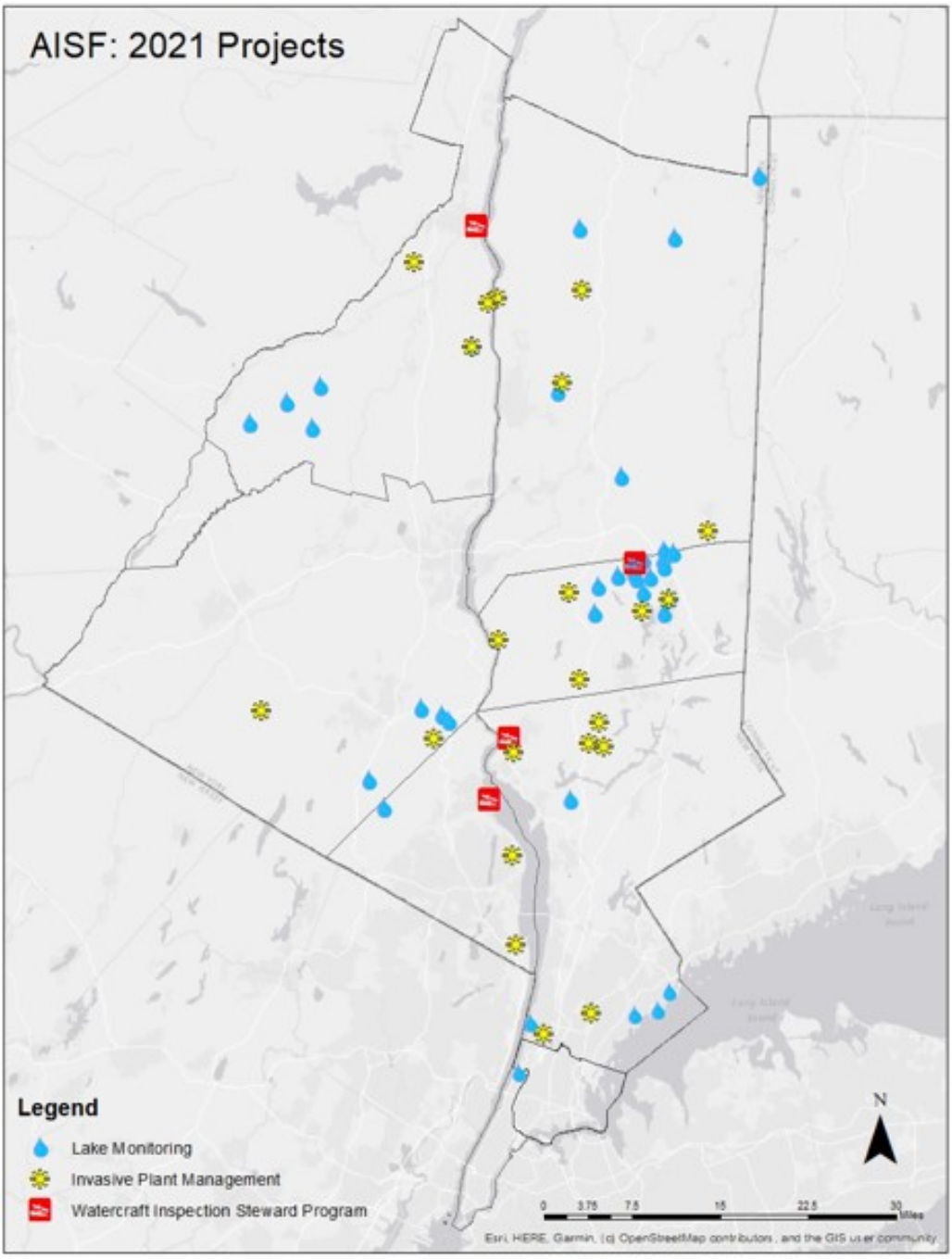
Town of Kent Invasive Species Management Project

The Town of Kent, in collaboration with Northeast Aquatic Research, completed a comprehensive inventory of aquatic invasive species data collected over the past 5 years and their threat level within Kent's waterbodies. This analysis revealed multiple populations of brittle naiad, curly leaf pondweed, Eurasian water milfoil and water chestnut and single populations of variable leaf water milfoil and fanwort. Northeast Aquatic Research also helped to develop a comprehensive lake management plan that utilized this AIS inventory to define best management practices for containing and removing AIS and help with spread prevention. Both of these primary deliverables were met and the reports are available upon request. The Watercraft Inspection Steward aspect to the original proposal did not get completed in 2021.

