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USING A TRAIN-THE-TRAINER APPROACH TO MAXIMIZE COMMUNITY SCIENCE TRAINING CAPACITY FOR THE IMAPINVASIVES CERTIFIED TRAINERS NETWORK

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USING A TRAIN-THE-TRAINER APPROACH TO MAXIMIZE

COMMUNITY SCIENCE TRAINING CAPACITY

FOR THE IMAPINVASIVES CERTIFIED TRAINERS NETWORK

By

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ABSTRACT

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Training Capacity for the iMapInvasives Certified Trainers Network, 165 pages, 10 tables, 14 figures, 2019. APA style guide used.

This research aimed to take a new approach to a community science program's current training method and create a resource that helps New York State residents and visitors expand their understanding and awareness of invasive species. Since launching in 2010, the invasive species community utilizing iMapInvasives has grown and training requests has exceeded staff capacity. Through sponsorship from the New York Natural Heritage Program and SUNY Environmental Science and Forestry, a Certified Trainers Network was created. The iMapInvasives Certified Trainers Network (CTN) consists of volunteers from diverse backgrounds interested in protecting NYS natural resources. The CTN was adopted following a train-the-trainer model approach, utilizing a three-step certification protocol. The CTN resulted in 12 trainer trainings, and 77 subsequent trainings with 1,162 attendees. As a result, 298 individuals representing 128 organizations submitted 4,290 observations, 546 animal observations and 3,743 plant observations, totaling 175 different species.

Key Words: Citizen science, community science, invasive species, volunteer, train-the-trainer, invasive species, certified trainer

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CHAPTER 1

Literature Review and Project Summary

Invasive Species

For the purpose of this research, invasive species are defined as "a species that is nonnative to the ecosystem under consideration, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (NYS Department of Environmental Conservation 2014a). The introduction of invasive species outside of their native range is often through human-mediated activities, where invaders then establish self-sustaining populations.

Impacts associated with invasions vary in extent by species, but typically include altering ecosystem-level processes, e.g., primary or secondary productivity, hydrology, nutrient cycling, soil development, disturbance frequency (Vitousek 1990). Additional consequences impacting human well-being include altering goods and services like fisheries, agricultural and forest products, reducing access to drinking water, climate destabilization, reducing pollination, and reducing enjoyment of recreation (Pejchar and Mooney 2017).

To preserve functionality of natural ecosystems, developing efficient methods to reduce introduction and spread of invasive species is crucial (Fig. 1.1). When prevention, the most cost-effective management method, is not successful, then early detection and rapid response management techniques need to be in place in order to reduce efforts and potential costs (Hobbs and Humphries 1995, State of Victoria Department of Primary Industries 2010, Harvey and Mazzotti 2018). Comprehensive information and data on invasive species locations help us to better understand where along the generalized "invasion curve" a given species lies.

Invasive Species in New York State

New York State is a rich blend of urban, agricultural, and forested areas with 4,000 freshwater lakes, 112,600 km of rivers and streams, and over 809,300 ha of wetlands. New York
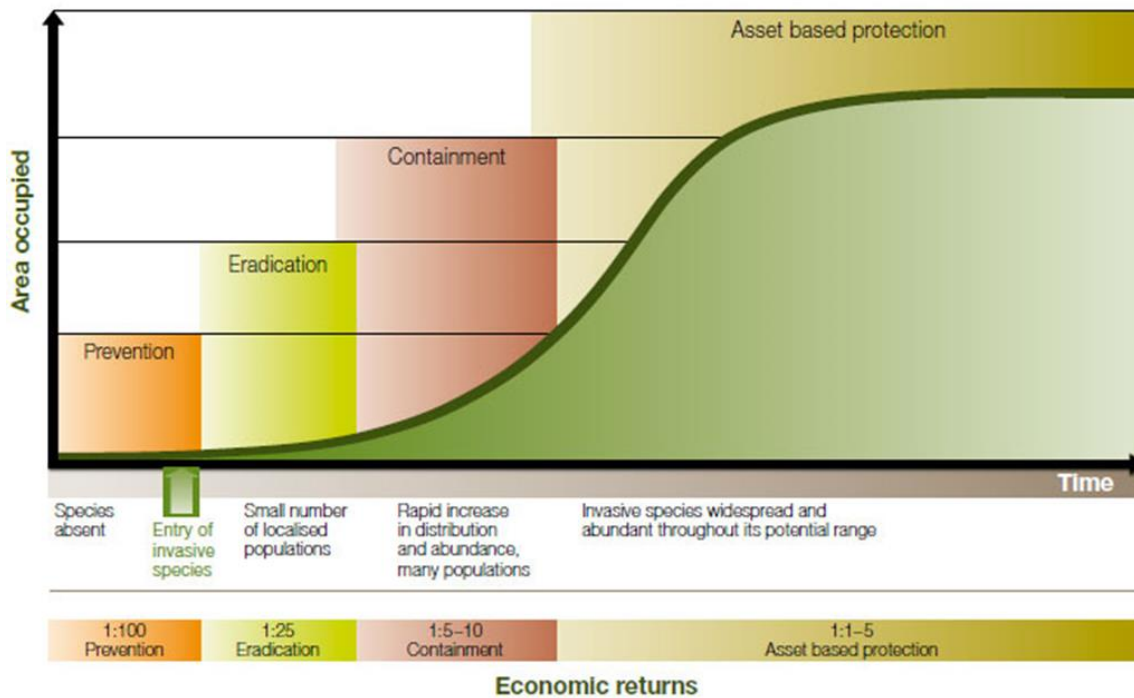
Figure 1.1. The Invasion Curve. (State of Victoria Department of Primary Industries 2010).

contains nine level III and 42 level IV ecoregions including low coastal plains, large river valleys, rolling plateaus, glacial lakes, forested mountains, and alpine peaks (Reschke et al. 2014). According to the New York Natural Heritage Program, only 56% of all 2,863 vascular plants, natural communities, and vertebrate animals native to New York State are secure (Fig. 1.2). In the U.S., 42% of species listed as endangered or threatened are in danger with effects of invasive species being a top contributor putting them at risk (Pimentel et al. 2005). In terms of the number of species threatened by a single cause, invasive species is second only to habitat destruction (Wilcove et al. 1998). The negative ecological impacts of invasive species create an urgency in detecting and managing new invasions early on.

New York State forests are among the most invaded in the U.S. (Fig. 1.3, Liebhold et al. 2013), with many species either being purposefully, e.g., Trouvelot's gypsy moth debacle, (Liebhold et al. 1989), or accidently, e.g., hemlock woolly adelgid (HWA, Souto et al. 1996), introduced. New York City is one of the largest shipping ports in North America and as more
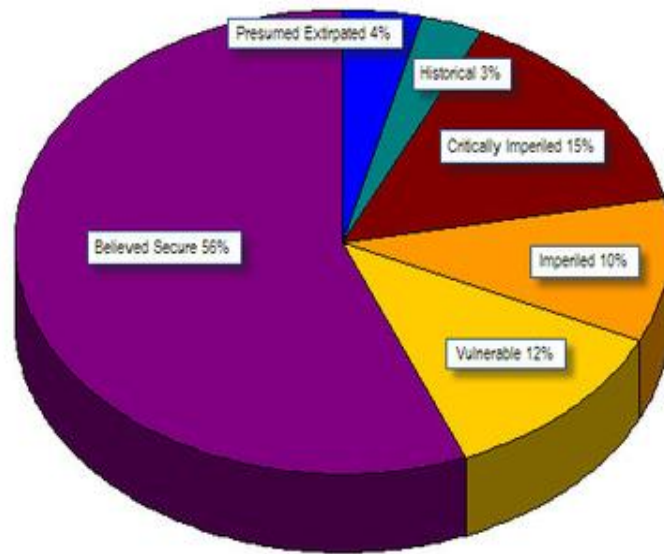
Figure 1.2. New York's Biodiversity at Risk: Half of New York's biodiversity appears to be secure, but 37% of the state's native plants, vertebrate animals, and ecosystems are in jeopardy of extirpation, and 7% may have been lost already (NYNHP 2017).
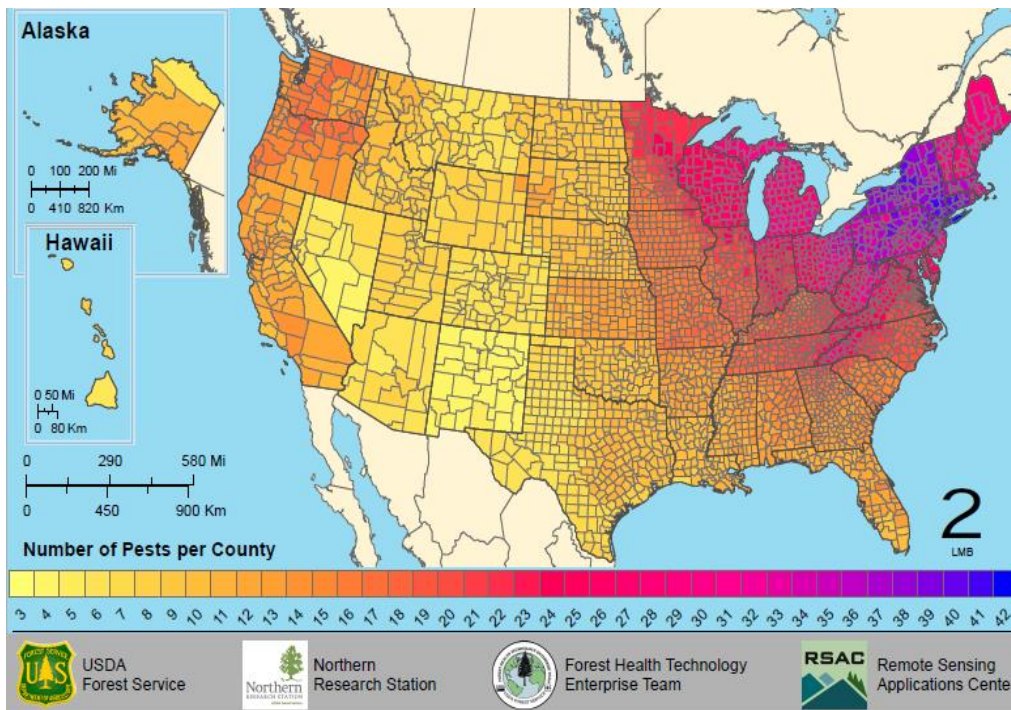
Figure 1.3. Invasive Forest Pest in US. Number of invasive forest pest and pathogen species established per county throughout the United States (Liebhold et. al. 2013).

efficient transportation modes were developed, global trade increased, and the number of introductions increased (Taylor 2013). New York is also home to >19 million people, half of whom live within the New York City region (Census Bureau 2017). With breathtaking scenery and a variety of national and state parks, New York hosts a variety of travelers, recreationists, and nature enthusiasts from across the world boasting nearly $67.6 billion in tourism alone (Oxford University 2012). Invasive species impacts jeopardize recreation and enjoyment of New York's natural ecosystems.

The Great Lakes Region of New York, with its oceanic shipping routes, also has a long history of invasive species introductions. Some particularly common aquatic animal species established in the Great Lakes include spiny waterflea, round goby, and zebra/quagga mussels (Hebert et al. 1991, Mills et al. 1993). Invasive species have also reached New York via many other routes including through ornamental plants, pets, bait, and recreational boating. Landscaping and nurseries have historically imported and sold mostly non-native species, which are potential transporters of invasive pests, e.g., HWA (*Adelges tsugae*, Souto et al. 1996) and more recently, the jumping worm (*Amynthas spp.*, Lauber et al. 2015).

The New York State Invasive Species Task Force, established in 2003, provided a full invasive species report to the NYS Governor and Legislature in 2005 (New York State Invasive Species Task Force 2005).This report included the invasive species problem, existing management efforts, both statewide and federal, and provided 12 recommendations on how the State could improve efforts and better address this issue. One recommendation by the Task Force directly related to the research proposed here is "*Integrate databases and information clearinghouses*" - discussed in more detail below.

Following the 2010 report "*A Regulatory System for Non-native Species*," the 6 NYCRR Part 575 regulations, *Prohibited and Regulated Invasive Species,* were adopted in an effort to reduce introduction and spread of invasive species by limiting commerce of invasive species, saving future time, efforts, and money for NYS (NYSDEC 2014a, 2014b). This report has served as a foundation to all NY invasive species efforts. In 2018, the final New York State Invasive Species Comprehensive Management Plan (NYSISCMP) was released. The ISCMP was designed to highlight successful programs currently being implemented, while identifying additional structures and processes to help guide invasive species management into the future.

Responsibility for the prevention, detection, management, research, and outreach about invasive species is shared by a variety of organizations, including, but not limited to, the eight Partnerships for Regional Invasive Species Management (PRISM), NYS Office of Parks, Recreation and Historic Preservation (NYSOPRHP), NYS Department of Environmental Conservation (NYSDEC), NYS Invasive Species Research Institute, and the NY Natural Heritage Program. All these organizations (and others) participate in the New York State Invasive Species Council or Invasive Species Advisory Committee. Invasive species can cause significant ecological and economic damage. Estimates of economic impacts of invasive species are staggering with some estimating damages exceeding $14.5 billion in China and $137 billion per year in the United States (Pimental et al. 2000, Xu et al. 2006). The NYS Environmental Protection Fund has recently allocated $13 million yearly to prevent the spread of invasive species in 2017 and 2018 in New York.

According to the 2018 NYSISCMP, "NYS has made outstanding progress toward creating and implementing a broad invasive species management program; however, New York State's ecological, economic, and public well-being continue to be threatened by the proliferation

of invasive species." It is imperative for the organizations managing invasive species to understand their distributions, and one way to make continued progress toward this effort is through continued collaboration between professionals and the public.

New York State Invasive Species Database

The NYS Invasive Species Task Force 2005 report included a recommendation to "Integrate Databases and Information Clearinghouses" further explaining that NYS should establish a state-wide database to provide aggregated location data in an on-line format utilizing a GIS system so that the information could be easily accessed and visualized by resource managers and the public (New York State Invasive Species Task Force 2005). This was again reiterated in the 2018 NYISCMP, which stresses the importance of reporting invasive species distributions to a centralized database. Original database development and roll-out funds were contributed by the Florida Natural Areas Inventory, the New York State Department of Environmental Conservation (via the Environmental Protection Fund), The Nature Conservancy Global Invasive Species Team, and The Nature Conservancy Oregon Chapter. These organizations worked collaboratively to create the original, iMapInvasives, which has been adopted as the NYS Invasive Species Database. Annual fees by organizations in individual states fund continued maintenance and other initiatives.

iMapInvasives is an online GIS-based data management tool utilized by community scientists, volunteers, and natural and agricultural resource professionals to protect natural resources from the threat of invasive species (Dean 2012). This tool is designed to manage invasive species information, including species distribution maps, treatment and survey efforts, and monitoring of management effectiveness. There are currently nine states and one Canadian province considered as Lead Partner Organizations with the iMapInvasives Network.

iMapInvasives was launched in New York in 2010 and is currently managed at the state level by the New York Natural Heritage Program (NYNHP), with funding from the New York State Environmental Protection Fund.

NYNHP is a partnership between the New York State Department of Environmental Conservation (NYSDEC) and the State University of New York College of Environmental Science and Forestry (SUNY ESF). NYNHP was established in 1985 with its mission being to facilitate conservation of rare animals, rare plants, and significant ecosystems. Towards this, NYNHP maintains New York's most comprehensive database on the status and location of rare species and natural communities (Young 2017). Currently, NYNHP is monitoring 179 natural community types, 802 rare plant species, and 466 rare animal species across NY, emphasizing the necessity to understand invasive species distribution and the need for iMapInvasives observation reports (NYNHP 2017). Invasive species are a key threat to rare species in NY, which is why NYNHP is managing the invasive species database.

The NYSDEC was created in 1970 to "conserve, improve, and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being" (Seggos 2017). SUNY ESF was established in 1911 and is the oldest and most distinguished institution in the United States focused on the study of the environment with 1,700 undergraduate and 500 graduate students studying within the 25 undergraduate programs and 48 graduate areas. The mission of SUNY ESF is "to advance knowledge and skills and to promote the leadership necessary for the stewardship of both the natural and designed environments" (SUNY ESF 2012, 2018).

iMapInvasives users play an important role in building New York's Invasive Species Database, by reporting new infestations and increasing the state's overall capacity for early detection. The user group in NY is very diverse, ranging from high school aged students, college students, full-time natural resource professionals, off-duty professionals, retirees and anything else in between, though they all share a common interest, invasive species. Users can easily participate using mobile and online platforms and report invasive species observations across the state. Since the launch of NY iMapInvasives in 2010, more than 54,000 user entered invasive species observations have been uploaded to the database, augmenting the 150,000 records aggregated from existing datasets (Fig. 1.4). These user data currently represent a total of 415 species, including 72 animals and 341 plants.
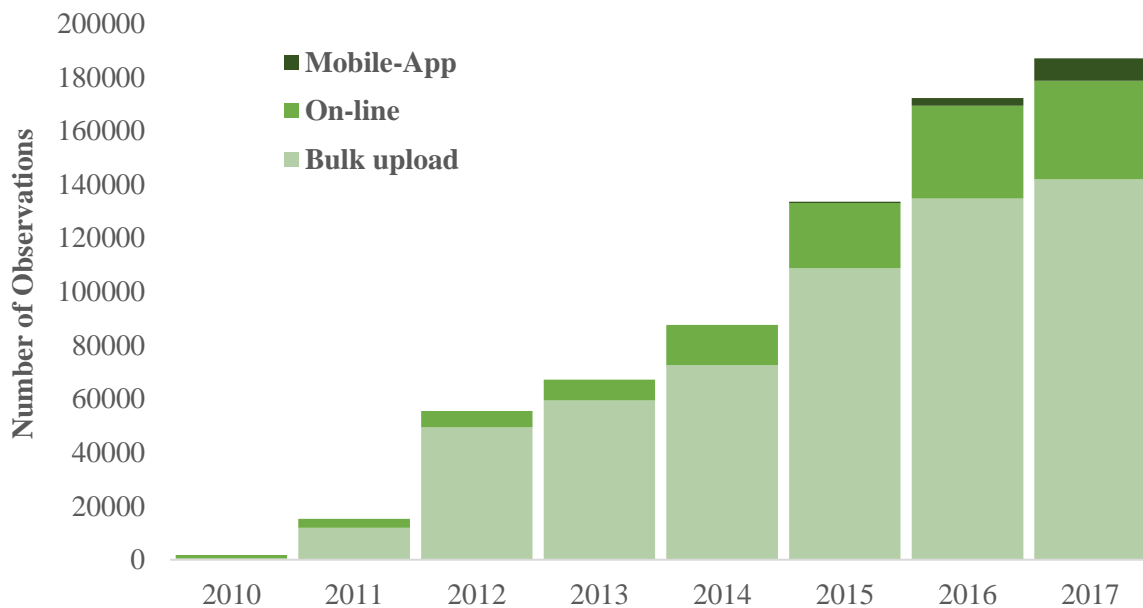
Figure 1.4. NY iMapInvasives observation and data entry methods over time.

iMapInvasives is also an important tool to distribute locational information about invasive species detections and spread and aids in early detection and rapid response efforts.

Natural resource professionals are alerted when new invasive species observations are reported. These alerts can be customized to a buffered distance or for a specific species of interest. Users can also customize their own email alerts to keep informed about new invasive species sightings in their area(s) of interest.

Access to iMapInvasives, through the beginning of 2019, was only available to users who attend trainings either online via webinar software or in-person workshops, though interested parties could request a username by reviewing static training materials on the website. With new functionality updates, users can now create their own usernames without having attended a training previously. All work within this study was based on iMapInvasives 2.0, which is still relevant, but different than the new platform, iMapInvasives 3.0. There were several user levels assigned with each progressive level providing greater access and resources within the site. There are currently multiple pathways for data submission, including bulk uploads, individually online, and through the mobile app. There are also options to submit assessments, surveys, treatments, and infestation management data, though this was previously limited to higher user levels. Most data are visible to the public to view online via maps, tables, and reports, but not all data is downloadable by users. A limited time agreement for use of data can be created under certain circumstances for research, or other projects enhancing the goals or mission of iMapInvasives and New York State.

The use of iMapInvasives is a growing effort enabling collaboration among professionals and volunteer users who observe and report invasive species location data, leading to an increase in shared knowledge. This has given NY the advantage of seeing the bigger picture as invasive species spread across the state. However, as this growing community continues to expand, the need for trainings and requests to work with the database has created a complex capacity

problem (Fig. 1.5). When programs like iMapInvasives, which both educates community scientists and expands our collective knowledge base, are confronted with training capacity issues, train-the-trainer approaches are a popular strategy to increasing organizational training capacity (Tobias et al. 2012).

Education and Outreach

Many community science programs include an education and outreach component and vice versa. This varies by program, but can focus on nature and the interface between natural resources and human well-being (Jacobson et al. 2015). The goals of outreach and education programs typically serve as an avenue for new awareness, knowledge, attitudes, skills, and participation (UNESCO 1978). Educators should strive to transfer information, provide tools and techniques, and enable the decision-making process (Stevens and Andrews 2006).
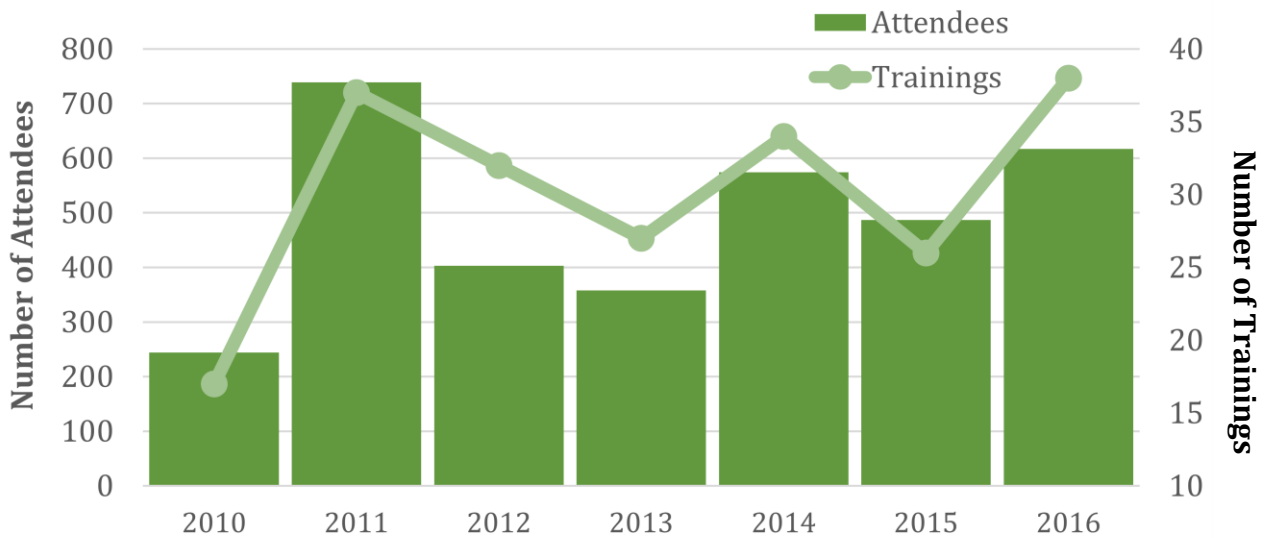
Figure 1.5. iMapInvasives training history prior to initiation of the CTN. Number of attendees is represented by the bars and trainings by the line.

For this research, educators are referred to as the people who are designing and delivering programs or other opportunities for, and in collaboration with, their audience. For simplicity, the terms educators, education, and outreach should be considered in the broadest sense. Outreach programs are designed to reach non-captive audiences in less formal settings. These programs typically increase the audiences understanding of different issues, exchange ideas and opinions, and establish a dialogue within the community. Environmental outreach techniques include publications, presentations, exhibits, and the use of technological tools. There is often a heavy marketing component to meet the needs of the audiences through social media, public meetings, advertisements and television (IUCN 2002).

Environmental education is often viewed as formal learning, defined as a process of imparting or acquiring knowledge, developing the powers of reasoning and judgment, and preparing oneself or others intellectually for mature life (Day and Monroe 2000). Environmental education techniques include investigation, community science, nature awareness, service-learning, and the use of interactive tools. Classroom teachers often use these techniques and more to give first hand experiences to students. Environmental education provides knowledge and skills that audiences should reasonably be expected to have, though it should not be confined to audience's formal education or professional background (Lucas 1972).

Environmental education is diverse, complex and continually evolving. According to the 1978 Tbilisi Report (as summarized by Palmer 1998) there are three goals of environmental education:

- To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas;

- To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;

- To create new patterns of behavior of individuals, groups, and society as a whole toward the environment.

Educating communities and ourselves about the importance of environmental conservation through outreach and education has been well-articulated in many fields (Aumen and Havens 1997, Bjorkland and Pringle 2001, Ecklund et al. 2012, Rocks-Macqueen 2016). Efforts to communicate science effectively must be portrayed beyond just information sharing, and may result in meaningful changes in policy and resource management (Pringle 1999). Collaborative efforts among mixed entities at local or state levels can spearhead effective environmental education efforts and create more sustainable projects (Hudson 2001). Conservation of the environment depends on public education, and strategies to achieve these goals need to be broad and incorporate community participation to be most effective (Bjorkland and Pringle 2001).

By creating and following a framework that organizes environmental education activities and strategies commonly used, program designers can link their purpose to the strategy and better select interventions for their programs. Here we will focus solely on a framework created by Monroe et al. (2007) based on the foundation of the Fien et al. (2001) and Scott and Gough (2003) frameworks. Monroe et al. (2007) write that the more the educator consults the audience, the more likely they are to achieve their objectives, some of these categories only being reachable by using participatory strategies. Monroe et al. (2007) define four categories of interventions based on previous framework objectives (Fig. 1.6):

- Convey Information – one-way communication, provide learners with missing facts or data to build awareness about a topic.

- Build Understanding – two-way communication, engage audiences in developing mental models, implies multiple thinking skills like remembering, recognizing, interpreting, summarizing and explaining (Krathwohl 2002).

- Improve Skills – enhance or change practice, performance and behavior, applying skill or organizing and critiquing information(Krathwohl 2002) also may more actively incorporate theories of diffusion (Rogers 2003), persuasion (Petty et al. 2009), community based social marketing (Thomson and Brain n.d.), and behavior change (Ajzen 2012) to improve adoption of behaviors.

- Enable Sustainable Actions – educator and learner work together to define goals and methods, beyond just skill building, but building capacity for effective stewardship in complex world.
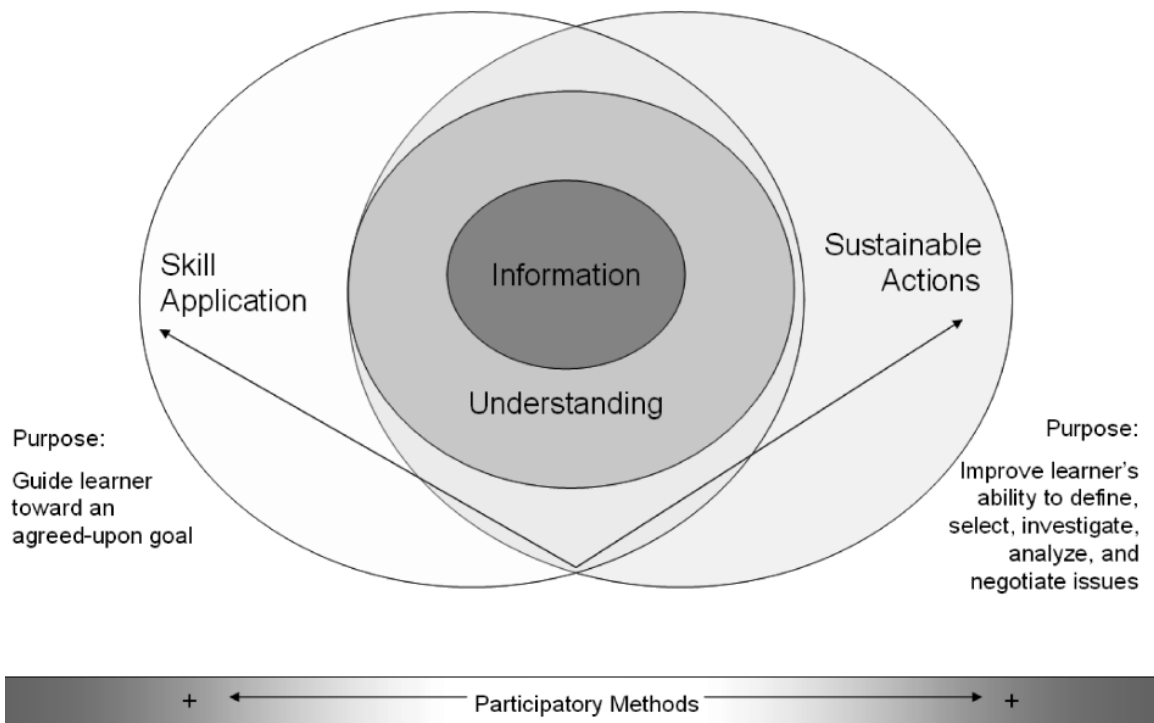
Figure 1.6. A Framework for environmental education strategies (Monroe et. al. 2007).

A practical example of this framework in New York would be efforts towards education on the spotted lanternfly (*Lycorma delicatula*); when a new individual was found alive in NY, mass alerts were communicated to a large population making them aware of the new observation (Convey Information). With time, educators developed resources with information on their distribution and potential damage (Build Understanding). Since, many workshops have been held emphasizing impacts of the spotted lanternfly, by showing communities how to inspect gear after being in an infested region, through recommendations on how to report sightings, and even how to put sticky tape traps on tree of heaven (*Ailanthus altissima*) to try and trap lanternflies (Improve Skills). Since NYS considered this species a high priority, additional efforts are being made to work within communities, many organizations like the eight PRISMs, Cornell Cooperative Extension (CCE), and other NYS agencies are now working together, to identify innovative solutions or create comprehensive management/response plans to lessen the harm this species will cause (Enable Sustainable Actions).

A strategy of environmental education and outreach to note is the development of positive perceptions of the natural world in the audiences' home community. These perceptions are often created by significant experiences within natural settings (Haluza-Delay 2001). It is important as an educator to instill a "sense of place" especially one that allows nature to be among civilization, not just in the wilderness, where people are not. A sense of place is constructed by experience, not just in passing (Tuan 1975). By building relationships with, and awareness of, the natural environment within communities, the dichotomy between humans and the natural world can be lessened, thereby fostering more environmentally sensitive behaviors (Haluza-Delay 2001).

Creating a sense of connection and meaning is an important aspect of the learning process as emotion is "the gatekeeper to learning" (McGeehan 2001). The research conducted by Richard Louv (2008) suggested environmental curriculum can have beneficial environmental, social, psychological, and spiritual implications and that students are often more aware of global issues and crises than they are of what is within their community. When faced with these global-scale topics and no hands-on learning connection to their community, the result is a reaction of cognitive dissonance (Umholtz 2013). Programs like iMapInvasives help stakeholders connect with their environment and understand that nature exists everywhere, in rural, suburban, and even urban areas.

By improving access to ecological knowledge through a variety of outreach and education techniques, programs can have a real demonstrable impact; efforts can enable more sustainable behaviors, improve public support for conservation, compliance with regulations, and influence policy affecting the environment (Day and Monroe 2000, Jacobson et al. 2015). Creating and implementing successful outreach and education programs requires knowing and understanding different audiences and strategizing how best to reach them. Beyond just raising awareness and improving our understanding of invasive species distributions, community science projects, like iMapInvasives, can motivate individuals to take action or make changes to improve the environment in their communities.

Community Science

Community science, also commonly known as citizen science, is defined as the participation of non-professionals in scientific work, typically in collaboration with, or under the direction of, professional scientists and academic institutions.

Community science is expanding the frontiers of ecological research while facilitating public engagement. Community science has modernized through many technological and societal advances and has historically been referred to as Public Participation in Scientific Research (PPSR), civic science, amateur science, or crowd-sourced science, though community science is now an accepted term for a range of programs (Bonney et al. 2009, Haklay and Wyler 2018). The amount of participation involvement varies, but typically includes data collection and reporting (Bonney et al. 2009, Shirk et al. 2012, Kosmala et al. 2016).

The rise of science as a paid profession is a rather recent phenomenon, only occurring during the late 19th century (Silvertown 2009). Prior to this, most scientists made their living through other professions, e.g., Charles Darwin (1809–1888) sailed on the *Beagle* unpaid and Benjamin Franklin was a printer and politician. Science in its historical form was mainly for those of privilege, though today it is becoming more and more available to all, through a variety of projects and platforms.

The earliest, and potentially most well-known, community science projects were initiated by the National Audubon Society and Smithsonian Astrophysical Observatory. The National Audubon Society's Christmas Bird count, initiated in 1900, provides a unique understanding of avian population trends over a wide geographic range, the results of which are resourced as a climate change indicator according to the fourth edition of EPA's *Climate Change Indicators in the United States,* published in 2016 (Schreiber and Schreiber 1977b, U.S. Environmental Protection Agency 2016). Another example involving tens of thousands of amateur scientists is the tracking of very early satellites through Moonwatch, which was initiated in 1956 by Fred Whipple and his colleagues (Smithsonian Institution 1957). This project was extremely successful, even though the team of professionals was criticized by Smithsonian Astrophysical

Observatory administrators and other scientists for incorporating non-professionals into their study (McCray 2006). Other noteworthy community science focused projects led by organizations across the globe include cherry blossom monitoring in Japan (Havens and Henderson 2013), monarch butterfly tagging in the United States (Howard and Davis 2009), and ladybird counts in the United Kingdom (Cooper 2016), all of which have influenced ecological observation and research projects (Dickinson et al. 2012).

There has been an expanding trend in projects and participants over the past decade (McKinley et al. 2017), fueled in part by increases in formal education, technological advances, management and policy needs, and long-term ecological monitoring programs, including those mentioned previously (Silvertown 2009, Newman et al. 2011). Today, there are many community science associations globally, which help improve the understanding, value, and participation of community scientists and organizations. The Citizen Science Association, initially sponsored by the National Science Foundation, the Noyce Foundation, and the Bechtel Foundation, has over 5,000 members, 1 million volunteers from 81 different countries, and offers many benefits, including access to a discussion listserv and serving as a tool to help build collaboration, community, and credibility. The Citizen Science Association's journal *Citizen Science: Theory and Practice* is the first peer-reviewed journal dedicated to community science related research.

Data quality is a common concern of scientists and organizations managing community science projects, and it is an aspect that has been extensively criticized (Crall et al. 2011). The concept of data quality is often task-dependent but consists of multiple metrics, focusing on data management practices, timeliness of data, accuracy, bias, and more (Dickinson et al. 2012, Kosmala et al. 2016). The application of data quality assurance mechanisms is directly related to

contributions solicited and include a wide variety of methods (Wiggins et al. 2011, Azavea;

SciStarter 2014). Some data validation techniques include, automatic filtering of unusual reports,

expert review, paper data sheets, photo submissions, replication or rating, by multiple

participants, and quality assurance, quality control training program.

This thesis will continue to use the term community science rather than citizen science

due to the polarizing nature of the word "citizen". These programs are designed to be inclusive

and create opportunity for the participation of all who are interested, and it is important to use

terminology that creates a more inclusive and equitable environment.

Many community science projects rely on volunteer training as part of quality assurance

and quality control. Training methods vary by project, but studies show in-person or web-based

interactions are more efficient than static documents alone (Wiggins and Crowston 1996,

Newman et al. 2012). Training volunteers is also considered a mechanism to increase

contributions, with regular training seminars further increasing participation (World

Meteorological Organization 2001). Developing protocols and training volunteers is time

intensive, but balances data reliability with public education, both of which are equally important

for many projects (Cohn 2008).

Train-the-Trainer Program Model

As the iMapInvasives community continues to expand, the need for trainings and

requests to work with the database has created a complex capacity problem. Since launching in

2010, the number of people utilizing iMapInvasives has grown and training requests,

traditionally fulfilled by NYNHP staff, has exceeded staff capacity (Fig. 1.5). The program

needed a way to address statewide need for training capacity, and in a standardized way to

increase efficiency, to reach new audiences and areas of the state without increasing staff travel,

and keep the momentum going of the growing iMapInvasives community in New York. When programs, like iMapInvasives, are confronted with training capacity issues, train-the-trainer (TTT) approaches are a popular strategy to increasing organizational training capacity (Tobias et al. 2012).

TTT approaches typically include the effort of training individuals about a program, who then use that information to train others. TTT programs provide participants with the necessary knowledge and skills they need to become trainers. Trainers are often expected to achieve an adequate level of expertise in the program's concepts in order to have the ability to disseminate that information to others (Ray et al. 2012). TTT programs are utilized in a variety of fields, e.g., public health care, workplace safety, nutrition, end-of-life care, clinical intervention programs (Burr et al. 2006, Stratos et al. 2006, Brimmer et al. 2008, Kalisch et al. 2013, Clifton et al. 2018). Following a TTT approach may benefit iMapInvasives by: reaching larger audiences, having direct access within communities, gaining a better understanding of issues affecting communities, enhancing collaboration and networking, and sustaining programs through potential cost reduction (Orfaly et al. 2005, Yarber et al. 2015, Clifton et al. 2018). An obstacle of TTT programs is the implementation of trainings. Literature suggests many programs have low training implementation at the local level, many programs sharing ranges from only 16–20% of trainers actually implementing the practices in their own communities (Orfaly et al. 2005, Lee et al. 2012, Ray et al. 2012), though not all literature includes a percentage of participants that actually initiate the next step of facilitating their own trainings (Hiner et al. 2009).

Creating and implementing successful education and outreach components within community science programs requires knowing and understanding different audiences and strategizing how best to reach them. TTT programs often rely on adult learning theories, known

as andragogy, to serve as a foundation of their work (Murphy and Carson-Warner 2002).

According to Knowles (1980), there are six core principles in andragogy (Holton et al. 2001):

- Adults need to know why they need to learn something

- The Self-Concept of adults is heavily dependent upon a move towards self-direction

- Prior experiences of the learner provide a rich resource for learning

- Adults typically become ready to learn when they experience a need to cope with a life situation or perform a task

- Adult's orientation to learning is life-centered, and they see education as a process of developing increased competency levels to achieve their full potential

- The motivation for adult learners is internal rather than external

To summarize adult learning theory, adults learn best when the trainer's role is to create and maintain a supportive climate for learning to take place, and allows participants to be involved in the planning, implementation, and evaluation of their own learning (Smith 2002).

To maximize efficiency and take advantage of existing technology, multiple TTT programs have utilized online or webinar based trainings to disseminate information (Stratos et al. 2006, Lee et al. 2012, Yarber et al. 2015). With the loss of face-to-face interactions, programs should carefully consider methods to enable partnerships and networking amongst peers, especially as these connections are highly rated as beneficial to the trainer (Yarber et al. 2015). Another important aspect of TTT programs is having support from faculty, via phone or email, for consultation in planning trainings, technical assistance, and additional factual information (Tobias et al. 2012). Program managers should also take into consideration the need to maintain knowledge and skills learned in the program through periodic booster courses or encouraging partnerships among organizations (Brimmer et al. 2008). According to Clifton (2018), TTT

models allow for a more holistic approach to training development as they consider conditions and constraints of potential trainers like time or funding restrictions. By also adopting more flexible approaches to training delivery, trainers may feel more motivated and confident to implement trainings, while having the advantage of being locally connected to their stakeholders, and having awareness of contextual factors potentially inhibiting participation in programs (Stratos et al. 2006, Clifton et al. 2018).

Efficient Volunteer Programming

Volunteering is generally defined as freely chosen involvement undertaken through an organization or agency and performed for the benefit of others or the environment as well as oneself (Cuskelly et al. 2006). The term volunteer in this research is referring to the Certified Trainers Network (CTN) members who are volunteering their time to promote use of iMapInvasives by conducting trainings and submitting observation reports, whether they are doing it for personal or professional purposes. CTN trainees are also considered volunteers participating in data collection through iMapInvasives, but terminology will be emphasized when referring to CTN members, trainers, non-trainers or trainees. In environmental education and community science, volunteers should have knowledge, understanding, and awareness about the environment and its challenges, and concern for conservation, whether of the whole ecosystem or just a specific aspect (Thiengkamo 2012). In the case of the CTN, volunteers should also have the necessary skills to monitor and evaluate trainee perception, knowledge transfer, motivation, potential barriers, and community dynamics. Volunteers should inspire themselves, friends, family, and society through their actions and collaborative networks (Gonggool et al. 2012).

For community science programs seeking community contribution, attention should not only be focused on a desired behavior, but also on what motivations or values create that behavior. According to Lewin (1951), motives are goal-oriented forces induced by threats or opportunities to ones values, or preferences. For example, if a person values an environment free of invasive species, then initiation of a management plan in their community is likely to be a goal, which will in turn induce motivation directed toward reaching this goal. This motivation may lead to volunteers joining the CTN to share information about the impact of invasive species and how to report their distributions to iMapInvasives. The management plan would be considered an ultimate goal, not meaning *most important*, but the specific state a person is trying to reach. Volunteers may also be motivated to participate due to instrumental goals, such as improving personal or professional knowledge and skills. There are also unintended consequences, both positive and negative, in the pursuit of a goal. For CTN members, positive unintended consequences could include hosting a training, which leads to recruitment of new CTN members. Negative unintended consequences could include somebody planting an invasive

Table 1.1. Four motives for community involvement (from Batson et. al. 2002).

Motive	Ultimate Goal	Strength(s)	Weakness(es)
Egoism	Increase one's own welfare.	Many forms; easily invoked; powerful.	Increased community involvement relates to the motive only as an instrumental means or unintended consequence.
Altruism	Increase the welfare of one or more other individuals.	Powerful; may generalize to group of which other is a member.	May be limited to individuals for whom empathy is felt; increased community involvement relates to the motive only as an instrumental means or unintended consequence.
Collectivism	Increase the welfare of a group or collective.	Powerful; directly focused on common good.	May be limited to ingroup.
Principlism	Uphold some moral principle (e.g., justice).	Directed toward universal and impartial good.	Often seems weak; vulnerable to rationalization.

plant they learned about at a training because they thought it was beautiful, regardless of the potential impact it could have. The list of motivations to volunteer is endless and varies as much as one's personal preferences or values (Batson et al. 2002). It is crucial to know and understand what motivations might lead to a volunteer's community involvement. There are four main motives (egoism, altruism, collectivism, and principlism) as described by the Batson et al. conceptual framework (Table 1.1).

Batson et al. (2002) recommended once a communities goal is identified, carefully orchestrating these four motives together to use the strengths of one to overcome the weaknesses of another, and appealing to one's altruism or collectivism may be the most successful in building a program. Successful volunteer programs focusing on natural resource education or restoration, like the CCE Master Naturalist Program, have found that values (altruism) and understanding (learning experiences) are the most prevalent motivators for joining their organization, which is consistent with many similar programs. Two different studies of community science volunteers found that contribution to scientific work was also an important motivator alongside values and understanding (Alender 2016). Recruiting should focus on the values and understanding of volunteers while retention strategies should incorporate social opportunities and egocentric enhancements, which will be explained further below (Broun and Nilon 2009).

Recruitment practices include developing position descriptions and creating resources that may be disseminated through email, conferences, word of mouth, and other venues to attract volunteers, like newsletters and social media (Larese-Casanova n.d., Cuskelly et al. 2006). People find it easier to absorb new ideas in areas in which they have some expertise (Reagans and McEvily 2003). Focusing initial CTN recruiting towards individuals already involved in

invasive species programs can be more beneficial than recruiting individuals outside of this

immediate area of expertise. Reagans and McEvily (2003) also suggest strong interpersonal

attachments and frequent communication are more likely to result in volunteers sharing

knowledge than those who are not. It is important to continuously recruit new volunteers, but

organizations should concurrently invest in retention of active volunteers as an estimate of 33.3%

of those who volunteer do not donate their time the next year, at any organization (Eisner et al.

2009).

Programs interested in retention of their volunteers should invest in strategies including

professional development for the manager, screening and training volunteers, evaluating

volunteer motivations, recognition, and social interactions (Hager and Brudney 2004). The study

conducted by Alender (2016), on water quality community science volunteers found recognition

for their work was important for retention and volunteers ranked hand-written acknowledgment

the most meaningful form of recognition. This study also suggested coordinators would benefit

greatly from more specific knowledge about how to show appreciation to their volunteers and

how to craft messages to recruit and retain volunteers based on the volunteer's specific

motivations and values. Satisfaction of the volunteer program is vital to retention of volunteers

and a sign of effective volunteer management (Mutawa and Ali 2012). It is important for the

organization to create a welcoming culture for volunteers and to support them with resources and

enlists them to recruit additional volunteers. The Corporation for National and Community

Service's Office of Research and Evaluation shared that 96.7% of NY residents regularly talk to

or spend time with friends and family, making word-of-mouth transmission a very important

recruitment strategy for programs like iMapInvasives. Previous studies have also emphasized the

importance of building relationships and providing feedback and assessments to volunteers,

despite increasingly busy schedules of volunteers and coordinators. Though found to be unrelated to retention, it is important to note that documentation of volunteer numbers and hours help organizations to better understand benefits and value of volunteers, information that is also important for funding and program justification. Programs use a variety of methods to document this information.

Volunteers have complex motivations, which may be difficult to completely satisfy, but volunteers are the backbone of community science programs, so the effort is essential. It is important to understand volunteers are not just free labor, but a method to maximize program capacity when utilized efficiently. Volunteers contribute an invaluable amount of effort to programs. By calculating the value of volunteers in numbers, it provides programs with a tangible measurement illustrating the power of the individuals who are transforming their communities, but is not meant to undermine or ignore the rich and diverse intrinsic contributions that are not easily measured.

According to the Corporation for National and Community Service's Office of Research and Evaluation (CNCS), 25.3% of NY residents volunteer, though only 1.8% of NY residents volunteer for environmentally related organizations, 5% nationwide. The CNCS is the federal agency that leads service, volunteering, and grant-making efforts in the United States and includes AmeriCorps, Senior Corps, Social Innovation fund, and more. The CNCS also provides resources and tools for improving programs and increases their ability to serve people more efficiently and effectively. The 2018 Volunteering in America report found that 77.3 million adults (30.3%) volunteered. Nationally, Americans volunteered nearly 6.9 billion hours, worth an estimated $175.5 billion in economic value, based on the Independent Sector's estimate of the average value of a volunteer hour for 2018. The independent sector estimates the value of NY's

volunteer time for 2018 at $30.18 per hour, 18.7% higher in NY than the national average. The Missouri Master Naturalist Program estimated that as of 2007 their almost 200 MN volunteers had donated over 16,000 hours of service, with an economic impact valued at over $330,000 (Broun and Nilon 2009).

Since environmental education is an effective instrument to raise awareness, attitude, and encourage behavioral change in activities for environmental conservation, proper management and coordination of CTN members is important and can be achieved through a series of strategies. These strategies include recruitment, training, communication, recognition, and assessment. According to RGK (2006), under-resourced volunteer programs with over-extended volunteer managers limited the capacity of the organization to capitalize on volunteer contributions, further limiting organizational capacity. It is important for organizations to recognize and support the role of volunteer management and capacity of each program (Knepper et al. 2015). Knepper et al. (2015) and others have studied the relationship between organizational capacity and volunteer management, which revealed success in maximizing volunteer engagement results from utilizing best management practices, though there are still barriers like limited funding, time constraints, and a lack of understanding of volunteer management. It is important to consider professional development and other trainings for volunteer managers, to ensure programs are being managed most efficiently.

Sustainability of community science projects like iMapInvasives depend on continued participation of users. Understanding motivations to begin volunteering and to continue participation is important. Participants are often initially motivated by an interest in the program, because they want to learn something or to contribute to science (deVries et al. 2019). Programs that follow best management practices and disseminate information via results, training, and

feedback to volunteers are more likely to retain volunteers (Baruch et al. 2016). The value of volunteers is exemplified through literature cited in this study. Satisfying their motivations for recruitment and retention through the strategies discussed above is beneficial to the program.