APPENDIX I: TERRESTRIAL INVASIVES STRIKE FORCE (ISF) AND AQUATIC INVASIVES STRIKE FORCE (AISF) WORK SITES

2021 Invasives Strike Force Project Locations





Lower Hudson PRISM Invasives Strike Force and partners worked on a variety of projects throughout the Hudson Valley in 2021, spanning from the northern-most Dutchess County and western-most Orange County to southeastern Westchester County. Shown above are the sites that both the Terrestrial and Aquatic Invasives Strike Force (AISF) crews worked on in 2021 and are expanded on in the ISF Program Reports section of this Annual Report.

APPENDIX II: AQUATIC INVASIVES STRIKE FORCE MONITORING & MANAGEMENT METRICS

Aquatic Invasives Strike Force Monitoring Site Metrics

Project Site	County	State Park	Species Observations	Species
Lake Stahahe	Orange	Harriman	52	MYSP, MYHE,
Queensboro Lake	Orange	Harriman	30	MYSP, MYHE,
Rudd Pond	Dutchess	Taconic	32	MYSP, POCR, CACA,
Silver Lake	Dutchess	N/A	72	MYSP, NAMI, MYHE,
Sylvan Lake	Dutchess	N/A	48	MYSP, MYHE,
Walton Lake	Orange	N/A	55	MYSP (1 obs.), CICH,
Wawayanda Lake	Putnam	California Hill	45	MYHE
Stissing Pond	Dutchess	N/A	80	MYSP, NAMI,
Hunns Lake	Dutchess	N/A	55	MYSP, POCR, TRNA
Kentwood Lake	Putnam	N/A	31	TRNA, POCR
Lake Carmel	Putnam	N/A	80	MYSP, POCR, NAMI,
Lake Dutchess	Putnam	N/A	47	POCR, TRNA,
Lake Louise	Putnam	N/A	19	MYSP, POCR,
Palmer Lake	Putnam	N/A	25	MYSP, NAMI, VIGE
Pine Pond	Putnam	N/A	44	MYSP, VIGE,
Roaring Brook	Putnam	N/A	80	MYSP, NAMI, CACA,
Sagamore Lake	Putnam	N/A	88	N/A
Seven Hills Lake	Putnam	N/A	67	MYSP, POCR, NAMI,
South Lake	Putnam	N/A	39	MYSP, NAMI,
Twin Island Lake	Dutchess	N/A	60	MYSP, POCR,
Harlem River	Bronx	N/A	13	N/A
Lake Awosting	Orange	Minnewaska	77	N/A
Lake Maratanza	Ulster	Minnewaska	55	N/A
Lake Minnewaska	Ulster	Minnewaska	28	N/A
Mianus River	Westchester	N/A	24	POCR, TRNA
Milton Harbor	Westchester	N/A	48	N/A
North Salem Pond	Westchester	N/A	6	N/A
North Salem Pond	Westchester	N/A	13	N/A
Playland Lake	Westchester	N/A	75	CAMA
Westminster Lake	Putnam	N/A	18	POCR, NAMI,
Teatown Lake	Westchester	N/A	36	MYSP, POCR,

TRNA= Water chestnut, MYSP= Eurasian watermilfoil, MYHE= Variable-leaf watermilfoil, MAQU=European waterclover, POCR= Curly leaf pondweed, CACA = Fanwort, NAMI=Brittle naiad, DRPO= Zebra mussel, CICH= Chinese mystery snail, CAMA=European green crab, VIGE= banded mystery snail

Aquatic Invasives Strike Force Program Management Site Metrics

Project Site	Area Managed (acres)	Number Plants Removed	Dry Bimoass Removed (lbs)
Junior Lake	2.27	90	1.4
Putnam County Veterans	0.22	180	2.9
Chodikee Lake	4.15	2185	122.2
Barger Pond	4.03	650	118.7
Crom Pond	2.70	440	79.5
Silver Mine	4.92	4685	144.8
Lake Carmel*	***N/A***	***N/A***	***100.0***
Sparkill Creek	0.68	6720	272.4
Constitution Marsh	0.23	26575	92.9
Black Creek	2.65	9840	1060.2
Rockland Lake	0.58	10525	1587.6
Norrie Point	0.05	11375	136.9
Blue Mountain	0.47	44300	1286.5
Tibbetts Brook	0.05	3400	136.9