Project Summary

The overall goal of this project was to take a new training approach to iMapInvasives by implementing a Certified Trainers Network, following a train-the-trainer model. The intention was to increase the iMapInvasives program's capacity gap and to serve the training needs of the growing and diverse iMapInvasives community across NYS. This was achieved through multiple objectives and helps New York State residents (and visitors) to expand their understanding and awareness of invasive species, while encouraging the development of more environmental stewardship practices that may in turn slow the spread of invasive species.

This research evaluates if following a train-the-trainer model was an effective method of improving this statewide community science program's capacity. It was hypothesized that by developing and implementing the Certified Trainers Network, following a Train-the-Trainer model, the ability of the NYS Invasive Species Database to engage new, and maintain old, users throughout the entirety of the State of New York will be improved. For the purposes of this research, the study period began October 17, 2017 and ended March 17, 2019, though the Network continued beyond the conclusion of this study.

This thesis begins with a literature review providing the necessary background information relevant to understand the study. Subsequent chapters cover creation and coordination of the TTT model program, invasive species knowledge gained and effectiveness as

a statewide program, and results from the CTN member assessment. Each chapter incorporates discussions that interpret results of each component of the study, while integrating past research. I conclude with limitations of the study and recommendations to be presented for the program moving forward.

CHAPTER 2

Development of iMapInvasives Certified Trainers Network

Following a Train-the-Trainer Approach

ABSTRACT

The concept of train-the-trainer (TTT) is not new, in fact, there are many successful existing programs focusing on a variety of topics, including workplace safety, nutrition, clinical intervention, and more. When community science programs, like iMapInvasives, are confronted with training capacity limitations, utilizing a TTT approach could be beneficial. This research focused on the development and coordination of NY's iMapInvasives Certified Trainers Network (CTN), and its potential as a statewide program. Different strategies (e.g., recruitment, initial training requirements, certification, etc.) are used to introduce new, and to maintain old, users. In this study, a total of 131 CTN members were trained, 78 of which ended up not becoming trainers (= non-trainers) and 53 who did (= trainers). Trainers hosted 77 in-person trainings using resources provided to CTN members across NYS during the 18 mo study period. These trainings were hosted in 52 cities/towns, with 1,162 people attending. The train-the-trainer approach to improve the iMapInvasives program capacity was successful as a statewide program with 298 attendees submitting 4,290 new observations in 60 of 62 counties in NYS.

Keywords: program capacity, train-the-trainer, invasive species, volunteer, member certification

INTRODUCTION

Use of iMapInvasives, a GIS based online tool managed by NY Natural Heritage Program, is a growing effort enabling collaboration among professionals and volunteers who observe and report invasive species location data, leading to an increase in shared knowledge. This has given NY the advantage of seeing the bigger picture as invasive species spread across the state. However, as the number of iMapInvasives users continues to expand, the need for trainings and requests to work with the database created a complex capacity problem. When programs, like iMapInvasives, are confronted with training capacity issues, train-the-trainer (TTT) approaches are a common strategy to increase organizational training capacity (Tobias et al. 2012). By incorporating multiple education and outreach strategies, efforts of volunteers should be more efficient, number of observations should increase, and a higher percentage of individual volunteers should be retained.

The overall goal of this research was to develop and coordinate a New York iMapInvasives Certified Trainers Network (CTN) following a TTT model. While this research focuses on community science programming and reporting invasive species, it is important to note that much can also be learned from other diverse and successful TTT model programs, e.g., public health care, workplace safety, and clinical intervention programs. In fact, many of the most successful models were formed through integration and collaboration of other disciplines.

METHODS & DESIGN

To increase training opportunities incorporating a TTT approach iMapInvasives members were offered the opportunity to become Certified Trainers. Towards this, a three-step certification protocol was developed:

1. attend an initial live training or review a recorded version of standardized training webinar

2. submit a certification plan

3. host their first training

There were two levels of certification created as part of this protocol:

- Certified Basic Trainer: member would host one or more trainings in their local community and then continue to host one or more per year to remain listed as active,

- Certified Master Trainer: member would host three or more trainings in their local community and then host two or more trainings per year.

Recruitment

The target audiences to solicit for the CTN included natural resource professionals, college students, professors, non-formal educators, and any additional community scientists interested in protecting NY's natural areas from the threat of invasive species. An informational flyer was created to announce the CTN and call it to the attention of intended audiences. The flyer described who should join the CTN, benefits of becoming certified, importance of the project, and how to become certified (Appendix 2.1. Call for Trainers Flyer). A webpage was created on the NY iMapInvasives website for the CTN, including information about upcoming trainings, members, and copies of resources created for the program (Appendix 2.2. CTN Webpage).

Due to the diverse community of individuals interested in invasive species already existing in NYS, recruitment began by utilizing the eight Partnerships for Regional Invasive Species Management (PRISM) email listservs and their 1,210 individual members (Appendix 2.3. PRISM Boundaries and Table of Members). In December 2017, the first email announcement was disseminated to these listservs announcing the new CTN with an opportunity

to register for multiple live webinar trainings (Appendix 2.4: Example of Recruitment Email from February 2018). At the time of the creation of the CTN, there was not a readily available method to solicit potential CTN participants from the iMapInvasives user pool, i.e. people who had previously gone through training and received a username to access the database. By June of 2018, an old "NY invasive species" listserv was revamped for use by the iMapInvasives staff to connect with active users in the database. The listserv is maintained by Cornell University through Lyris ListManager, a three-tiered internet application designed to deliver email quickly and efficiently to large numbers of recipients. This resulted in a list of nearly 7,500 potential participants for the CTN, though members of the PRISM listserv overlapped with the iMapInvasives user list and there were multiple duplicate emails in the iMapInvasives user list. Announcements for webinar trainings were also shared on the CTN webpage via the iMapInvasives website.

Other important venues for recruitment included word-of-mouth through iMapInvasives trainings, participating in the Going Green video series (a program devoted to environmental problem solving, produced by YNN News in collaboration with SUNY ESF), participating in invasive species related workshops, and professional conferences, e.g., the New York State Society of American Foresters Annual Conference, New York State Outdoor Educators Association, and an in-service event for the Cornell Cooperative Extension Agriculture, Food & Environmental Systems.

Initial Training Webinar

All CTN members were/are required to attend a standardized initial training webinar or review a previously recorded version of the training. To maximize efficiency and take advantage of existing technology, multiple TTT programs have utilized online or webinar-based trainings to

disseminate information (Stratos et al. 2006, Lee et al. 2012, Yarber et al. 2015). Initial CTN trainings, were between 1.75–2 hours long, varying based on the number of attendees and how interactive they were when given opportunity to speak aloud or through the chat feature. All attendees were encouraged to introduce themselves, relay their interest or purpose for joining the CTN, and to share ideas for hosting future trainings. Information shared not only connected them to create a sense of community, but also formed the basis of their certification plan — making the second step of certification easier. The webinar consisted of a 52–56 slide PowerPoint presentation (Appendix 2.5. Initial Training Webinar PowerPoint). The training presentation increased in total slide length as the year progressed as it was updated to separate information from one slide to multiple, to add a slide with CTN updates, and to include additional suggestions for upcoming dates and training opportunities. This additional information did not change the overall message of the training, but helped to deliver the message more clearly.

Two pilot trainings were conducted in-person before full implementation of the CTN program to ensure the training was effective and to allow for changes to be made (Jacobson et al. 2015). The initial training agenda and PowerPoint presentation were piloted through in-person trainings with two separate organizations with experience in iMapInvasives (Hobart and William Smith Colleges and Rochester Institute of Technology with four individuals total). These trainings were completed in-person and included discussion to obtain in-depth evaluation and feedback on the delivery and presentation between October and November 2017. The final format of the webinar was ~ 2 hrs long with an overview of iMapInvasives and the CTN. The first initial training webinar with the public was offered January 4, 2018.

Interested parties were required to attend a standardized webinar-based training as initiation into the CTN, though this did not mean they were Certified Trainers, as they would

need to complete additional tasks following the training. All initial training webinar registration responses were reviewed prior to the webinar to ensure audience questions could be addressed during the training. (Appendix 2.6: ITW Registration Form sample). Registration was collected via Google Forms to gather participant's first and last name, email, city, county and state, telephone number, organization represented (if any), position title (if any), if they had an iMapInvasives account, why they were interested in the CTN, and to solicit questions and comments. Registration information collected was compiled into a directory of members.

The initial training webinar was designed to provide attendees with information and skills needed to efficiently conduct an iMapInvasives training within their organization or community. Eleven live webinars were offered between 01/04/2018 and 11/06/2018. An additional 12th training section is included in this report, which includes the 4 individuals who participated in the in-person pilot training sessions and those who viewed a recorded version of the training via YouTube, which reached 160 views.

CTN Levels of Membership

Two levels of certification were offered to CTN members who embraced the responsibility to host their own trainings where they would facilitate the dissemination of invasive species and iMapInvasives program information. These members were required to: 1) view the initial training webinar, as described above, 2) submit a certification plan, and 3) host their first training to train new iMapInvasives users, who will be referred to as CTN "trainees" (Appendix 2.7. Certification Plan). To become a Master Certified Trainer (MCT), individuals were required to host three or more trainings and continue to host two trainings per year to keep their certification. To become a Basic Certified Trainer (BCT), individuals were required to host one or more trainings and continue to host one training per year to keep their certification.

Master and Basic Certified Trainers will be referred to collectively as "trainers" for the remainder of this document. The continual certification process (and multi-training requirement) served as a goal for each of the trainers to achieve, helping to expand the iMapInvasives program within local communities. Attendees who have yet to host a training since participating in the initial training webinar are hereafter referred to as "non-trainers" and are considered valuable in that they are contributing observations to iMapInvasives and retain the potential to become trainers (Fig. 2.1).

CTN Strategies

After individuals attended the initial training webinar, they became CTN members and had the option to become either a Basic or Master Certified Trainer. Based on the literature review conducted for this research, multiple strategies were then used to continue recruiting,
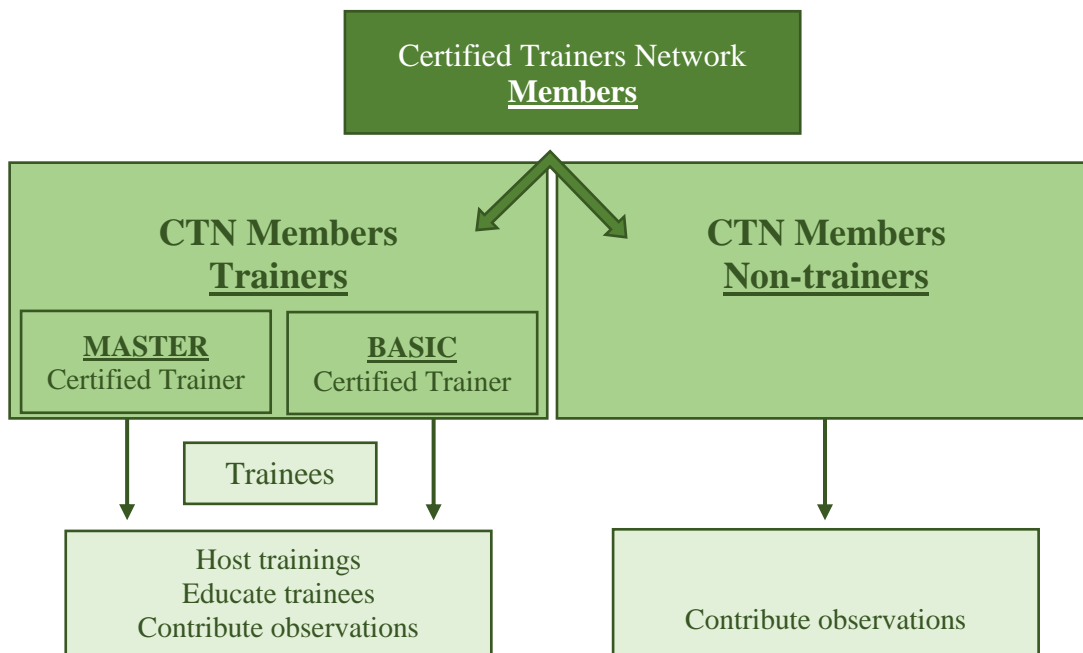

Figure 2.1. Certified Trainers Network Levels of Membership. All CTN Members were either trainers or non-trainers, though their overall contribution to iMapInvasives was different.

retaining, and engaging this network. Three main strategies were focused through the creation of resources, communications and trainings.

RESULTS AND DISCUSSION

A total of 231 people registered for the initial training webinars (Table 2.1). Of the registrations received, 143 (61.9%) attended the training they registered for. Some of the absentees attended a later webinar or did not participate at all. Previous research indicated that without a fee or other requirement to attend the webinar, up to 65% of registrants would not attend the event, so a 61.9% attendance rate was considered very good (Molay 2009, Britton 2014, Hoke et al. 2018). Trainings were offered Monday to Thursday with the start time varying between morning (9:00AM – 9:30AM), afternoon (12:30PM – 2:00PM), and evenings (4:00PM – 6:00PM). Morning sessions produced the highest number of trainers 22 (49%) and the afternoon sessions had the highest number of total attendees, 54 (40%). It would be ideal to continue tracking these results as more trainings are offered for new members of the CTN, there was a heavy concentration of morning trainings in the first quarter and more opportunity to host trainings due to length of time in the CTN.

There were three main sections of the initial training webinar. The first covered basics of the iMapInvasives program introduction and background as well as multiple tips for trainers for sharing information. The middle and longest section was walking through the iMapInvasives website, online database, and the mobile app. The training concluded with tasks that had to be completed before, during, and after trainings, i.e. the certification plan and next steps following the training.

Attendee participation included verbal conversations for in-person trainings and text/chat for online webinars, both features were readily available through WebEx and Zoom software that

Table 2.1. Summary information from Certified Trainer Network initial training webinars, CBT = Certified Basic Trainer, CMT = Certified Master Trainer.

Certified Trainers Network Initial Training Webinars								
Type of Training	Date	Time	Registered	Total Attendees	CBT	CMT	% attended	% trainer
Webinar 1	1/4/2018	9:30AM	23	19	5	6	82.6%	57.9%
Webinar 2	1/9/2018	12:30PM	14	10	1	2	71.4%	30.0%
Webinar 3	1/17/2018	9:30AM	18	10	1	1	55.6%	20.0%
Webinar 4	3/13/2018	9:00AM	22	14	3	1	63.6%	28.6%
Webinar 5	4/19/2018	2:30PM	21	12	2	3	57.1%	41.7%
Webinar 6	5/7/2018	12:30PM	19	10	5	0	52.6%	50.0%
Webinar 7	8/13/2018	9:00AM	13	8	3	1	61.5%	50.0%
Webinar 8	8/13/2018	4:00PM	11	6	2	0	54.6%	33.3%
Webinar 9	10/16/2018	6:00PM	21	12	4	0	57.1%	33.3%
Webinar 10	10/18/2018	2:00PM	28	22	3	0	78.6%	13.6%
Webinar 11	11/6/2018	5:30PM	32	11	1	0	34.4%	9.1%
Other (5)	N/A	N/A	9	9	1	8	100%	100%
TOTAL			231	143	31	22	61.9%	40.5%

was used. Attendees were periodically given time to respond to information on the slides and asked to share their responses aloud. Some attendees did not have microphones or had technical difficulties, which prevented them from verbally sharing information, though all webinar attendees utilized the chat feature. The initial training webinar was recorded and uploaded to YouTube, so attendees could review the training if they were interested and to give opportunity to others to join the network without participating live, though it was encouraged for all to attend live to have a social interaction component as part of their training. Following completion of the initial training webinar, attendees were considered members of the CTN.

Member Certification

At the end of the 18 mo cycle, 131 (92%) of CTN members who attended initial trainings remained in the CTN and will be considered for this research. Of the removed members, most left their employment positions. Of the CTN members remaining, there were 53 trainers (40.5%); 31 Certified Basic Trainers (23.7%) who hosted one to two trainings, and 22 Certified Master

Table 2.2. CTN Certified Trainer trainings hosted across NYS during the 18 mo study period, including training unique ID number, training town/city location, and number of attendees (mean = 13.2 attendees/training, SE ± 1.1).

iMapInvasives CTN Certified Trainer Trainings							
Date	ID	Location	Attendees	Date	ID	Location	Attendees
10/17/2017	283	Syracuse	3	6/30/2018	359	Gardiner	11
11/16/2017	290	Rochester	15	7/5/2018	343	Buffalo	13
1/18/2018	294	Morrisville	9	7/10/2018	386	Moreau	11
1/26/2018	296	Syracuse	31	7/11/2018	369	Niagara Falls	3
2/7/2018	300	Niagara Falls	7	7/11/2018	342	Honeoye	9
2/16/2018	299	Niagara Falls	7	7/12/2018	340	Auburn	11
2/23/2018	302	Redwood	15	7/13/2018	341	Voorhesville	19
3/14/2018	307	East Syracuse	7	7/14/2018	344	Jamestown	7
3/24/2018	304	Skaneateles	10	7/16/2018	345	Setauket	10
3/28/2018	312	Syracuse	10	8/8/2018	350	Oswego	21
3/29/2018	308	Rochester	27	8/14/2018	363	Hamlin	12
3/29/2018	309	Syracuse	41	9/5/2018	383	Cobleskill	43
4/3/2018	311	Lakeville	11	9/13/2018	361	Buffalo	7
4/7/2018	313	Jamesville	14	9/17/2018	362	Syracuse	11
4/11/2018	314	Oneonta	10	9/17/2018	351	Newark	20
4/11/2018	371	Putnam Valley	11	9/19/2018	370	Cortland	11
4/14/2018	352	Ghent	4	9/22/2018	366	Huguenot	4
4/18/2018	315	New Paltz	19	9/24/2018	364	Delhi	8
4/24/2018	353	Watertown	7	10/4/2018	368	Ithaca	32
4/28/2018	317	New Lebanon	2	10/5/2018	367	Ithaca	30
4/28/2018	354	Syracuse	7	10/20/2018	372	Rensselaerville	7
5/10/2018	321	Wilton	17	10/31/2018	373	Cooperstown	5
5/12/2018	320	Chatham	3	11/3/2018	374	Bolton Landing	13
5/18/2018	355	Skaneateles	9	11/5/2018	375	Saratoga Springs	9
5/21/2018	356	Niagara Falls	28	11/10/2018	381	Jamesville	6
5/23/2018	325	Geneva	24	11/14/2018	388	Oneonta	3
5/24/2018	357	Staatsburg	10	11/20/2018	384	Morrisville	4
5/31/2018	324	Ithaca	32	12/4/2018	385	Morrisville	39
6/5/2018	316	Lower Hudson	7	1/26/2019	389	Sherburne	15
6/6/2018	329	Owego	28	1/28/2019	399	Niagara Falls	2
6/9/2018	346	Danby	29	1/31/2019	391	Morrisville	20
6/18/2018	331	Oswego	17	2/5/2019	392	Norwich	16
6/19/2018	333	Cortland	4	2/6/2019	390	Rochester	14
6/22/2018	334	Jamestown	3	2/8/2019	393	Danby	2
6/22/2018	332	Bemus Point	3	2/14/2019	394	Kings Park	30
6/25/2018	360	Poughkeepsie	9	2/15/2019	395	Lowville	7
6/27/2018	337	Geneva	6	2/23/2019	396	Bronx	19
6/27/2018	336	Geneva	7	2/26/2019	397	Binghamton	9
6/28/2018	358	Oneonta	4	Total	77	52	1,020

Trainers (16.8%) who hosted three or more trainings. The other 78 individuals remain as CTN

members, or "non-trainers". A thorough literature review (Chap. 1) suggested TTT training

implementation rates are typically very low, ranging from16–20% (Orfaly et al. 2005, Burr et al.

2006, Ray et al. 2012). However, this study exceeded those expectations at 37% implementation.

The 53 trainers hosted a total of 77 in-person trainings across NYS during the 18 mo

study period (Table 2.2). Through the efforts of the CTN, these trainings were hosted in 52

cities/towns and boasted 1,020 trainees. Of those 77 trainings, 31% were facilitated in

collaboration with 2–4 trainers, and attendance ranged from 3–43 attendees ($M = 13.3$ attendees,

$SE = \pm1.1$). This has helped to create new organizational partnerships and allowed for members

to interact with each other, forming a community within the Network.

A certificate for CBTs was distributed electronically with a thank you email while CMTs

were sent a hardcopy of their certificate along with an iMapInvasives CTN t-shirt (Appendix 2.8

Certificate for Certified Master or Basic Trainers). Recognition of volunteers is considered

essential to convey appreciation for and knowledge of the work contributed by the Network (e.g.,

Alender 2016).

Resources

Many resources were created to assist trainers while they hosted iMapInvasives trainings.

These resources included the following and can be found in the Appendices. Resources were

designed to minimize the time spent by individuals on the intensive process of creating resources

for each training, so trainers could focus on planning, recruitment, and delivery aspects involved

in community science and educational programming (Table 2.3).

These resources were made available via the NY iMapInvasives website (PDF format) or

through a Google Drive Folder where all members of the CTN were invited to join/edit. Google

Drive was chosen as not all CTN would have access to, or the skills needed, to use other

Table 2.3. Resources created to assist CTN members with trainings. Each of these resources can be found within the Chapter 2 Section of the Appendix.

Purpose:	Resource Title	Appendix
Certification	Initial Training Webinar Recording	N/A
	Initial Training Webinar Presentation	Appendix 2.5
	Certification Plan	Appendix 2.7
Pre-training	Checklist	Appendix 2.5
	Training Class Details Form	Appendix 2.9
	Advanced Registration Spreadsheet	Appendix 2.10
	Draft Training Reminder email temp.	Appendix 2.11
During-training	Sign-in sheet (customizable)	Appendix 2.12
	Training PPT Template	Appendix 2.13
	Call for Trainers handout template	Appendix 2.1
	Calling All Users handout template	Appendix 2.14
Post-training	Evaluation Form template	Appendix 2.15
	Draft Follow-up email template	Appendix 2.16

potential software that was explored. Google also gave them the opportunity to edit documents and print them from the Drive without having to download. Trainers were also invited to upload documents they created/updated with the Network as well. Unfortunately, results from the CTN Survey (results provided in Chap. 3) indicated many organizations block access to Google Drive, so other options should be explored in the future.

Communications

Many programs have found volunteers are more likely to sustain involvement in community science projects if they feel connected to the organization and content experts. For example, a study of volunteers participating in water quality focused community science

programs found that 30% of their respondents reported recognition for their work as important and that contribution to scientific work was also an important motivator alongside values and understanding (Alender 2016). To build a "community" for the CTN, the following communication strategies were adopted to maintain member interest in the CTN and hosting iMapInvasives.

Immediately following each initial webinar training an email was sent to webinar attendees welcoming them to the CTN and sharing the presentation slides, certification plan document, and other important resources (Appendix 2.17 CTN member welcome email). At the beginning of each month, an email update was sent with relevant updates about iMapInvasives, invasive species, upcoming events, or issues needing to be addressed (Appendix 2.18 Monthly email update from November 2018). This email served as a reminder to trainers to plan and conduct trainings, to advertise training opportunities, and to offer additional support and assistance. CTN members were given the opportunity to submit articles for the new NY iMapInvasives newsletter created as part of this project and were encouraged to submit information to be highlighted on the iMapInvasives social media pages.

It was hypothesized volunteers would benefit from additional trainings to further orient them to the goals of the network and organization, so additional advanced training was offered throughout the year and via webinar in December 2018 and April 2019. The winter webinar training offered to the CTN had multiple presenters, including other trainers who shared highlights of their programming related to iMapInvasives and guest speakers to help focus training efforts and address barriers trainers may have been facing regarding planning a training and determining content to include. The April training was hosted by iMapInvasives staff to

teach the trainers about the new iMapInvasives 3.0 upgrade which was completely transforming the database.

Administrative Time

Although the CTN was designed to address iMapInvasives training capacity, a considerable amount of administrative time was still dedicated to working with the Network throughout this study period (Table 2.4). A mean of 3.2 hrs was spent on each training, e.g., communication with trainers regarding the event, adding information to an online calendar and social media, downloading and editing registration spreadsheets, creating new users, sending

Table 2.4. iMapInvasives training administrative tasks with estimated time per item, per training.

Task	Hours spent per Training	77 Total Trainings
Communication with trainer regarding event (i.e., email, phone, etc.)	0.7	51.3
Adding to calendar, social media or other venue	0.3	10.0
Downloading and editing registration spreadsheet	0.3	25.7
Creating training classes	0.2	12.8
Create new user (based on average attendees)	0.7	51.3
Send usernames to trainer	0.2	12.8
Add users to training class	0.7	51.3
Follow-up email to attendees	0.2	12.8
Total Hours	**3.2**	**228.2**
Mean time spent per Month		**14.3**

Tasks per Training
- Creating Training classes
- Send usernames to trainer
- Follow-up email to attendees
- Registration spreadsheets
- Publicizing Events
- Communication with trainer
- Create new user
- Add users to training class
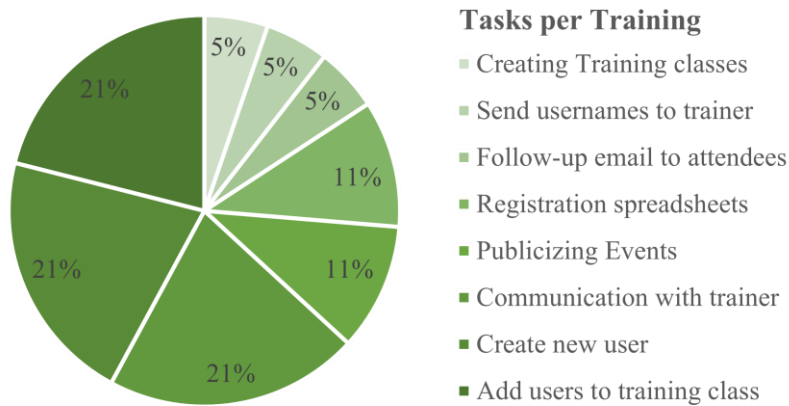
Figure 2.2. iMapInvasives administrative tasks indicating the minimum time spent per task to assist CTN trainers, based on 3.2 hrs per training and a total of 230 administrative hrs spent.

45

updated registration back to the trainer, creating and adding users to the training classes, following up with attendees and trainers after the training concluded (Fig. 2.2). Administrative time spent uploading training information online to social media or calendars is based on 30 trainings as not all trainings were open to the public or requested to be shared. The mean time spent per month was approximately 14.3 hrs, but varied with a minimum of 3.2 hrs in Oct/Nov 2017, Dec 2018 and a maximum of 38 hrs in Jun 2018 (Fig. 2.3, Table 2.5).

Results from the 2018 CTN Survey indicated trainers spent over 400 hrs preparing for and hosting trainings. This time does not incorporate other aspects of time spent, including initial training, advanced training, travel to and from trainings, and more. Additional administrative time stretched well beyond 20 hrs per week throughout this entire study period, to conduct tasks like communicating with potential members, trainers, and their trainees, creating and updating resources, planning initial and advanced trainings, and more.

It is assumed that some of these tasks will be less time consuming with iMapInvasives 3.0 updates when users are able to create their own usernames, potentially freeing up 1.3 hrs per training, however, there will be other tasks, e.g., ensuring users are listed in the correct projects and organizations as well as additional administrative tasks including updating and maintaining the CTN based on the recommendations of this report, especially with the anticipation that this program will continue to grow so long as the CTN remains a priority to the larger iMapInvasives program.

Trainings and observations reported

Through efforts of the CTN, there were 89 iMapInvasives trainings held for the trainers, public, natural resource professionals, specific projects or species, and even for educational purposes. These trainings reached 1,162 people, of which 298 submitted 4,290 observation

Table 2.5. Monthly iMapInvasives CTN administrative time spent on assisting trainers with planning trainings, estimates are based on tasks outlined in table 2.4 and the number of trainings per month.

	Trainings	Hours
2017 (total)	**2**	**6.4**
Oct	1	**3.2**
Nov	1	**3.2**
2018 (total)	**65**	**205.8**
Jan	2	**6.3**
Feb	3	**9.5**
Mar	5	**15.8**
Apr	9	**28.5**
May	7	**22.2**
Jun	12	**38.0**
Jul	8	**25.3**
Aug	2	**6.3**
Sep	7	**22.2**
Oct	4	**12.7**
Nov	5	**15.8**
Dec	1	**3.2**
2019 (total)	**10**	**31.7**
Jan	3	**9.5**
Feb	7	**22.2**
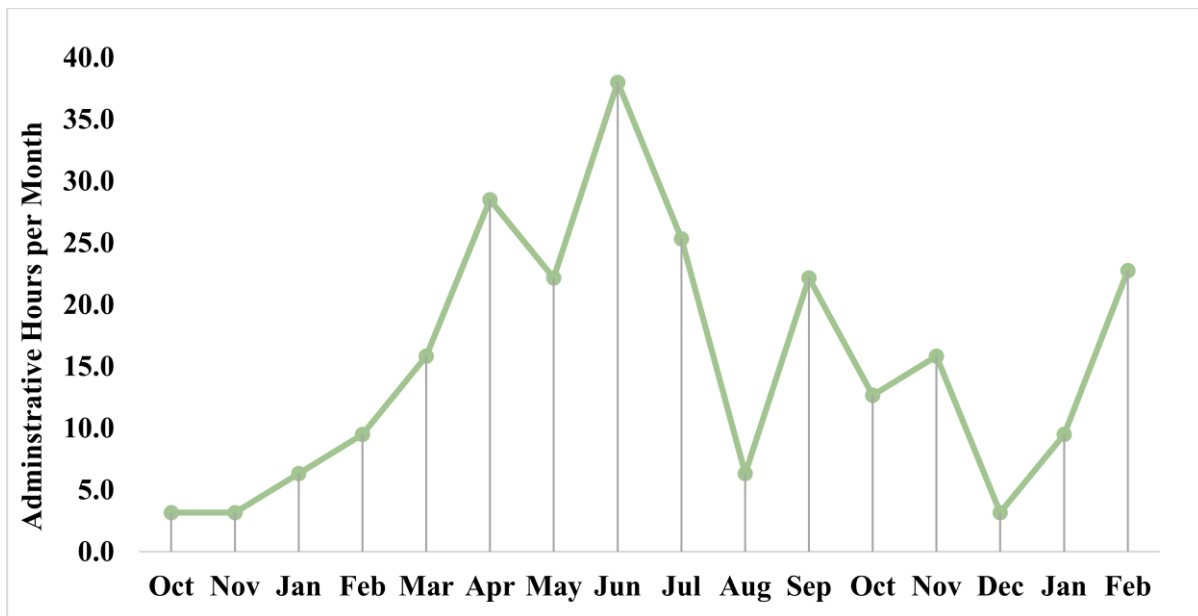
Figure 2.3. iMapInvasives administrative effort per month based on 77 trainings, 3.2 hrs per training. Dates reflect the study period for this research, Oct 2017 – Mar 2019.

reports. These reports were submitted by 52 CTN members and 246 of their trainees. Observations were submitted in 60 of 62 NYS counties. These observations were made on 175 species, 546 animals and 3,743 plants. The most common reports included 483 *Lonicera spp.*, honeysuckle (species unknown); *Rhamnus cathartica*, Common buckthorn; *Adelges tsugae*, hemlock woolly adelgid (Not Detected); *Rosa multiflora*, multiflora rose; *Alliaria petiolata*, garlic mustard; and 183 *Celastrus orbiculatus*, Oriental bittersweet. More information on these results are presented in Chapter 3.

Limitations

This research has a few minor limitations:

1. As a new program, strategies for optimal program implementation were continuously evolving as the program was being built and varied somewhat from one quarter to the next. As the program continues to grow, there should be some expected change, though likely not as much as during this initial phase.

2. Members who volunteered to participate in this program do not represent a random sample. Recruitment of members for the CTN was through invasive species related sources like the PRISM listserv and iMapInvasives user list. Though information was open to others, little effort was directed to recruiting members outside these resources. Future work with the program could target other venues, e.g., recreational groups. The current members may have been more highly motivated to participate in the CTN and host trainings than those less focused on invasive species. Additional incentives for participation, e.g., offering continuing education credits, could benefit the program and its members.

3. Members were not recruited for any particular skillset beyond their specific interest in joining the CTN. Incorporating attention to soft skills like enthusiasm, willingness to teach, and communication could improve the focus of advanced trainings and foster a higher return of trainers.

There are a number of factors impacting trainer's abilities to host trainings, e.g., time constraints, access to resources. It is essential to understand barriers faced by trainers and to provide possible solutions. For example, if possible, staff could assist directly in planning trainings or workshops or provide resources to mitigate this obstacle. Simply increasing training capacity does not automatically translate to a more capable workforce and should be critically assessed (Brimmer et al. 2008). Additional barriers faced by the CTN will be addressed with the survey results in Chapter 4.

Assessment of this program is based on the 18 mo study period which did not allow for an understanding of the retention of trainers and their trainees. This program should be continuously studied, evaluated, and improved, so long as administrative constraints do not obstruct the future of the program.

Current CTN members provided valuable feedback to the program based on their initial training and experiences hosting trainings on their own. Recommendations enumerated later in this thesis, and results from this research, will be used to inform best management practices for this program and others in the future. The CTN illustrates the advantage of collaborative partnerships among agencies, organizations, and the public. Representation of CTN members was diverse in terms of occupation and geographic region, though attention should be focused to improve trainings offered in the Adirondack and Long Island regions of NYS by working with or recruiting new members from those geographic areas.

CONCLUSION

Following a TTT model is a widely used approach to address training shortages in a variety of fields, and can be used to improve trainer participation, commitment, and ultimately retention to community science programs like iMapInvasives. While initiation of the CTN was successful based on the number of trainers and trainings held, it is important to continue to maintain and assess the program for success in the future. Many organizations have found volunteers are not retained from year to year, so special attention should be paid to communicating with trainers - to keep them interested and involved. There is a continuously growing pool of skilled and motivated trainers and continued recruitment will be critical to sustaining this program. Based on the success of the CTN following a TTT model, it is recommended that other programs consider adopting a similar model to build local capacity.

The iMapInvasives Certified Trainers Network shoulders a certain responsibility, which helps ensure users are being engaged with and are becoming more effective participants in our program. Following a TTT model is essential to building on this overall community science program and the greater goal of slowing the spread of invasive species across NYS.

CHAPTER 3

Evaluating Effectiveness of the Certified Trainers Network

for the iMapInvasives Statewide Training Program

ABSTRACT

This research focused on New York's iMapInvasives Certified Trainers Network (CTN), and its potential as a statewide program, by analyzing the Network's contributions using GIS information tools. A total of 89 trainings were held, 12 for trainers and 77 by trainers. As a result, 131 CTN members were trained, 53 of whom became trainers and trained 1,020 trainees during the 18 mo study. Of the 1,162 individuals trained, 298 submitted 4,290 observations of invasive species across NYS. The train-the-trainer approach to improve the iMapInvasives program capacity was successful as a statewide program with new observations in 60 of 62 counties in NYS, with multiple species being reported for the first time in a county. With this research we are better able to understand how using the train-the-trainer approach for the CTN can be coordinated on a statewide level.

Keywords: train-the-trainer, invasive species, volunteer effort, statewide, spider diagram

INTRODUCTION

The iMapInvasives Certified Trainers Network (CTN) consists of enthusiastic volunteers interested in protecting NYS natural resources. The term volunteer in this report is referring to CTN members and their trainees who voluntarily promote the use of iMapInvasives by conducting trainings and submitting observation reports. CTN members and trainees are a diverse group, ranging from high school-aged students, college students, full-time natural resource professionals, off-duty professionals, retirees, and everything in between. Trainers inform their communities about invasive species and how to report invasive observations to iMapInvasives, a community science program.

The CTN was adopted following a train-the-trainer approach, giving members the opportunity to become a certified trainer through a three-step certification protocol. In total the CTN conducted 89 iMapInvasives trainings, 12 for trainers, and 77 for the public, natural resource professionals, specific projects or species, and even educational purposes. By hosting trainings, trainers encourage development of environmental stewardship practices that may slow the spread of invasive species. This effort to increase the iMapInvasives program's training capacity will benefit New York's diverse invasive species networks.

The main objective of this research was to evaluate the effectiveness of the iMapInvasives as a statewide program. For the purposes of this research, the study period began 17-Oct 2017 and ended 17-Mar 2019, though the Network will continue to exist beyond that date. This chapter provides a brief overview and background for the topic, efforts initiated by trainers and their trainees, programmatic outcomes, and conclusions.

METHODS

To evaluate effectiveness of the CTN as a statewide program, we studied the trainer locations, number of trainings, and observation reports submitted by trainers and trainees within New York State boundaries. The CTN was designed for trainers to provide training on iMapInvasives and general education and outreach information on invasive species and environmental topics. By also evaluating effectiveness of this program spatially, using ESRI geographical information systems (GIS) tools, we can better understand efforts of the CTN and are better equipped to identify areas where trainings and observations have already occurred during this project, and areas needing attention in the future.

When analyzing success/importance of the CTN as a statewide program, it is important to document the location of CTN members, trainings they have hosted, and CTN member and trainee observations, as well as potential distances travelled through each of these areas. For this study, trainer and training locations are at the city/town level, a central point in the location they indicated on their initial registration. Their addresses or exact work locations are not included to keep personal information confidential, thus trainee locations contain only an origin point assigned to the first training they attended. Distance estimates were based on a polyline created with the Spider Diagram Geoprocessing Tool in Esri ArcMap Version 10.6.1. It is important to note that most distances were measured as a straight polyline from origin to destination, rather than using actual roads and directional traffic.

RESULTS & DISCUSSION

Through efforts of the CTN, 89 iMapInvasives trainings were held, 12 initial training webinars for the CTN, and 77 for the public, natural resource professionals, specific projects or species, and even for educational purposes. These trainings reached 1,162 people, of which 298

individuals submitted 4,290 observation reports. These reports were submitted by 52 CTN

members and 246 of their trainees, representing 128 organizations. Observations were submitted

in 60 of 62 NYS counties (Fig. 3.1). These 4,290 observations include 546 animals and 3,743

plants totaling 176 different species. The most common reports included 494 *Lonicera spp.*

(honeysuckle, species unknown), 367 *Rhamnus cathartica* (common buckthorn), 362 *Adelges*

tsugae (hemlock woolly adelgid – which was not detected), 239 *Rosa multiflora* (multiflora

rose), 184 *Alliaria petiolata* (garlic mustard), and 183 *Celastrus orbiculatus* (oriental

bittersweet). See Appendix 3.1–6 for a full list of resource maps and species reported.
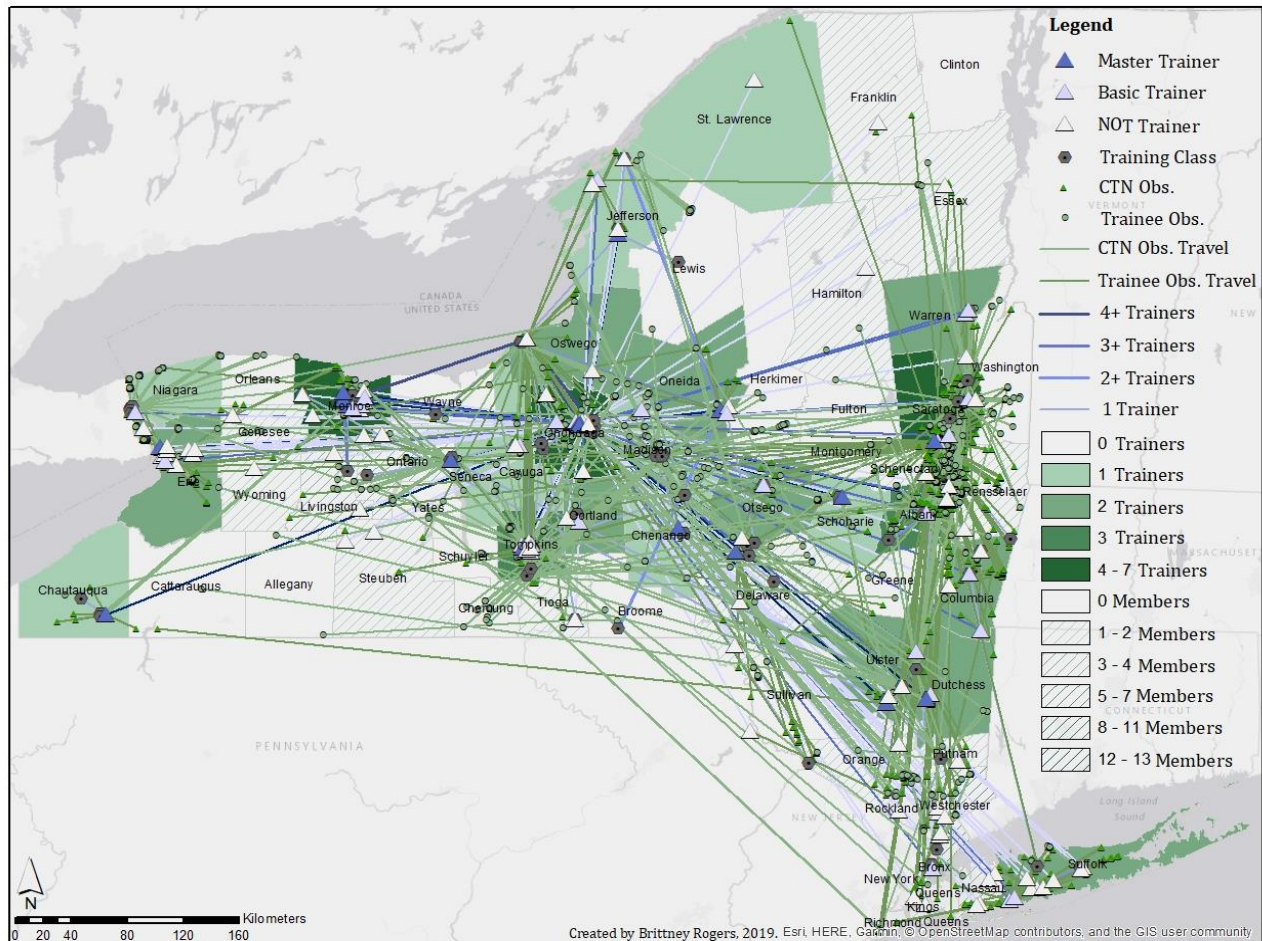
Figure 3.1. CTN impact on NYS, including location of CTN members and trainers by county, trainer and training locations by a central city point. Polylines indicate connections between trainers and trainings, CTN members and observations, and trainees and observations.

Trainings: Trainers and Training Locations

To facilitate trainings across NYS, trainers travelled a total of 112 times. 31% of trainings were collaborative involving more than one trainer (Fig. 3.2). Trainers often represented multiple organizations with different professional backgrounds. CTN members live/work in 86 cities/towns in 45 counties across NYS, with Monroe, Onondaga, Erie, and Suffolk Counties the most represented at 34% combined. CTN members who became Certified Master/Basic Trainers were from 34 cities/towns located in 25 counties. Trainings were held in 52 cities/towns in 30 counties. Each PRISM had at least one training in the region through the CTN, though 37 trainings were in the Finger Lakes PRISM, which included 20 trainers and 26 members. The mean distance (straight line, not road travel) between a trainer and the training they facilitated was 42.6 km (min = 0.52 km and max = 351.1 km).
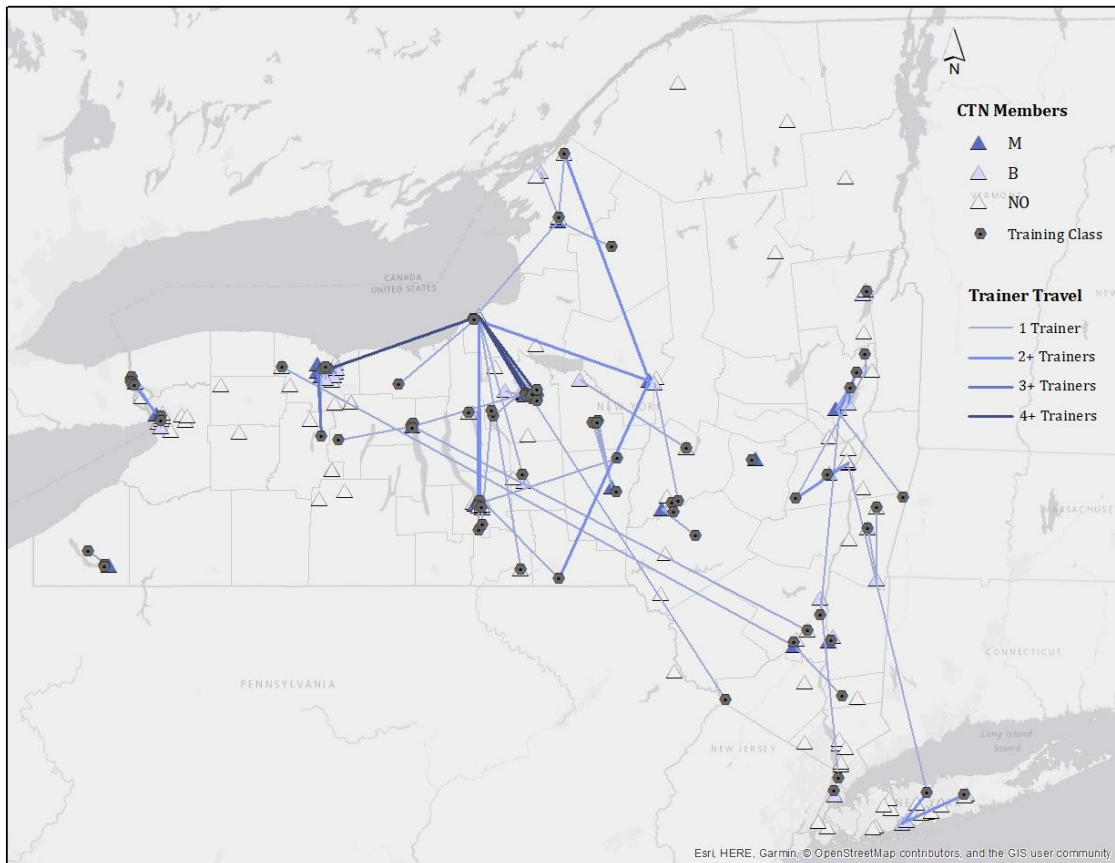
Figure 3.2. Map showing CTN trainer connections to trainings they hosted across NYS.

In comparison, the distance between NYNHP staff at the Central Offices in Albany, NY and the furthest training location, where three trainings were held, was 575 km or 5.5 hrs drive time in each direction. There were 11 separate trainings held in the Syracuse area, which is lower than the maximum distance between a trainer and the trainings but is still 233 km or 2.3 hrs drive time in each direction. Total distance traveled among the Certified Trainers to their respective trainings was ~4,684 km; the equivalent of driving from Albany, NY to Wichita, Kansas and back, or just over 43 hrs of driving.

Observations: CTN members (trainers and non-trainers)

Of the 12 CTN initial training webinars held, members from 11 training sessions submitted observations (including trainers and non-trainers). Of 131 CTN members, 40% submitted observations. A total of 1,348 observations reported by 52 members of the CTN (Table 3.1, Fig. 3.3). Of the 53 members who hosted trainings, 77% submitted observations, which was lower than expected. The mean number of observations was 25.9 per person. This was slightly skewed because of an outlier with 537 observations - the next highest reporter

Table 3.1. CTN member observational data associated with iMapInvasives.