*Removal at this site was of Eurasian milfoil
All other sites represent water chestnut removal numbers

APPENDIX III: TERRESTRIAL INVASIVES STRIKE FORCE MONITORING & MANAGEMENT SITE METRICS

Project Site	Acres Surveyed	Acres Treated	Hours	Plants Managed	Treatment sq. ft.	Species Managed
Bedford Hardy Kiwi	11.1	0.39	81	237		Hardy kiwi
Bear Mountain- Scotch Broom	4.61	0.22	63	1,678		Scotch broom
Black Rock Forest	1.42	0.22	61	909		Japanese barberry, burning bush, multiflora rose
Brinton Brook Sanctuary	1.85	0.15	42	- *	6,441.60	Hardy kiwi
Bronx River Reservation (Mt Vernon)	0.114	0.052	18	3,223		Incised fumewort
Bronx River Reservation (Tuckahoe)	2.3	0.84	36	34		Siebold's viburnum
Cary Institute For Ecosystem Studies	5.98	0.48	54	689		Japanese spiraea, chocolate vine, Chinese wisteria, Japanese angelica-tree
Croton Point Park	6.98	1.86	168	855		Sycamore maple, paper mulberry, Chinese bushclover
Dover	130.82	63.13	483	46,571		Sticky sage
Ruth Walgreen Franklin & Winifred Fels Memorial Sanctuary	25.34	2.83	83	8,052		Sapphireberry
Giant Hogweed	23.62	2.02	93.5	7,116		Giant hogweed
Granite Moutain	4.49	1.55	48	1,129		Yellow archangel, linden viburnum, Japanese angelica-tree, burning bush
Great Swamp	2.03	1.15	146	823		Autumn olive, asiatic bittersweet, border privet, multiflora rose, bush honeysuckle
Harriman Scotch Broom and Restoration	15.85	3.28	270.5	12,358		Scotch broom, Japanese barberry, multiflora rose, Asiatic bittersweet
Harriman Miscanthus	1.8	0	3	0		Chinese silvergrass
High Tor State Park	2.89	0.33	10	232		Pale swallowwort, black swallowwort, Chinese silvergrass
Iona Island	79.41	3.54	103	1523		Cutleaf blackberry, Chinese bushclover, Japanese angelica-tree
Joppenbergh Mountain	0.25	0.2488	102	642		Asiatic bittersweet, autumn olive, wineberry, Japanese barberry
Kudzu	9.223	0.396	95	92	17,266.30	Kudzu
Lawther Preserve	6.17	4.81	97.5	873		Sapphireberry
Mianus River Gorge	13.97	11.56	169	3,715		Sapphireberry, linden viburnum, Asiatic photinia, Japanese snowbell, yellow archangel
Nature Study Woods	0.76	0.05	24.5	351		Incised fumewort
Halmi Preserve (North Salem Open Land Foundation)	0.4	0.13	3.2	- *	5,855.20	Chocolate vine
Old Croton Aqueduct Trail	4.2	3.35	144	1,226		Siebold's viburnum, black jetbead, wisteria spp., garlic mustard, burning bush, wintercreeper, narrowleaf bittercress
Ralph E. Ogden Foundation	2.58	1.1	25.5	3,695		Scotch broom
Pine Croft Meadow Preserve	1.23	0.304	36	551		Cutleaf blackberry, bamboo spp.
Pound Ridge Sticky Sage	0.33	0.0008	2.5	4		Sticky sage
Edith G. Read Wildlife Sanctuary	0.974	0.0305	24	197		Chinese fountaingrass, cutleaf blackberry, castor aralia
Sachs Park	15.85	1.3	56	241		Sapphireberry
Shrub Oak Memorial Park	0.13	0.01	12	7	plus one bucket (5gal)	Small carpetgrass, Siebold's viburnum
Spotted lanternfly	0.44	0.18	134	-		Spotted lanternfly, general vegetation
Teatown Lake Reservation	7.09	3.82	46.5	954		Asiatic photinia
Three Arrows Cooperative Society	14.38	1.74	137	2,856		Japanese spiraea
Vassar College/Ecological Preserve	13.11	2.69	200	607		Castor aralia, sapphireberry, hardy kiwi, linden viburnum
Totals	411.691	113.7621	3071.7	101440	29563.1	
* Too dense to count individual plants managed. Estimated by treatment square footage (next column)						