Certified Trainers Network Members and Observations	
Total trained	143
% Reporting	36.4%
Total observations	1,348
Obs. per reporter	25.9
Confirmed spp	958
State regulated spp	744
Species Richness	150
Spp of significance	27
Animals	15.7%
Plants	84.3%
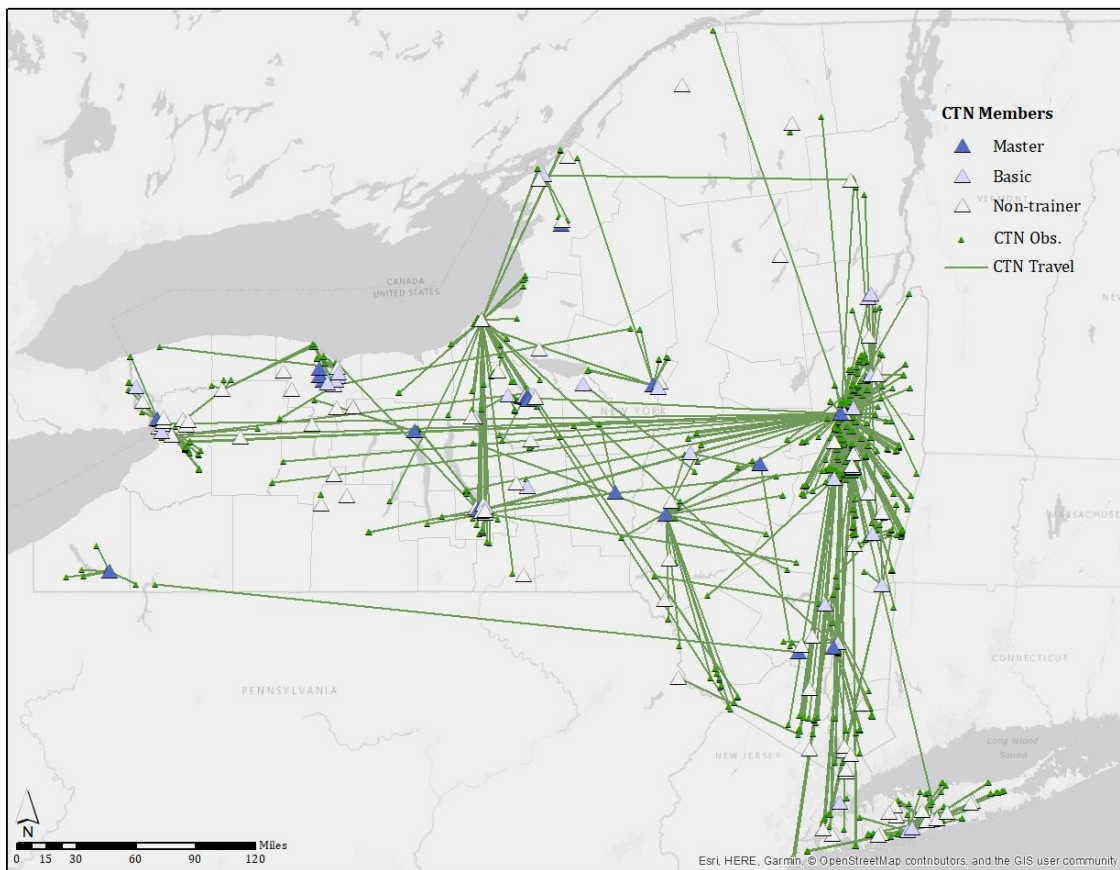
Figure 3.3. CTN member observations with polylines connecting member location at the central point within their registered city or town (origin point) to observations (destination points) using the Spider Diagram Geoprocessing Tool in Esri ArcMap.

submitted 81 observations. Trainer ID #6000 attended Training ID #318 and then submitted 537 observation reports across 23 counties in NY, mostly in the Capital Mohawk PRISM.

These 1,348 observations include 146 invasive species detected and four invasive species reported as not detected (Table 3.1). The top six species with > 50 records included hemlock woolly adelgid (*Adelges tsugae*) – submitted as not detected, tree-of-heaven (*Ailanthus altissima*), honeysuckle (*Lonicera spp.*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and Japanese knotweed (*Reynoutria japonica var. japonica*). In total, 744 observations were species regulated in NYS, three of the top species with > 50 reports were listed as regulated. An additional contribution of CTN members included 27 "significant species" reports, which refers to species reported in a county for the first time.

For trainers, their location is their city/town (a central point in the polygon) and the observation is the GPS coordinates recorded with the original observation record. The mean distance (based on polyline, not road travel) between a trainer and each observation they submitted to the iMapInvasives database was 52.4 km (min = 0.25 km and max = 407.9 km).

Observations: CTN Trainings – Trainee Observations

The CTN hosted 77 in-person trainings and trainees from 52 classes submitted observations. A total of 2,942 observations were submitted from 246 trainees out of 1,020 (24.1%) training attendees (Table 3.2, Fig. 3.4). The mean number of observations per person was 12.0. This is lower than the average of all iMapInvasives program reporters at 23.8 observations per person; however, it is important to note 86% of CTN trainees became users after initiation of the CTN in October 2017, while more than 50% of all iMapInvasives users were users since before 2014, giving them the advantage of additional field seasons to report observations.

The top seven training classes with >100 observations submitted were trainings as part of college courses at Cornell University (two trainings), SUNY Morrisville (two trainings), and SUNY Cobleskill (one training). Others were for two Friends of Recreation, Conservation, and

Table 3.2. CTN trainee's observational data associated with iMapInvasives.

Trainees and Observations	
Total Trained	1,020
Reporters	24.1%
Total Observations	2,942
Obs. per person	12.0
Confirmed	1,530
State Regulated Spp	1,840
Species Richness	111
Spp of significance	7
Animals	11.6%
Plants	88.7%

Environmental Stewardship (FORCES) Steward trainings. The FORCES Program was launched in 2008 via New York State Parks (NYSOPRHP) in the Central NYS Region with the intention of boosting and growing volunteerism within the state. Each of these trainings included captive audiences, where trainees were obligated to attend and potentially obligated to submit observations. The training class with the highest number of observations was one of the 2018 spring blitz trainings in the Capital Mohawk PRISM, Training #321, with 1,083 observations being submitted. Among those, 758 were mobile reports from one student and 158 from another, both attending Siena College and conducting research at the campus and along a local bike path, while one other trainee, who attended Training #321, submitted 152 reports primarily searching
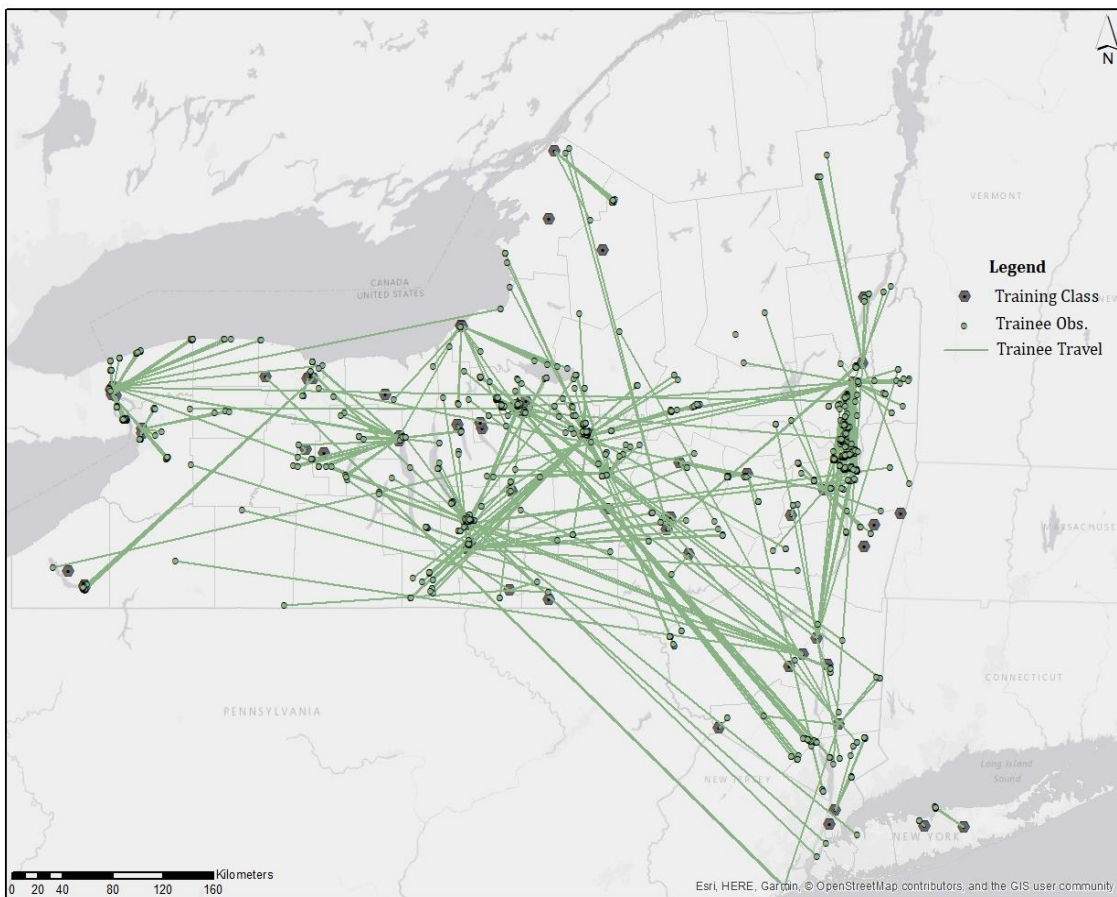
Figure 3.4. Trainee Observations with polyline connecting trainee training (origin point) to observations (destination points) using a Spider Diagram Geoprocessing Tool in Esri ArcMap.

for and reporting not-detected HWA submissions. This trainee, ID #7260, became a trainer in August 2018.

These 2,942 observations included 111 invasive species and 4 different invasive species reported as not detected (Table 3.2). The top eight species with >100 records included honeysuckle (*Lonicera spp.*), common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), Norway maple (*Acer platanoides*), garlic mustard (*Alliaria petiolata*), Oriental bittersweet (*Celastrus orbiculatus*), Morrow's honeysuckle (*Lonicera morrowii*), and hemlock woolly adelgid (*Adelges tsugae* = not detected). In total, 1,840 observations were species regulated in NYS, seven of which had >100 reports. An additional contribution of the trainees included 7 "significant species" reports.

For trainees, there was no specific location data to where they live/work, so an origin point of the first training they attended was assigned as their location and all subsequent observations submitted were measured from that location, regardless as to whether they did another training elsewhere after their first. The mean distance between initial training and each trainee observation submitted to iMapInvasives was 39.7 km (min = 0.68 km and max = 481.7 km). The maximum distance was travelled by trainee #7260. It should be assumed that some travel was incurred by trainees to attend the training, and the same for observations submitted, but it is still important to understand how far away from training locations users were making observations.

Observations: Comparison to iMapInvasives program population prior to CTN

iMapInvasives was launched in New York in 2010 and since then 4,310 people have been trained to participate and have submitted 45,123 observations (Table 3.3). Considering only trainings from 2014–2016, i.e. years just prior to initiation of the CTN, iMapInvasives offered an average

of 30.3 trainings per year, with 351 reporters representing 102 organizations. During the 18 mo

study period, not including any other NYNHP staff facilitated trainings, there were 89 CTN

trainings, with 1,162 trainees, 298 of which became reporters and reporters represented 128

organizations. This is a 97.8% increase in average trainings, and a 25.1% increase in

organizations represented by those reporting observations.

At first, it appears there was a 15.3% decrease in reporters (users submitting observations

annually, Table 3.3), but it is important to point out that this does not include reports from

previous users who reported data or new users trained outside of the CTN by NYNHP staff. The

CTN hosted 77 in-person trainings and trainees from 52 classes submitted observations. A total

of 4,290 observations were submitted from 298 out of 1,162 (25.7%) members and trainees

associated with the CTN. The mean number of observations per person was 14.5, and though this

appears lower than the average of all iMapInvasives program reporters (at 23.8), as mentioned

earlier, 86% of trainees became users after the initiation of the CTN while more than 50% of all

iMapInvasives users have been users since before 2014, giving them the advantage of additional

Table 3.3. iMapInvasives CTN impact in comparison to entire program through 2017.

	iMap to 2017	CTN Impact
Total Trained	4,310	1,162
Reporters	1,310 (30.4%)	298 (25.7%)
Total Observations	45,123	4,290
Obs. per person	23.8	14.5
Confirmed spp.	37,188	2,488
State Regulated	30,787	2,584
Species Richness	294	175
Significant	1,081	34
Animal	10.9%	12.7%
Plant	81.8%	87.3%

field seasons to report observations. During this 18 mo study, 597 users submitted observations

to iMapInvasives, 49.9% of those users were members of the CTN and their trainees. Trainings held by the CTN trainers also showed an increase in the number of specific trainings, whether for species or projects, for educational purposes, and for natural resource professionals.

Limitations

There were training and observation gaps in the Long Island, Adirondack, and Alleghany regions that require additional focus, by recruiting more CTN trainers and training more individuals on invasive species identification and how to report them as the program continues. Areas with lower frequencies of observations submitted correlated with areas that the entire iMapInvasives program had less observations reported in, though there were non-trainers in areas that could have expanded the program.

The importance of contributions of members who took the CTN initial training, but did not move on to become a Certified Basic/Master Trainer, was not something initially considered when creating the CTN program. However, CTN non-training members did end up submitting 190 observations to the database, and many also attended advanced trainings offered by iMapInvasives staff, or were in close contact with staff about their plans to host trainings in the future.

CTN members were trained over a 12 mo period, giving those who attended early trainings increased opportunity to become a CMT compared to those who attended in November 2018 (Fig. 3.5). In other words, this study ended before all members had at least 12 mo to host their first training. Another consideration towards this would be the number of observations submitted as attendees at spring trainings would have had a growing season to report, whereas those attending in Nov–Feb would not have had a similar opportunity.
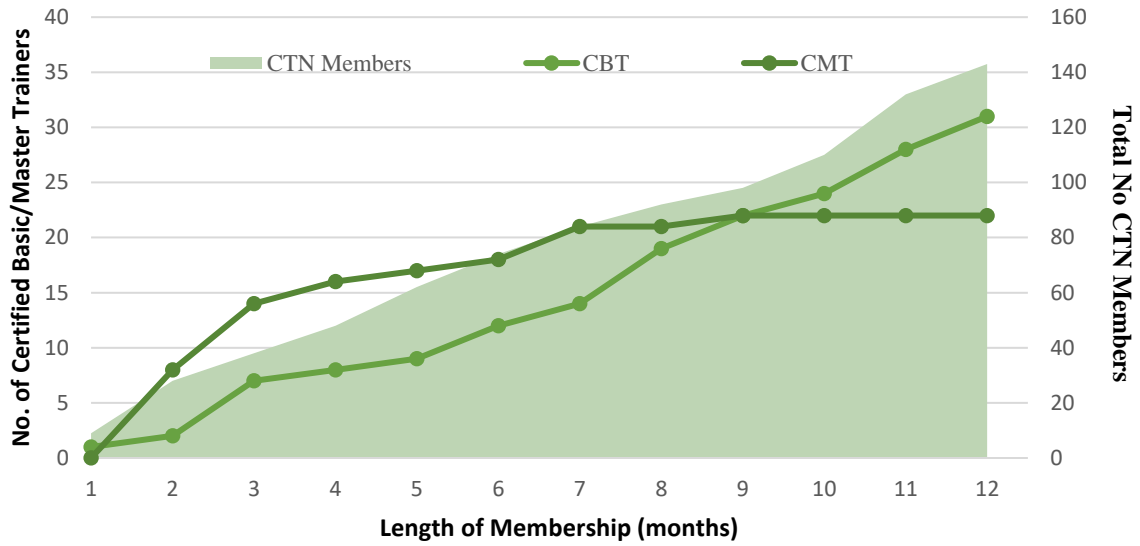
Figure 3.5. View CTN members and trainers indicating growth of the program over time.

Though beyond the scope of this study, more in depth spatial analyses could be conducted to elucidate trainings, trainees, and their travels while using iMapInvasives. These analyses could include differences between observations submitted on public or private lands, distances from rare or protected species populations, roadways, recreation trails, and more. This would also improve efforts for future training locations choices.

CONCLUSION

The iMapInvasives Certified Trainers Network, following a train-the-trainer approach, was an effective statewide outreach and education program. Trainings were held in 52 cities and 30 counties and each PRISM region had trainings and observations submitted, while there were observations submitted in 60 of NY's 62 counties. While the CTN was successful based on the number of trainers, trainings they held, trainees, and observations, it is important to continue to maintain and assess the program for success in the future.

There were regions that did not have as many active volunteers, so special attention may need to focus on communicating with these trainers and their trainees to keep them interested

and involved. Continued recruitment will be critical to sustaining and expanding this program. Based on the success of the CTN following a train-the-trainer model, it is recommended that other programs consider adopting a similar model to build local training and reporting capacity.

CHAPTER 4

Assessment of Certified Trainers Network via an Online Survey

ABSTRACT

This research was designed to assess the success of the iMapInvasives Certified Trainers Network (CTN), which followed a train-the-trainer approach. Assessment consisted of a multi-question survey, developed and implemented online, to collect information on multiple aspects of the program. 131 CTN members are spread across 45 counties in NYS, and of these 52 members (40%) responded to the survey, providing new insights into the program. There were multiple strategies used to coordinate the CTN, understanding which created the biggest return on investment (which was trainers who host trainings, thereby training new users). There was an association between the length of time in which a CTN member was a part of the network, the number of barriers they encountered, and whether they hosted a training. Survey results were essential to provide recommendations to the New York Natural Heritage Program on if the program worked and whether to continue this program. It also provides a framework for other organizations interested in modeling a train-the-trainer program.

Keywords: invasive species, train-the-trainer, assessment, volunteer effort

INTRODUCTION

New York Natural Heritage Program's iMapInvasives Certified Trainers Network (CTN) consists of enthusiastic volunteers interested in protecting NYS natural resources. CTN members are a diverse group, ranging from college students, full-time natural resource professionals, off-duty professionals, retirees, and everything in between. Trainers inform their communities about invasive species and how to report invasive species observations to iMapInvasives. The CTN was adopted following a train-the-trainer (TTT) approach, giving members the opportunity to become certified trainers through a three-step certification protocol.

Through efforts of the CTN, there were 89 iMapInvasives trainings held, 12 for the trainers, and 77 for the public, natural resource professionals, specific projects or species, and even for educational purposes. These trainings reached 1,162 people, of which 298 individuals submitted 4,290 observation reports. These reports were submitted by 52 CTN members and 246 of their trainees, representing 128 organizations. These observations included 546 animal and 3,743 plant observations totaling 175 different species.

An assessment of the initial CTN webinar attendees who joined and participated in the CTN will help elucidate the following: 1) the most successful aspects from the trainer's point of view, 2) most useful components for trainers (e.g., online resources), and 3) what contributed to motivating and retaining CTN members and trainers. Through this survey and previously described research, we hope to better understand best practices to increase state-wide participation and improve volunteer retention through methods incorporated into the CTN based on both a literature review and statistical analyses of the survey results.

The focus of this research was to evaluate the iMapInvasives CTN, a TTT program. The specific objective was to assess different aspects of the CTN through an online survey. For the

purposes of this research, the study began October 17, 2017 and ended March 17, 2019, though the Network will continue beyond that final date.

METHODS

An online survey was distributed to 131 of the initial training webinar attendees at the conclusion of the study period to assess key factors hypothesized to be associated with adoption of the CTN and the iMapInvasives program. The 131 CTN members included 53 trainers who hosted iMapInvasives trainings and were either Basic or Master Certified Trainers and 78 non-trainers (people who either chose not to host trainings or simply did not have time from their initial CTN training to hold one). The instrument was developed, approved by the Syracuse University Institutional Review Board (IRB 19-074), piloted and edited prior to sending by multiple individuals, and then disseminated to the CTN between April 17 and May 24, 2019.

Participants

All participants in this study attended the standardized initial training webinar as initiation into the CTN. The focus of the webinar was to provide attendees with information and skills needed to efficiently conduct an iMapInvasives training within their organization or community. For more detailed information on the initial training webinar, see Chapter 2 of this thesis. Due to the diverse invasive species community that already existed in NYS, recruitment for the CTN began by utilizing the eight Partnerships for Regional Invasive Species Management (PRISM) email listservs and eventually included announcements to the iMapInvasives listserv, established June 2018.

Instrument Development

There were multiple components to the online survey. The survey began with user involvement in iMapInvasives, why they joined the CTN, and what they have accomplished.

Critical to understanding these outcomes, they were also asked to rate CTN resources. The final portion of the survey collected demographic characteristics and other background information on the participants (e.g., their participation in other community science programs), which were then compared with responses in the previous sections of the survey.

Specific communication, training, and resources were designed and made available to CTN members to eliminate as many barriers as possible, i.e. barriers that might prevent them from hosting a training. Creating these resources, planning additional trainings, and communicating with the trainers was time-intensive, so understanding which aspects were the most useful, or not, to the trainers is very important for the future of this program and other programs utilizing a TTT approach for their own program. For each of the nine questions in this section, the survey instrument assessed overall usefulness using a Likert Scale, a psychometric scale in which responses are scored along a range. The overall usefulness scale, for the purposes of this survey, ranged from 1–5, (1 = not useful, 2 = slightly useful, 3 = moderately useful, 4 = very useful, 5 = extremely useful).

The survey included questions on whether the respondent had hosted trainings, number of trainings hosted, time spent planning for trainings, barriers they faced to hosting trainings, and recommendations of ways to improve the program, or overcome barriers. This information allowed us to further analyze areas providing the largest return on investment. This investment included time spent working with trainers and resources expended to provide trainers with necessary training materials. The return included training events, attendees – both new and returning users, and observation data submissions following trainings.

Optional self-reported socio-demographic factors included age, race/ethnicity, academic level, employment, and PRISM region they reside or work in. This information was collected to

better understand characteristics of the sample population and proved to be helpful when determining how to improve or change the program from trends noted in responses. A full sample of survey questions are in Appendix 4.2.

Pilot Survey

According to Dillman et al. (2014), it is important to pilot surveys before disseminating to participants. Pilot studies can give the surveyor an opportunity to test the entire process, especially as technology is involved, which poses a greater risk for things to go wrong. The respondents can identify issues with the technology across multiple platforms, order and flow of the questions, and their overall experience of the survey, especially for the participants with less technological knowledge and experience. This survey was piloted by 12 stakeholders, both familiar and unfamiliar with the program, these stakeholders were not CTN members from the sample population who were asked to take the actual survey. The study was tested with multiple platforms, e.g., smartphone, Macintosh and PC computers, tablets, prior to distributing to the sample population.

Survey Implementation

Survey Monkey was used to host the survey, which was disseminated through email to all participants. This was the most attractive method because of speed, low cost, and ease of access to all participants, especially as the main communication with the sample population had been via email. Due to this research including collection and analysis of qualitative and quantitative data designed to answer a series of research questions by human subjects, Institutional Review Board approval was obtained (IRB #: 19-074).

Recruitment for the survey occurred via an email sent on April 17, 2019. The first page of the survey described the research, purpose of the study, and consent information. An HTML link

was provided in the email body to take participants to the survey where the description and informed consent language appeared again as well. Risk to participants was minimal and no personal information was collected. All participants were 18 years of age or older and were provided the ability to withdraw from the study at any time. Participants were also informed of the opportunity to view a summary of the research findings upon request. All raw data will be kept confidential to protect survey respondent's privacy. Four reminder emails were sent every 6 days and the survey was taken offline May 24, 2019.

Data Analysis

Analysis of survey data consisted of descriptive statistics and chi squared test of independence using $\alpha = 0.05$ for significance to understand the influence of network conditions on levels of membership in the network. These explorations were similar to other TTT program evaluations (Corelli et al. 2007, Lee et al. 2012, Yarber et al. 2015). Analyses were conducted using SPSS (version 26, *IBM Corp. SPSS Statistics for Windows* 2017). Only results relevant to research questions are represented.

RESULTS AND DISCUSSION

From October 2017 to March 2019, 143 participants attended an initial training webinar to join the CTN, and 131 remained in the network throughout the duration of the study. Some members advanced their level of membership by hosting trainings. The three levels of membership include non-trainers, certified basic trainers, and certified master trainers. The 131 members comprised 53 (40.5%) trainers and 78 (59.5%) non-trainers. Of the 131 CTN members, 52 (39.7%) completed the assessment survey. Once the survey was closed, results were checked for errors prior to analyses.

Nearly 64% of participants were between the ages 25–44 years old and 96% were of white ethnicity. Twenty-five participants had at least an associate degree, while 23 had a graduate or professional degree (Table 4.1). Employment status typically was full-time (39), 8.3% (4) were retired, 6.3% (3) were working part-time, and 4.2% (2) were students. Trainers represented 60.4% (29) of the participants and non-trainers represented 39.6% (19) of the participants. This differs from total CTN membership, which consisted of 40.5% (53) certified trainers and 59.5% (78) non-trainers.

Participants represented each PRISM region, though fewer individuals responded from the Long Island Invasive Species Management Area (LIISMA) (8.2%) and Adirondack Park

Table 4.1. Characteristics of CTN members participating in the post-program assessment.

CTN Assessment Participant Characteristics			
Characteristics	Potential Responses	N	%
Trainer	Yes	29	60.4%
	No	19	39.6%
Ethnicity	White	45	95.7%
	Other	2	4.3%
Age	18–24 years old	5	10.6%
	25–34 years old	18	38.3%
	35–44 years old	12	25.5%
	45–54 years old	6	12.8%
	55 years and beyond	6	12.8%
Education	Associate/Bachelors (BA, BS, etc.)	23	47.9%
	Graduate or professional degree (MS, MBA, MD, JD, PhD, etc.)	25	52.1%
Employment	Student	2	4.2%
	Part-time	3	6.3%
	Full-time	39	81.3%
	Retired	4	8.3%
PRISM Location	Adirondacks	1	2.0%
	Capital/Mohawk	9	18.4%
	Catskills	6	12.2%
	Finger Lakes	11	22.4%
	Long Island	4	8.2%
	Lower Hudson	6	12.2%
	St. Lawrence Eastern Lake Ontario	6	12.2%
	Western New York	6	12.2%

Invasive Plant Program (APIPP) (2.0%). These regions also had the lowest participation overall, including trainings, attendees, and observations submitted. A total of six members (4.5%) were from APIPP, two of whom became basic trainers. So, although only one individual non-trainer participated in the survey, this represented 16.7% of the APIPP region CTN members. A total of 15 CTN members (11.2%) were from LIISMA, two of which became basic trainers. Four individuals participated in the survey, representing 26.7% of the LIISMA CTN members. It is important to note that 100% of the LIISMA trainers responded to the survey, while only 15.4% of the non-trainers responded. Finger Lakes participants represented 22.5% of the responses, though this is 23.9% of the FL members (11 of 46 individuals), with only 11.5% of the non-trainers participating. A lower response from the non-trainers (24.4%) means it is difficult to understand their lack of participation and perspectives on the CTN, but this was not unexpected, as this echoed their overall lack of participation in hosting trainings. Participants rated their knowledge of invasive species at a moderate amount, with the trainers slightly rating theirs slightly higher than non-trainers, showing room for improvement and potentially opportunity to expose non-trainers to new information regarding invasive species (Fig. 4.1).

Based on the previous research, we expected motivational forces for this kind of network to include professional accomplishment, personal accomplishment, to join a community of like-minded individuals, to protect a local natural area, and to connect with nature (Batson et al. 2002, Alender 2016, Baruch et al. 2016). Towards this, a question was developed to elucidate this for the CTN. In addition, an "*other*" option was also included to allow participants to add any additional motivations for them personally.

For trainers, the primary purpose to become a Certified trainer was for professional accomplishments (72.4%), 82.8% indicated they felt this was met through their participation
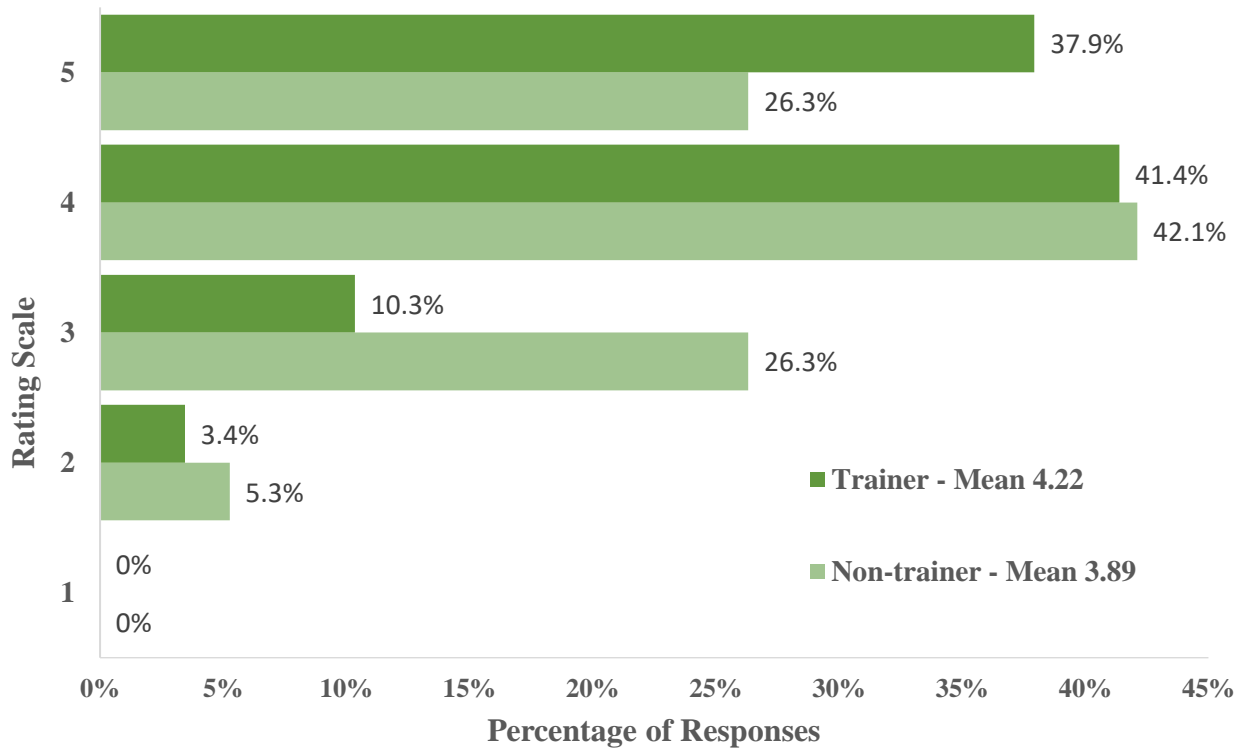
Figure 4.1. Trainer and Non-Trainer participant self-rating of overall knowledge of invasive species (n = 51). "How would you rate your knowledge of invasive species?"

(Fig. 4.2). Non-trainer participants indicated professional accomplishment (63.2%) was also a common reason for them to participate as well as protecting a local natural area (52.6%). For non-trainers, though they primarily signed up for professional reasons, they indicated what they felt they got was predominantly a personal accomplishment (82.8%).

Many studies have found individuals are motivated to volunteer and participate in community science programs for the community aspect, or "to join a community of like-minded individuals" (Hager and Brudney 2004, Alender 2016). When we asked this question of the network, 38% reported they joined the CTN for this reason, and after participating, this aspect increased to 69.0%, a 31.0% increase, thus indicating they did *interact with a community of like-*

Why did you attend a CTN initial training webinar?

Category	Trainer	Non-trainer
Professional accomplishment	72.4%	63.2%
Personal accomplishment	55.2%	31.6%
Join Community	37.9%	31.6%
Protect a local natural area	37.9%	52.6%
Connect with nature	27.6%	15.8%
Other	10.3%	15.8%

What have you accomplished by participating in the CTN?

Category	Trainer	Non-trainer
Professional accomplishment	82.8%	68.4%
Personal accomplishment	69.0%	84.2%
Join Community	69.0%	42.1%
Protect a local natural area	37.9%	36.8%
Connect with nature	37.9%	26.3%
Other	3.5%	0.0%

Figure 4.2. Trainer and non-Trainer responses regarding motivations for joining the network and what was accomplished.

minded individuals. Of the non-trainers, 31.6% reported they joined the CTN for this reason and 42.1% reported they interacted with a community of like-minded individuals, a 10.5% increase.

When rating different aspects of communication, 31% of trainers and 26.3% of non-trainers indicated communication with other members was *very useful*. Although 69.0% of

trainers and 42.1% of the non-trainers indicated they accomplished this (Fig 4.2), < 1/3 found this interaction to be *very useful*. In fact, "Communication with Other CTN and Invasive Species Professionals" topic was rated *not useful* more frequently, and resulted with the lowest mean of the categories at 3.85 on a scale of 5.

There were three questions to rate how useful each category of trainings, communication, and resources were to CTN members. Trainers rated CTN trainings at 4.12 with the initial training webinar the highest at 4.24; communications were rated at 4.26 with coordinator communication as highest with a mean of 4.54; and resources were rated at 4.12 with resources to prepare for training highest at 4.17. Non-trainers rated CTN trainings at 4.0, with the initial training webinar rated highest at 4.3; communications were rated at 3.9, with coordinator communication highest with a mean of 4.06; and usefulness of resources was rated at 4.3, with general invasive species information as the lowest rating with a mean of 4.1. The quality of communications, training and resources provided to all members impacted 48.3% of the trainer's decisions to host a training, while 66.7% of non-trainers indicated that these did not influence their decision, further indicating the potential of outside influences beyond these impacted their ability/decision to host a training.

Participants were asked to indicate what, if any, barriers they encountered preventing them from hosting a training. As anticipated, 76% of participants indicated time constraints as the most frequent barrier encountered. The next highest ranked barriers participants encountered were knowledge of, or access to, training space and potential training attendees. In the short answer responses when specifying *other* barriers, participants mentioned lack of funding, needing assistance with planning and hosting trainings, and issues accessing resources via Google Drive.

Influence of Network Conditions on Membership

Forty-seven of forty-eight CTN members who responded to the CTN survey indicated they attended the initial training webinar with an intention of becoming a trainer, while only 60% of survey participants (40.5% of total CTN members) ended up hosted trainings. Whether or not a member has held a training or not may have been influenced by: 1) duration of membership in CTN; 2) duration as iMapInvasives user; and 3) barriers encountered.

We hypothesized the date of a trainer's initial training webinar was the most likely factor influencing whether the CTN Member had become a Certified Trainer. A chi-squared test of independence suggested there was an association between when a CTN Member attended a training and when they became a trainer (χ^2 = 13.8, p = 0.000, Table 4.3). This could be for a variety of reasons, such as having more time as a CTN member, they could be more comfortable with material, were exposed to more support or opportunities, or they simply just had more time to find a venue and prepare for a training.

Based on the previous result, we further hypothesized that the longer the CTN member has been an iMapInvasives user (prior to becoming a CTN member), the more likely they were to host a training. A chi-squared test of independence indicated there was an association between duration as an iMapInvasives user and becoming a trainer, (χ^2 = 6.6, p = 0.010, Table 4.3). The

Table 4.2. Impacts on Level of Membership in Certified Trainers Network.

	Pearson χ^2	df	*p*-value
Duration as CTN member	13.8	1	0.000*
Duration as iMapInvasives user	6.6	1	0.010*
Number of barriers encountered	4.4	1	0.036*

*indicates significant differences at *p* < 0.05.

longer the participant was involved with iMapInvasives, the more likely they were to become a trainer.

We further hypothesized as CTN members were faced with increasing numbers of barriers, the less likely they were to become trainers. A chi-squared test of independence indicates there was an association between the two groups, $\chi^2 = 4.4$, p = 0.036 (Table 4.3). By minimizing these barriers, more trainers, trainings, attendees, and observations might be realized. Recommendations to overcome barriers include continuing current communication strategies, increasing advanced training opportunities and assisting with planning and facilitating trainings whenever possible. By recruiting new stakeholders, and updating resources based on trainer feedback, time constraints can also be minimized.

Retention of CTN Members

Just over two thirds (68.8%) of participants indicated they were very likely to host their first, or another training, in the future; 12.5% indicated somewhat likely, 10.4% indicated neither likely or un-likely, 6.3% indicated somewhat unlikely, and 2.1% indicated not likely. Of the 48 participants, 13.8% of trainers indicated it was neither likely nor un-likely that they would host a training, indicating a potential that these CTN trainers would not be retained in the future, while 52.6% of non-trainers indicated they were very likely to host their training in the future, suggesting they have a strong interest in becoming trainers. Efforts to retain current trainers, and to recruit new trainers, should happen concurrently, especially if barriers faced by CTN members are minimized. This could easily be accomplished by targeting advanced CTN trainings in regions where participation and retention are important, like APIPP or LIISMA.

Limitations

Of the survey participants, 60.4% were trainers and 39.6% were non-trainers. Response rates for online surveys can vary, with most being quite low (<30%); however, of the 131 CTN members, 40.5% of trainers and 59.5% of non-trainers responded. Despite this relatively high response rate, the number of individuals surveyed overall are low and so pose a limitation to the study.

The formatting of the survey potentially limited responses from multiple individuals. Display logic was used in the online survey, which brought participants to a new page based on the answer of *Yes* or *No* to "Have you heard of other citizen science programs?." After initial analysis of responses, five initial participants stopped participating in the survey as the survey required them to go to a new page.

According to Corelli et. al. (2007), post-test assessments may be considered as less significant than conducting both pre- and post-test assessment of participants. However, other literature suggests only post-test ratings may be more reflective of a training program's impact, and may control for response-shift bias. The age of the program should also be considered a limitation to this study as it has only existed for ~18 mos. Many trainers were iMapInvasives users prior to initiation of the CTN, while many non-trainers attended the initial training webinar as their first exposure to the program (Fig. 4.4). Though beyond the scope of this study, continued evaluation of the program should be considered.

CONCLUSION

With this survey, we are better equipped to understand which aspects of the CTN (training, website, supporting materials, etc.) were most successful at increasing capacity of the

invasive species network by training and retaining instructors statewide. This survey and subsequent results are essential to provide recommendations to iMapInvasives coordinators on how to continue this TTT program. CTN resources, communication, and trainings enabled participants to host trainings, though improvements should be made to facilitate interactions of the CTN community, to solidify and increase ease of use for the resource database (i.e. not Google Drive), and to create a more diverse culture. Overall participation was directly related to individual interest in increasing their professional skills while protecting natural habitats by potentially reducing impacts of invasive species. This TTT program was successful at reaching a 60% implementation rate, with a high potential to continue to expand its capacity through recruitment strategies while also retaining current members. As we hypothesized, duration of membership in CTN, duration as an iMapInvasives user, and barriers encountered by members impacted whether members advanced their membership from non-trainer to basic or master trainer.

CHAPTER 5

Lessons Learned, Recommendations, and Discussion

This program was initiated October 17, 2017, with the first initial pilot training, and for the purposes of this document, concluded on March 17, 2019 to complete a full 18 mo period. The Certified Trainers Network (CTN) is still active and will continue into the foreseeable future, however, a goal of this project was to create a self-sustaining program, and unfortunately, was not entirely accomplished. Though resources and most initial requests were fulfilled during this period, without coordination and additional efforts of iMapInvasives staff, literature suggests a network of this caliper would not continue as a standalone program (Brudney 1999, Cuskelly et al. 2006, Knepper et al. 2015) if NYNHP staff do not continue working with the CTN.

Continued maintenance of this program could be less focused on recruitment, though members who do not renew their certification would need to be replaced. This could be accomplished by offering a minimum of two initial training webinars each year, though more may be necessary in the immediate future. Efforts to retain trainers and trainees would be the bulk of the maintenance, consisting of communication strategies like social media, newsletters and website updates, creating new and updating training resources, and hosting seasonal advanced trainings. It is estimated that this program could be maintained at ~10–20 hrs/week, fluctuating during different seasons when trainings are being offered.

While initiation of the CTN was successful based on results summarized in this report, it is important to continue to maintain and assess program success in the future. This report concludes with several recommendations intended for the CTN and the iMapInvasives program. Rather than produce a full-fledged product based on a one-time interaction with stakeholders, these recommendations allow for iteration of the design, thereby creating a more effective program to engage with stakeholders in multiple cycles of feedback and refinement.

Eight Recommendations for the Certified Trainers Network

1. **Continue to expand CTN through additional networks:** Tap into additional networks outside of the current invasive-interested communities and partner with other community science initiatives, e.g., Soil and Water Conservation Districts, Cornell Cooperative Extension, university campuses - both in formal and informal settings, tap into campus clubs (e.g., SUNY ESF's Conservation Biology or Bob Marshall clubs) as well as hiking or other outdoor enthusiast organizations as well. Recruiting trainers who have access to captive audiences, through university campuses, may result in more observations and active users. This recruiting campaign should include full assessment and research with time spent meeting with organization leaders to come up with plans to incorporate iMapInvasives into their programming. Another opportunity is to work with Faculty to incorporate into their courses, e.g., Dr. James Gibbs uses iMapInvasives in his Conservation Biology course at SUNY ESF, which serves ~100 students/year.

2. **Ensure trainers are hosting their allotted trainings per year:** This will simply be maintained in a spreadsheet, but will need to include staff time for reminders to host trainings and additional support as necessary to continue to include trainers in the CTN.

3. **Increased communication strategies for retention of trainers and their trainees:** Many organizations have found volunteers are not retained from year to year, so special attention may need to be focused on communicating with trainers to keep them interested and involved in the CTN. This communication could also be passed onto their trainees.

4. **Continuation of monthly updates to trainers:** Throughout the duration of the CTN study, there were monthly emails sent to the trainers (as noted in "Development of CTN" section of the thesis) and these should continue to be sent to trainers. This is the most

engaging method of working with trainers without being bothersome, but provides some interesting statistics about the program, invasive species or other hot topics in general.

5. **Plan seasonal trainings hosted by CTN and publicize:** There are several factors that could impact trainer's ability to host trainings. Time constraints were reported as the most frequently encountered barrier to hosting a training. Lack of access to, or knowledge of, stakeholders and/or training space were close seconds. It is essential to understand barriers faced by trainers and to provide possible solutions. For example, if possible, staff could assist directly in the planning of trainings or workshops or provide resources to mitigate this obstacle. This could be done through annual spring blitz trainings, e.g., plan 1–2 workshops in each PRISM with multiple guest speakers that would allow for an interesting and diverse group of trainees. There could also be winter workshops for those more involved in iMapInvasives to learn about program updates, receive additional trainings, etc.

6. **Continue to host CTN initial training webinars:** Continued hosting of the standardized initial training webinars on a quarterly basis is suggested. Over time this could be reduced to every 6 mos based on participation and need. This will facilitate administrators keeping up with notifying new users of the program and replacing volunteers not retained from year to year. Continuing to work with campus programs, like the RIT student group in the conservation biology course, is suggested as beneficial, as is expanding similar partnerships with additional universities.

7. **Creation of iMapInvasives Training/CTN Handbook:** Creation of a policy guide, volunteer handbook, or other device that can be given to trainers to refer to would be helpful to stay organized and retain trainers (Brudney 1999). This was a goal of the CTN

initial project but could not be efficiently completed prior to analyzing the results of this study. The handbook could be based on resources already created.

8. **iMapInvasives Resources:** Though the initial and most time-consuming aspect of creating \ resources was conducted between Aug and Dec 2017, these resources will need to be continuously updated, as they are already outdated with the new iMap3 updates. An additional factor to be considered is the location in which all the editable files will be stored, where they can be accessed by trainers, but not the public. Google Drive was used for this program but through the survey, we realized not everyone has access to this technology. These resources are a benefit to trainers who take the initiative to be part of the CTN, recognizing that their efforts and time spent working with iMapInvasives are important to the program.

Seven Recommendations to the NYNHP iMapInvasives program

1. **Standardization for trainers, reporting trainings and attendees:** All individuals who wish to host iMapInvasives trainings should be required to be a member of the CTN. This will help to emphasize the value of the program and create a better understanding of why the program was created in the first place. Non-CTN individuals hosting training efforts are important, but trainers who put additional time and effort into the CTN should reap the benefits of being a part of this program. All trainings being held that include iMapInvasives should be funneled into the same reporting system to better organize information, for both staff and the CTN. The current CTN method to report trainings, a Training Class Details Form (via Google Forms), is working well, but needs to be obligatory. It is recommended to create and distribute an evaluation form for each training to collect attendees and information following each training. One possible

solution is using the Training Information Monitoring System (TIMS), a Microsoft Access database application. These recommendations are especially important now that iMapInvasives version 3.0 no longer tracks training classes and could be used to improve the program in the future.

2. **Improve online training:** With the recent changes to iMapInvasives, e.g., with the release of version 3.0, users no longer need to attend a training to submit observations, so there should be effort to update online trainings. This work should be done collaboratively with the iMapInvasives network, i.e. not solely NYS. This could be through creation of video tutorials of the app and the online database. Many other community science programs have creative trainings that can be used for reference. This online training could also be used to "flip the classroom" and improve the use of time during in-person trainings (Sezer et al. 2018). The trainer should still allow for some technology setup and issue resolution, but could spend more time on species ID sessions, getting users out reporting invasive species in the field, or analyzing records in the area, depending on the focus of the training. A flipped classroom is a newer method to hold trainings and can keep iMapInvasives at the forefront of this technological world.

3. **Increased communication strategies for retention of users:** Many organizations have found volunteers are not retained from year to year, so special attention should be focused on communicating with users more frequently to keep them interested and involved. This could include communicating current CTN efforts, sustained email updates to users, more frequent newsletters, improved use of social media, and more.

4. **iMapInvasives User Competition and Appreciation:** Using creative and friendly competition, user retention can be improved whether through seasonal competitions (e.g.,

a mapping challenge, a photo contest), leader boards, badges (1, 5, 10, 50, 100, 1,000…

etc.) for both reported observations and species diversity, and awards or "swag" for most

diverse reporting, etc. This is something that should be further explored as iMap3

continues to unfold.

5. **Create behavior changes and reinforce social norms**: It is important to incorporate

more behavior change research in the post-training sector of iMapInvasives. For example,

after a new user attends a training, they get a follow up email thanking them for their first

submission within a few days. Then after ~ 30 days, they receive another update

reminding them of the importance of participating in iMapInvasives and ways they can

easily incorporate it into their lives/work. Another good way would be to create a

response system to confirm their first uploaded records and thank them for their efforts.

6. **Improved confirmation of observations/reporting:** Confirmation of records is an

important aspect of maintaining the state database. Reports for priority species and

locations are reviewed regularly by NYNHP staff, but the of thousands of reports for

widespread, established species submitted each year do not receive the same level of

attention due to the sheer amount of time required to review each record. Regardless of

species reported, users appreciate knowing their observations are being looked at and

used for management or other purposes. Some users have even questioned if they should

continue to participate if there is no response from the program about their data. This

could be completed through the creation of a confirmers network, potentially even a

sibling to the CTN, but to confirm invasive species records by collaborating with natural

resource professionals who want to be more involved in iMapInvasives. From the data

analyzed for this report, of the 4,290 observations reported, 2,488 (or ~ 58%) of the

observations were confirmed. Within the unconfirmed data, 163 were submitted without images, 19 were listed as significant records, and 903 were state regulated species. It would be good to improve this effort, though with increasing numbers of participants, it is difficult at times to stay up to date. New confirming user roles in iMapInvasives 3.0 will allow for more involvement of the iMapInvasives community in processing records efficiently.

7. **Hyper-local or Regional Reporting (County/PRISM):** It is recommended that a standardized method of quarterly reports is created using the new ESRI software to share information about invasive distributions in each region. This information could promote the PRISM species tier lists currently being developed and would be beneficial to trainers to highlight during their trainings, for managers to better understand what is happening in their area, and for users to be able to get simple overviews of their community. These lists currently exist for some PRISMs and will be developed further by an ESF master's student starting in Fall 2019. This information will also aid in quarterly and final reports submitted to NYS and funders.

Of these recommendations, for both the CTN and iMapInvasives program, actions should be taken in manageable steps collaboratively rather than independently. All recommendations relate to each other and will help build a stronger program, create opportunity for continued research, and potentially create more involved communities while retaining users. This report recommends all efforts be designed with users in mind and in ways that are inclusive and support user diversity.

CONCLUSION

The findings of this study go beyond the CTN and could be utilized in a variety of fields. Invasive species programming in NYS and other regions can be expanded using TTT approaches, so long as they utilize education and outreach strategies that best suit their audiences. While working with volunteers, understanding the best management practices is essential to successfully expand the program. It was hypothesized that through the creation of a volunteer-based program, using a train the trainer model approach, capacity of the community science program, iMapInvasives would be expanded across the state. Based on the research conducted and discussed, this approach was successful and would be recommended to others.

Through iMapInvasives and the CTN, these trained trainers are equipped with the necessary tools to create significant memorable experiences within natural settings through environmental education and outreach. These programs also encourage more environmental stewardship that may in turn reduce our role in the spread of invasive species. Enabling community scientists with the opportunity to understand impacts of invasive species on their local communities, and to participate in statewide management efforts, will be beneficial to all.

Our trainers shoulder a certain responsibility, which helps ensure users are being engaged with and are becoming more effective participants in our program. Following a train-the-trainer model, this Certified Trainers Network is essential to building on this overall community science program with the overarching goal of slowing the spread of invasive species across NYS.

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Appendix 2.1. Call for Trainers Flyer

*i*MapInvasives
Certified Trainers Network

Join the iMapInvasives Trainers Network by becoming certified to train others how to report invasive species!

Who should get certified:
Natural resource professionals, college students, educators, and citizen scientists interested in protecting our natural areas and working with others

Benefits for Certified Trainers:
Involvement in local and statewide projects, increased awareness of invasive species, improves resume, networking opportunities, professional experience

Project Importance:
The more information we have about invasive species, the more effective our efforts are to minimize impacts on the places we love. The iMapInvasives Certified Trainers Network helps grow the number of people knowledgeable about, and looking for, invasive species, boosting our ability to detect new invaders early.

How to Get Certified:
Offered via webinar or in-person (when available)
- *Basic Trainer:* Receive free training on iMapInvasives, host 1+ trainings in your community, host 1+ training per year
- *Master Trainer:* Receive free training on iMapInvasives, host 3+ trainings in your community, host 2+ training per year

Contact: Brittney Rogers; brrogers@syr.edu
www.NYiMapInvasives.org

New York Natural Heritage Program

ESF State University of New York
College of Environmental Science and Forestry

Appendix 2.2. CTN Webpage

Appendix 2.3. PRISM boundaries and table of members

PRISM	Members		Supporting Information
APIPP	248		1,867 Total Members
CapMo	181		1,210 Individuals
CRISP	219		
FL	314		64.8% Unique Individuals
LH	296		35.2% Overlap in Members
LIISMA	192		
SLELO	154		
WNY	263		

Appendix 2.4. Example of Recruitment Email from February 2018

Brittney L Rogers

From:	Brittney L. Rogers <blr93@cornell.edu>
Sent:	Wednesday, February 28, 2018 10:52 AM
To:	Brittney L Rogers
Subject:	FW: New opportunity to join iMapInvasives Certified Trainers Network!
Attachments:	Call for Certified Trainers Network.pdf

New Opportunity to Join the iMapInvasives Certified Trainers Network!

Are you interested in learning more about iMapInvasives? Participating in a statewide effort to combat invasive species? Did you miss the first round of trainings? Now is your chance, register to join us!

Each training webinar will last approximately two hours with time for discussion throughout. The training will include a walk-through of the iMapInvasives website, observation database and steps for hosting a training. Webinar registration is limited to create a more inclusive environment. More information can be found at the Certified Trainers Network. Please be sure to register for the training of your choice, if these dates don't work for you, please let me know.

Upcoming Webinar Trainings:
TUESDAY **MARCH 13, 2018; 9:30AM-11:30AM**
        REGISTER HERE: https://goo.gl/hJj46H

THURSDAY **APRIL 19, 2018; 12:30PM-2:30PM**
        REGISTER HERE: https://goo.gl/qibd7H

MONDAY **MAY 7, 2018; 9:30AM-11:30AM**
        REGISTER HERE: https://goo.gl/Tk5iba

Please forward this email to others who may also be interested in this opportunity. If you have any questions, please let me know.

Thank you,

Brittney

--- ><)))*> ..... ><)))*> ...... <*)))>< ..... <*)))>< ---
Brittney Rogers
SUNY College of Environmental Science and Forestry
Environmental and Forest Biology, Environmental Interpretation
iMapInvasives, New York Natural Heritage Program
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LinkedIn: https://www.linkedin.com/in/brittney-rogers/
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Appendix 2.5. Initial Training Webinar PowerPoint (1/5)

Appendix 2.5. Initial Training Webinar PowerPoint (2/5)

Appendix 2.5. Initial Training Webinar PowerPoint (3/5)

Appendix 2.5. Initial Training Webinar PowerPoint (4/5)

Appendix 2.5. Initial Training Webinar PowerPoint (5/5)

Appendix 2.6. ITW Registration Form sample

Certified Trainers Network Registration

Please provide all of the contact information requested below. This information is confidential and not shared with others.

Remember to click "Submit" at the bottom of the form!

* Required

Please select the training you wish to attend... The October trainings are now full. *

◯ November 6: 5:30PM-7:30PM

First Name (Full first name; ex. Joseph not Joe) *

Your answer

Last Name (Full last name) *

Your answer

Email *

Your answer

City *

Your answer

County

Your answer

State *

Your answer

State *

Your answer

Telephone Number

Your answer

Organization *

Your answer

Title *

Your answer

Do you have an existing iMapInvasives account?

◯ Yes

◯ No

◯ Not sure

Briefly explain your interest in joining the Certified Trainers Network:

Your answer

Questions or Comments

Your answer

SUBMIT

Never submit passwords through Google Forms.

Appendix 2.7. Certification Plan

iMapInvasives
Certification and Planning

Name: _____
Organization: _____

iMap Username: _____
Email Address: _____

Initial Certification Training Received:
Date: _____ Location: _____

Certified iMapInvasives Basic Trainer
Training 1: Date: _____ Additional Comments:
Location: _____
Audience: _____

*Must host 1 training per year to keep certification
Yearly Training 1:
Date: _____ Additional Comments:
Location: _____
Audience: _____

Certified iMapInvasives Master Trainer
Training 2: Date: _____ Additional Comments:
Location: _____
Audience: _____

Training 3: Date: _____ Additional Comments:
Location: _____
Audience: _____

*Must host 2 training per year to keep certification
Yearly Training 1:
Date: _____ Additional Comments:
Location: _____
Audience: _____

Yearly Training 2:
Date: _____ Additional Comments:
Location: _____
Audience: _____

Please provide additional responses on page 2

Certified Trainers Goals:
Please provide a short response about your goals as a certified trainer.
Why did you want to become a Certified Trainer? What certification do you hope to achieve? What opportunities are you looking for by being a part of the Trainer's Network? When do you plan to complete trainings by? Do you have target audience or user group you plan to reach? Etcetera.

Appendix 2.8. Certificate for Certified Master or Basic Trainers

Certificate of Achievement

WE THE UNDERSIGNED DO HEREBY PROUDLY PRESENT THIS
CERTIFICATE OF ACHIEVEMENT FOR OUTSTANDING EFFORT TO

Brittney Rogers

FOR THE ACHIEVEMENT IN THE YEAR 2018 OF BECOMING AN

IMAPINVASIVES CERTIFIED MASTER TRAINER

AND FOR YOUR COMMITMENT TO PROTECT NEW YORK'S NATURAL RESOURCES

MELISSA FIERKE, EFB DEPARTMENT CHAIR
SUNY COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY

DJ EVANS, DIRECTOR
NEW YORK NATURAL HERITAGE PROGRAM

JOSH THIEL, INVASIVE SPECIES COORDINATION SECTION CHIEF
NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Appendix 2.9. Training Class Details Form

iMapInvasives Training Class Details

Please submit information for you upcoming training class. We will send you an email confirmation following your submission of this form. Provide as much information about your training as possible. Indicate if you would like your training listed on the iMapInvasives website and calendar (we request at least 3-weeks advance notice for events to be added to our website/calendar).

Thank you for hosting a training for iMapInvasives!

* Required

Email address *

Your email

Your Name *

Your answer

Training Class Title - Format [Year -Organization - Title] *

Your answer

Training Instructor Name(s) *

Your answer

Location (City/Town) *

Your answer

Date of Training *

Date

mm/dd/yyyy

Start Time of Training *

Time

:   AM ▾

End Time of Training (Can be approximate) *

Time

:   AM ▾

Regarding iMapInvasives, what will you cover?

○ Online database demonstration

○ Mobile Application demonstration

○ Both online and mobile application

○ Other:

iMapInvasives Training Type (What will you cover?) *

○ Basic: Observations (Mobile/Online)

○ Advanced: Assessments, Treatments, Surveys, Infestation Management

○ Other:

iMapInvasives Taxonomic Group (Are you focusing on certain invasive species?) Select all that apply. *

☐ All Species

☐ Animals, Aquatic

☐ Animals, Terrestrial

☐ Insects

☐ Plants, Aquatic

☐ Plants, Terrestrial

☐ Other:

If your program is open to the public, would you like to have this listed on our website/calendar?

○ Yes

○ No

○ Other:

If public: How can interested attendees register?

Your answer

If public: Please provide a description of the training to share on our calendar/website.

Your answer

If public: Please list the address of the training or any specific driving directions.

Your answer

Additional Comments:

Your answer

THANK YOU FOR HOSTING A TRAINING!

PLEASE CONTACT US IF YOU HAVE ANY QUESTIONS. iMapInvasives@nynhp.org or Brrogers@syr.edu

iMapInvasives

⬜ Send me a copy of my responses.

SUBMIT

Never submit passwords through Google Forms.

Appendix 2.10. Advanced Registration Spreadsheet

	First Name	Last Name	Email Address	Organization	Project(s)	Attended?	Additional information...... Please add additional columns if you prefer!
Instructor:	Brittney	Rogers	brogers@svr...	iMap			
Registrants							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Appendix 2.11. Draft Training Reminder email template

Hello,

Thank you for registering for the upcoming iMapInvasives training.

Just a few quick notes:
[insert date time location and any directions or parking information]

Please bring a smartphone, tablet or other device to make observations during the training.

Download the mobile app: https://www.nyimapinvasives.org/mobile

If you have any questions please view the FAQ or email us at [insert email address] or contact the iMapInvasives team directly.

See you soon!

Thank you,
[insert signature]

Appendix 2.12. Sign-in sheet template

iMapInvasives Training Sign-In

First Name and Last Name	Email Address	Organization	Interested in hosting own training?
Brittney Rogers	Brrogers@syr.edu	SUNY ESF	Yes!

*i*MapInvasives

THANK YOU FOR ATTENDING!

Appendix 2.13. Training PPT Template (2/5)

Appendix 2.13. Training PPT Template (3/5)

Appendix 2.13. Training PPT Template (4/5)

Appendix 2.15. Evaluation Form created and shared by Certified Master Trainer, Luke Gervase

iMapInvasives
geotracking invasive exotic species

iMapInvasives Training Evaluation

1) Date of Training: _____

2) Location: _____

3) How did you learn about this training?
☐ Email/website ☐ PRISM or CCE event ☐ Colleague ☐ Other _____

4) Select the position that best describes you:
☐ Scientist (Specify affiliation: _____
☐ Government employee (Specify local, state, or federal _____
☐ Natural resource professional (Specify agency or organization _____
☐ Community volunteer (Specify which PRISM: _____
☐ Other (Please explain) _____
☐ Student
☐ Master volunteer (Circle one: Master Gardener Master Naturalist Master Forest Owner)
☐ Extension or outreach educator (Specify association _____
☐ Tree care professional (Specify organization _____
☐ Other educator (Specify _____

5) Rate your knowledge of iMapInvasives *prior* to attending today's training:

1	2	3	4	5
Poor/low		Average		Excellent/High

6) Rate your knowledge of iMapInvasives *after* attending today's training:

1	2	3	4	5
Poor/low		Average		Excellent/High

7) To what extent did this training meet your expectations?

1	2	3	4	5
Did not meet		Met Exactly		Exceeded

8) What aspects of iMapInvasives do you think will be most valuable for your work? _____

9) If iMapInvasives was to be redesigned, what would be the most useful improvements to make? _____
_____
_____

10) What actions will you take following today's training?
☐ Use iMap to find information about invasive species in NY
☐ Use iMap to report infestations
☐ Use iMap as a data management system for my organization's invasive species efforts
☐ Train others in my organization or community
☐ Other (please specify): _____

11) Suggestions for future iMapInvasives training: _____
_____

12) Optional: Please provide your name and email address for additional follow-up:

a. NAME: _____

b. email address: _____

Thank you for taking the time to fill out this evaluation. Your comments are most appreciated and will be helpful in planning future trainings.

Appendix 2.16. Draft Follow-up email template

Thank you for attending the iMapInvasives training!

Just a few quick reminders:

- To log in, visit www.NYimapinvasives.org and click the "Login Now" link.
- Your username is your email address
- If you have forgotten your password, click on the "Forgot Password" link. You will need access to your email (username) to reset your password
- Check to be sure your account information is correct and you are associated with the correct organizations and projects.
- Start mapping!

Want to use your smartphone to report invasive species? Check out the Mobile Mapping options at: www.nyimapinvasives.org/mobile

Appendix 2.17. CTN member welcome email

Brittney L Rogers

From:	Brittney L Rogers
Sent:	Tuesday, November 6, 2018 8:36 PM
To:	
Cc:	

Subject:	iMapInvasives Certified Trainers Network - Follow Up
Attachments:	Certification Plan_iMapInvasives.pdf;
	iMapInvasives_CertifiedTrainersNetwork_InitialTraining_101618.pdf

Hello and Welcome to the Certified Trainers Network!

I just wanted to take a moment and thank you all again for your interest in joining the network, I hope that you found the initial certification training to be informative and useful of your time. I am looking forward to working with each and every one of you over the next couple of years while we work together to develop this network and expand the number of knowledgeable people on the ground looking for and reporting invasive species observations.

Don't forget to visit the Certified Trainers Network page and the Trainers Google Drive folder for additional resources. 'Like' the Facebook Page to be able to communicate with other trainers and let me know if you think of other avenues you are interested in pursuing with this network. If you are having trouble with your username or submitting observations, contact me and I can help troubleshoot!

Below my signature you will find the November update that I sent to the CTN with some updates. Fill out the brief survey if you are interested in attending the trainer winter webinar. I have attached a PDF of the PPT slides and the certification plan word document that was mentioned on the webinar. This document will help you and I keep track of your certification process! I hope you find this to be helpful and not cumbersome. You can review the webinar recording if you would like, please just do not share this with anyone else.

Just a reminder, please feel free to reach out at any point if you are looking for more information about hosting a training or if you are looking for ideas that would be helpful to you. I'm really looking forward to building this network and would not be able to do this without you.

Thanks again for joining the network!

Brittney

Appendix 2.18. Monthly email update from November 2018

Hello trainers!

Congratulations (and thank you!) to the members of the Certified Trainers Network who have hosted a training in 2018. The full list can be found on the Certified Trainers Network (CTN) page on our website.

Please fill out this brief survey to determine the content for a December webinar hosted solely for the current CTN members. (https://goo.gl/forms/H5xHnZk2CMk2YOBz2)

DID YOU KNOW? (+) and (−) facts for November

(+) **May** is the month with the highest number of new users who join iMapInvasives.

(−) **December** is the lowest... December also happens to collect the lowest number of observations from users. It would be great to see more observations reported this December, possibly even in the counties mentioned below – *and you can help!* Contact me to plan a training for December... And if you haven't already, become a Basic or Master Certified trainer for iMapInvasives for 2018!

(+) **Tompkins County** has the highest number of invasive species observations submitted to iMapInvasives with over 7,000 reports.

(−) The following **15 NYS Counties** have the lowest number of observations reported into iMapInvasives from our users, these counties are also closely reflecting the locations with very few trainings.
- Allegany
- Kings
- New York
- Fulton
- Montgomery
- Cortland
- Clinton
- Washington
- Steuben
- Chenango
- Tioga
- Chemung
- Queens
- Wayne
- Yates

As I continue crunching numbers within iMapInvasives data, I will share that with you all. I hope this gives you more than one reason to host a training between now and the end of 2018. ☺

Thank you for all you do,

Brittney

--- ><)))*> ..... ><)))*> ...... <*)))>< ..... <*)))>< ---

2

Appendix 3.1. CTN Members Map: Initial Training Webinar attendees by county, Certified Basic Trainers by county, Certified Master Trainers by county
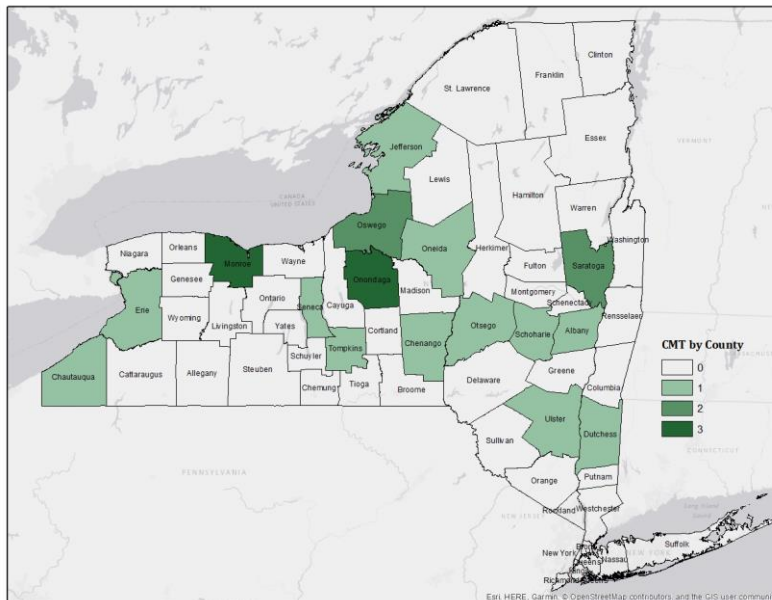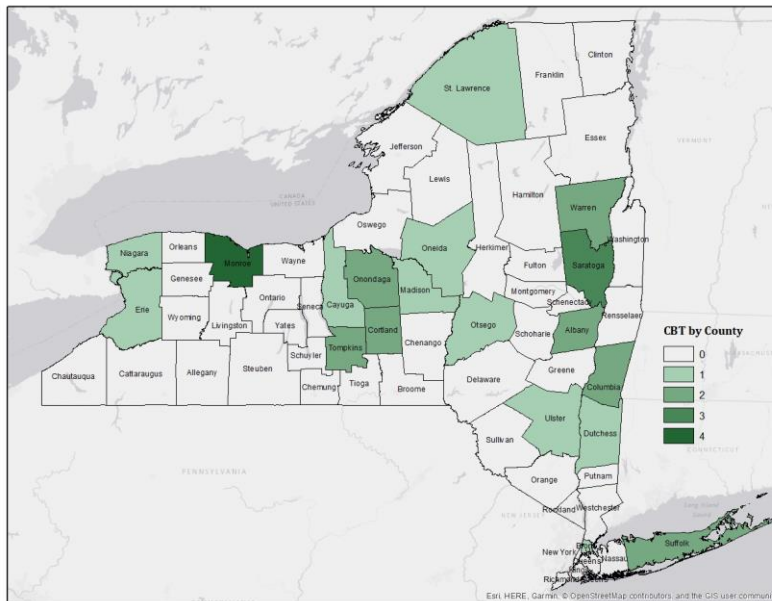
Appendix 3.2. Training classes hosted by CTN Map with polyline connecting trainer's city/town central point to the training locations
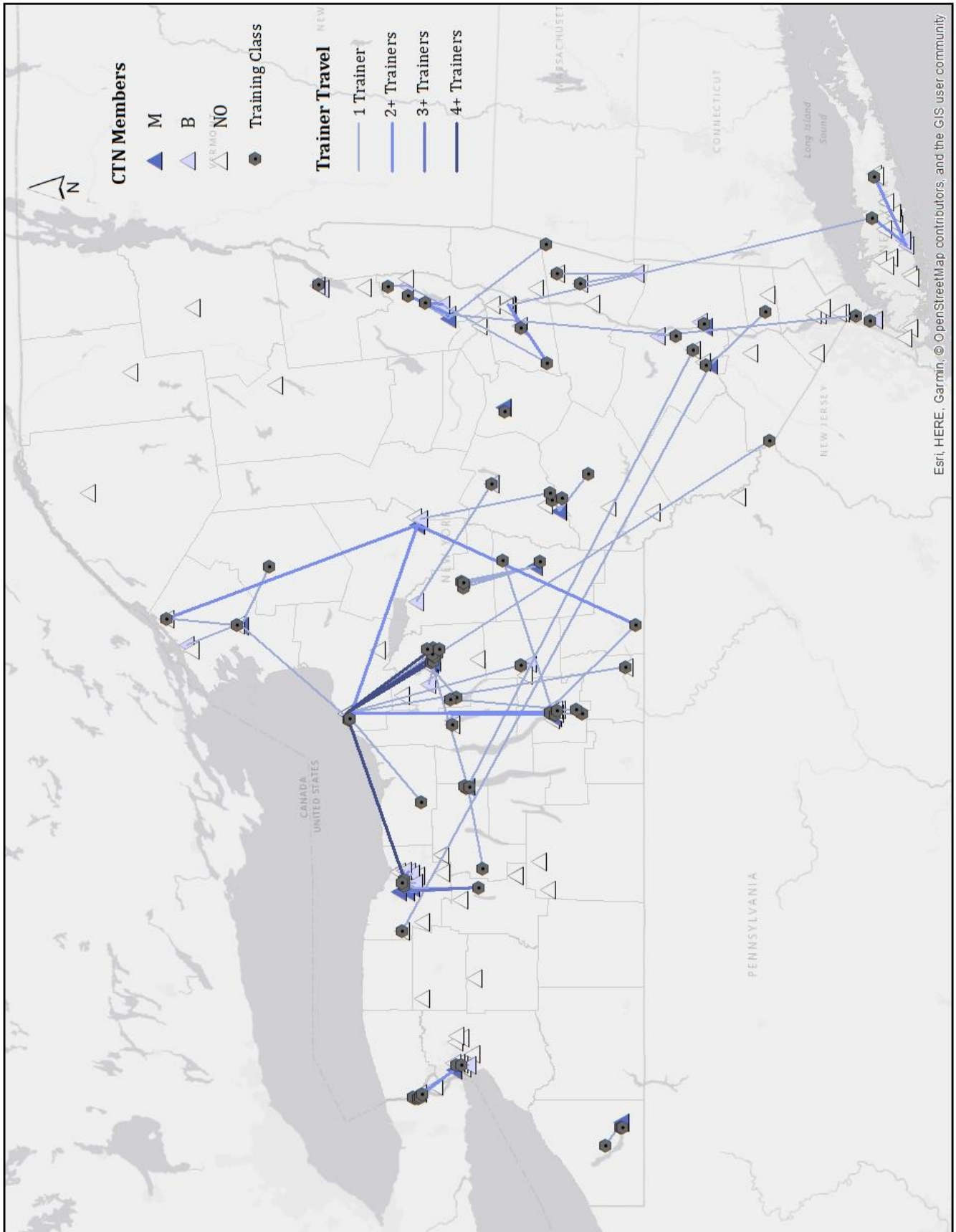
Appendix 3.3. CTN members observation points map, polyline from city/town central point to observations
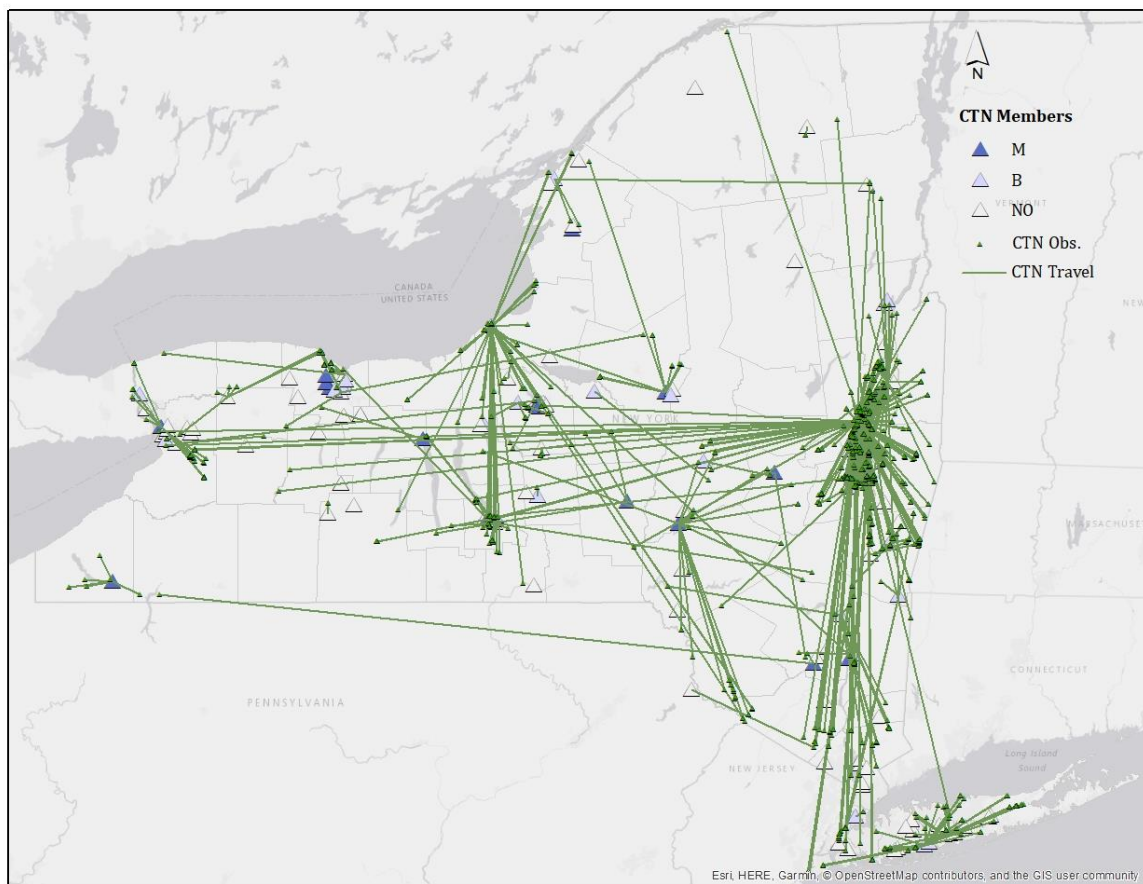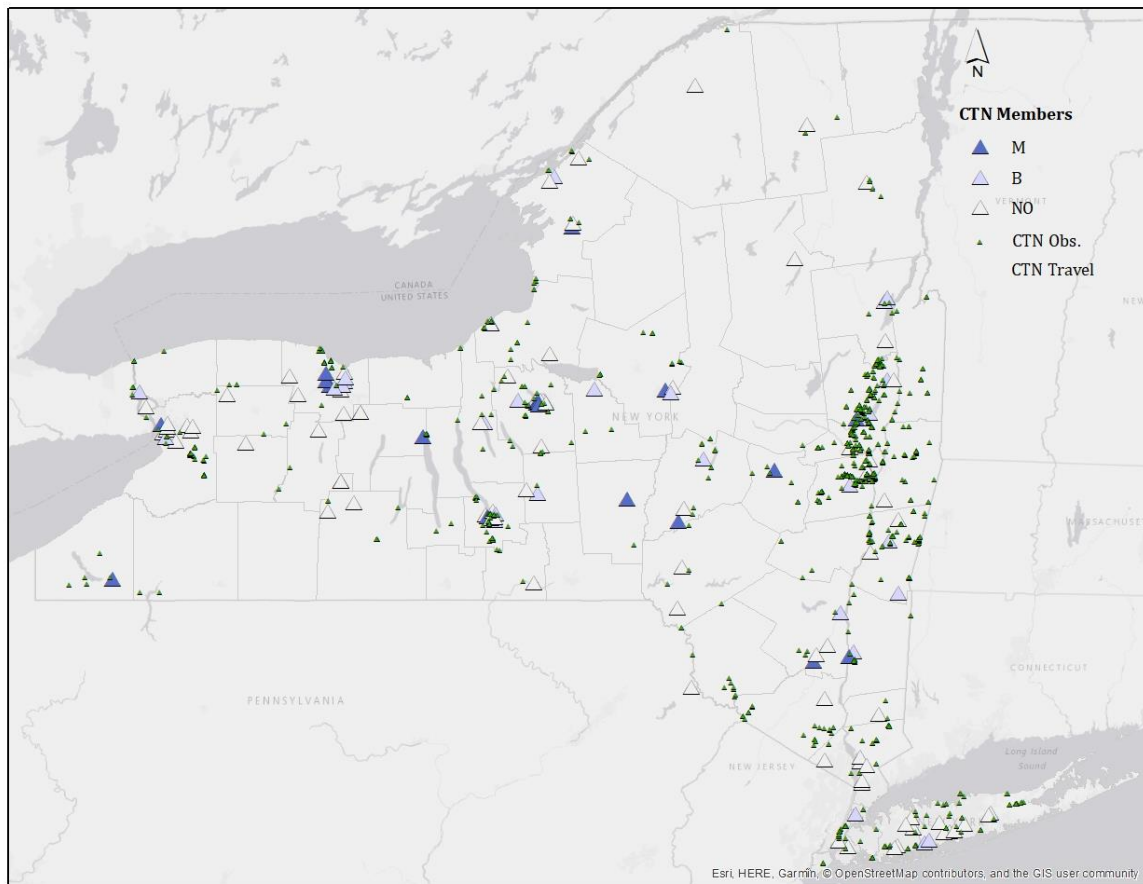
Appendix 3.4. Trainee observation points map, polyline from trainees original training to observations
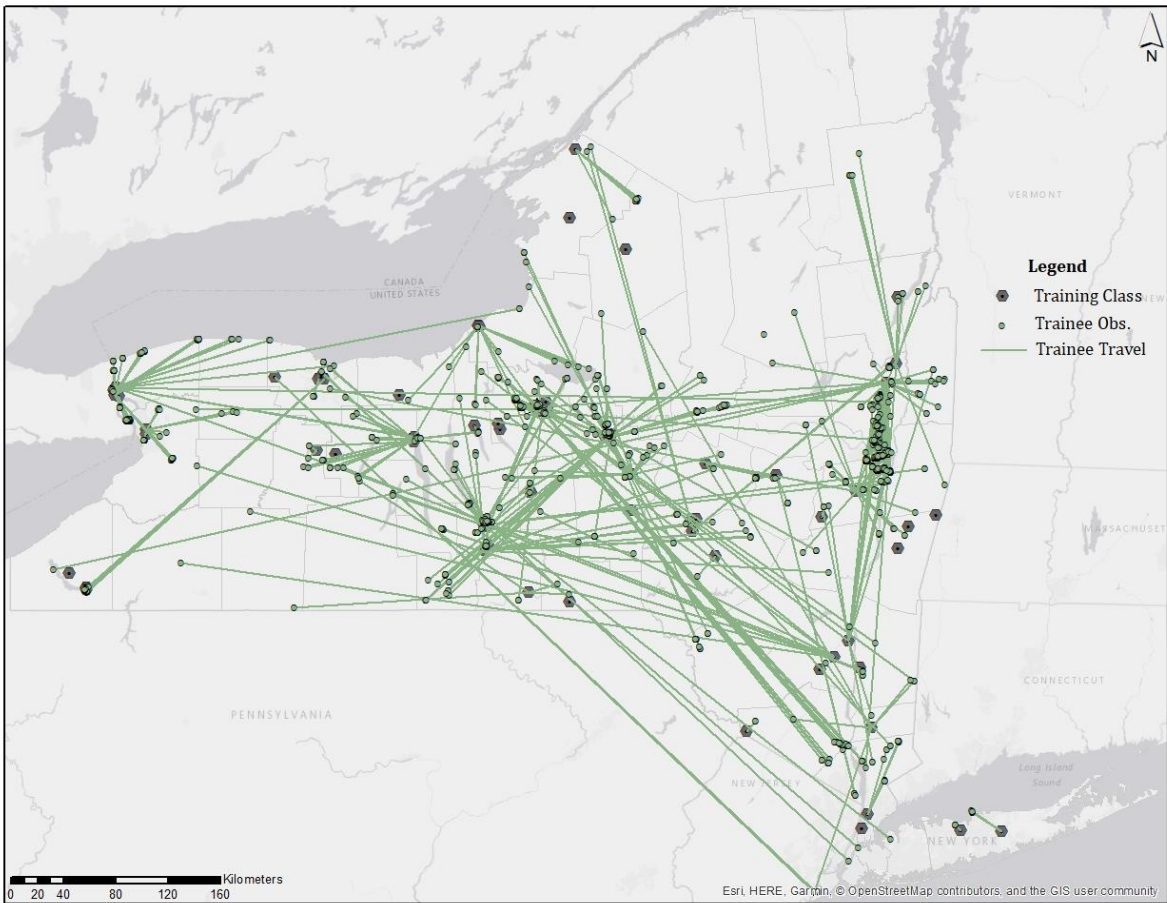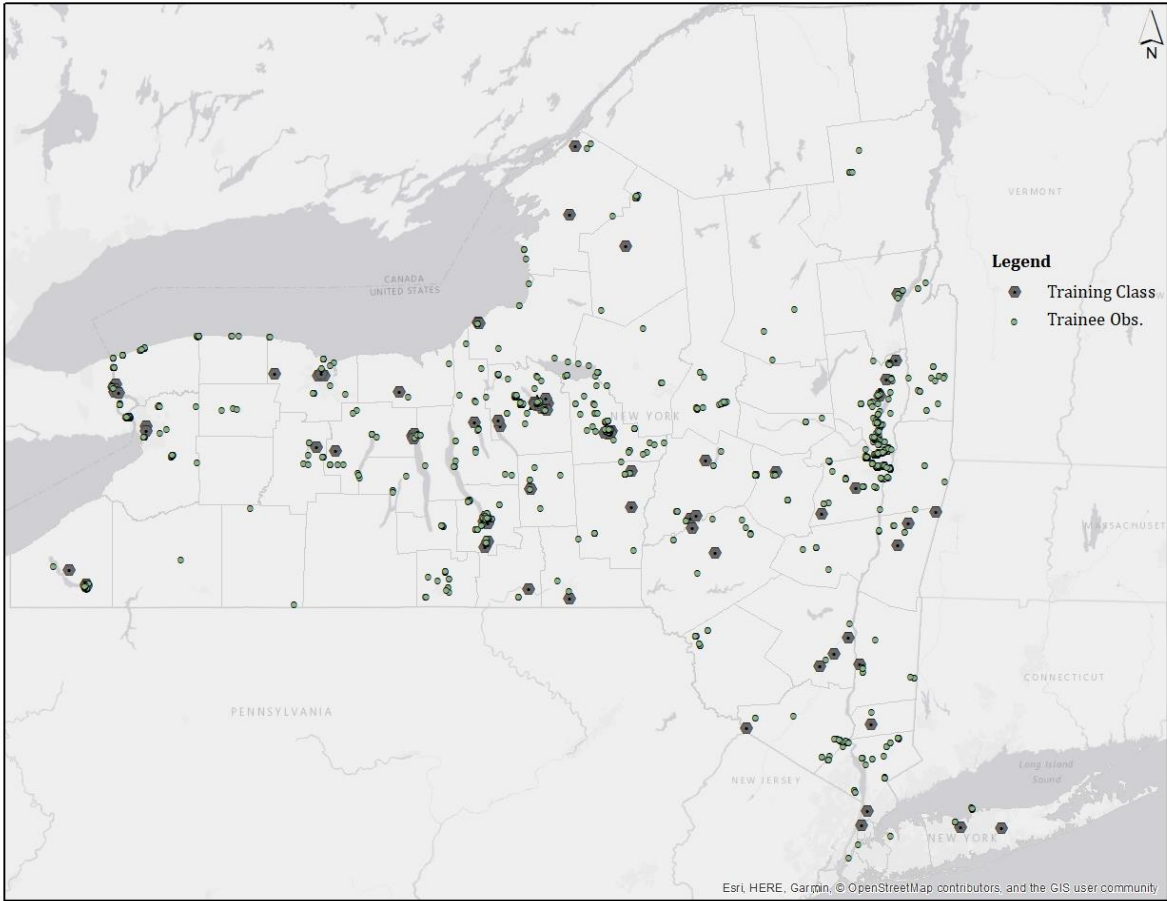
Appendix 3.5. CTN impact on NYS Map; including location of CTN members by county polygon and city/town point data, trainers and training location points, connective polylines for trainers to trainings and all observations to the CTN member or trainee who submitted the observation into iMapInvasives.
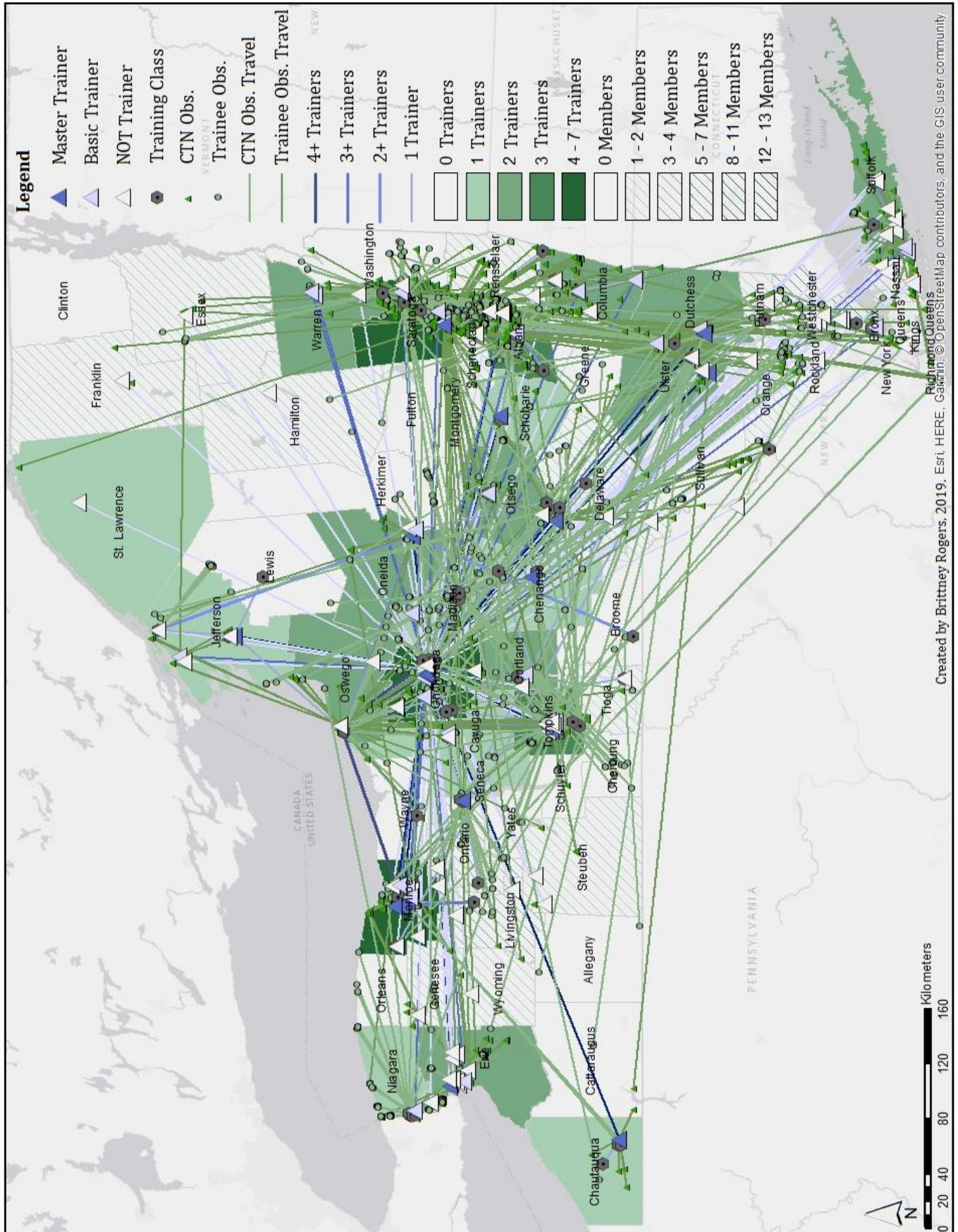
Appendix 3.6. CTN member and trainee observations by spp and total number of reports. "X-" is not detected.

Acer ginnala	2	Daphne mezereum	1	Lonicera japonica	26	Potamogeton crispus	20
Acer platanoides	171	Daucus carota	1	Lonicera maackii	9	Pueraria montana var. l	1
Actinidia arguta	4	Digitalis purpurea	1	Lonicera morrowii	116	Pyrus calleryana	1
Adelges tsugae	78	Dipsacus fullonum	4	Lonicera spp (species	494	Ranunculus repens	1
Aegopodium podagra	34	Dipsacus laciniatus	7	Lonicera tatarica	2	Reynoutria japonica var.	116
Agrilus planipennis	9	Dreissena bugensis	1	Lonicera x bella	1	Reynoutria sachalinensis	2
Ailanthus altissima	172	Dreissena polymorph	13	Lonicera xylosteum	2	Reynoutria spp.	5
Akebia quinata	3	Egeria densa	1	Lotus corniculatus	5	Reynoutria x bohemica :	2
Alliaria petiolata	184	Elaeagnus umbellatc	84	Ludwigia peploides ss	3	Rhamnus cathartica	367
Alnus glutinosa	10	Epipactis helleborine	1	Lychnis flos-cuculi	7	Rhodotypos scandens	1
Ampelopsis brevipedu	9	Eubosmina coregoni	1	Lysimachia nummula	21	Robinia pseudoacacia	108
Amynthas-Metaphire s	13	Euonymus alatus	22	Lysimachia vulgaris	7	Rosa multiflora	239
Aralia elata	12	Euonymus europaeu.	1	Lythrum salicaria	67	Rosa rugosa	1
Artemisia vulgaris var.	86	Euonymus fortunei	4	Malus spp. (species u	10	Rubus phoenicolasius	14
Berberis thunbergii	76	Euphorbia esula	1	Marsilea quadrifolia	1	Saponaria officinalis	2
Berberis vulgaris	20	Ficaria verna ssp. ve	24	Melilotus albus	5	Silphium perfoliatum va	23
Brachypodium sylvatic	3	Fiorinia externa	12	Microstegium vimine	22	Solanum dulcamara var.	11
Bromus inermis	1	Frangula alnus	14	Miscanthus sinensis	1	Spiraea japonica	6
Butomus umbellatus	1	Galium odoratum	3	Morus alba	32	Syringa reticulata	2
Bythotrephes longimai	1	Glechoma hederacec	5	Myriophyllum aquatic	4	Trachemys scripta elegar	1
Cabomba caroliniana	6	Halyomorpha halys	3	Myriophyllum heterop	1	Trapa natans	33
Carassius auratus	1	Hedera helix	29	Myriophyllum spicatu	13	Trifolium repens	1
Carcinus maenas	1	Hemerocallis fulva	1	Myrmica rubra	1	Tussilago farfara	7
Cardamine impatiens	4	Hemigrapsus sanguii	1	Najas minor	4	Typha angustifolia	3
Catalpa speciosa	2	Heracleum mantegaz	4	Nasturtium officinale	2	Typha x glauca	4
Celastrus orbiculatus	183	Hesperis matronalis	3	Nelumbo lutea	1	Ulmus pumila	7
Centaurea spp (species	20	Humulus japonicus	8	Neogobius melanosto	2	Verbascum phlomoides	2
Centaurea stoebe spp.	21	Hydrilla verticillata	4	Nitellopsis obtusa	1	Verbascum thapsus	26
Cercidiphyllum japoni	1	Hydrocharis morsus-	6	Nymphoides peltata	1	Viburnum dilatatum	4
Chelidonium majus	4	Hypericum perforatu	2	Pachysandra termina	5	Viburnum opulus var. op	2
Cichorium intybus	2	Impatiens glandulife:	2	Parthenocissus tricusp	2	Viburnum sieboldii	3
Cipangopaludina chin	5	Inula helenium	2	Pastinaca sativa	43	Vicia cracca ssp. cracca	19
Cirsium arvense	23	Iris pseudacorus	25	Paulownia tomentosa	6	Vinca minor	29
Cirsium palustre	3	Kalopanax septemloi	1	Persicaria nepalensis	2	Vincetoxicum louiseae	13
Cirsium vulgare	8	Lamiastrum galeobd	8	Persicaria perfoliata	9	Vincetoxicum rossicum	27
Commelina communis	3	Lathyrus latifolius	1	Petromyzon marinus	1	Vincetoxicum spp. (speci	33
Conium maculatum	2	Lathyrus odoratus	1	Phalaris arundinacea	13	Viviparus georgianus	6
Convolvulus arvensis	4	Lepidium latifolium	5	Phellodendron amure	71	Wisteria floribunda	1
Corbicula fluminea	5	Lespedeza bicolor	2	Phleum pratense	1	Wisteria spp. (species unk	5
Coronilla varia	14	Lespedeza cuneata	1	Photinia villosa	1	X-Adelges tsugae (NOT L	362
Crataegus monogyna	16	Ligustrum obtusifoli:	3	Phragmites australis :	135	X-Amynthas spp. (NOT L	3
Cygnus olor	5	Ligustrum spp. (spec.	13	Phyllostachys spp. (sp	3	X-Lycorma delicatula (N	19
Cyprinus carpio	1	Lilioceris lilii	1	Picea abies	12	X-Trapa natans - NOT D	10
Cytisus scoparius	25	Linaria vulgaris	1	Populus alba	7	Grand Total	4290

Appendix 4.1. Certified Trainers Network Survey *Introduction soliciting participation in survey: Final Consent Language*

Hello Certified Trainers Network,

We are inviting you to participate in the following study. The purpose of this study is to better understand the most important aspects of the Certified Trainers Network (CTN), and in turn provide support for future citizen science program goals of slowing the spread of invasive species.

You are invited to participate in this survey because you viewed a webinar training to join the iMapInvasives Certified Trainers Network. This voluntary survey should take less than 15 minutes to complete. All information submitted is confidential; no identities will be linked with responses.

I, the researcher, may include the data and results of the study in future scholarly publications and presentations. This confidentiality agreement will be effective in all cases of data sharing. Through these generalized findings of the study, participants may benefit through improved resources and for programs to gain a better understanding of how to utilize a train-the-trainer approach similar to the Certified Trainers Network.

This survey was created for the NY iMapInvasives Certified Trainers Network by Brittney Rogers, SUNY ESF Graduate Student. If you have any questions about the survey or how the data will be used, please contact Brittney (Brrogers@syr.edu). If you have any additional questions about this survey or research, please contact Jennifer Dean, New York Natural Heritage Program (jennifer.dean@dec.ny.gov).

Whenever one works with email or the internet there is always the risk of compromising privacy, confidentiality and/or anonymity. Your confidentiality will be maintained to the degree permitted by the technology being used. It is important for you to understand that no guarantees can be made regarding the interception of data sent via the internet by third parties.

By completing this survey, you agree that you are at least 18 years of age and consent to participate in this study. All participants can withdraw from the research study at any time without penalty.

Certified Trainers Network Survey

Please answer the following questions.

How would you rate your knowledge of invasive species?

I know very little 1	2	3	4	I know a great deal 5
○	○	○	○	○

How long have you been an iMapInvasives user?

○ Less than one year

○ 1–2 years

○ 3–4 years

○ 5 or more

Which (if any) of the following iMapInvasives activities have you completed as a user? Select all that apply.

☐ Browsed website resources or calendar

☐ Entered data online via desktop version

☐ Entered data via mobile application

☐ Viewed reporting maps

☐ Created queries, reports or downloaded data

☐ I have not tried any of the above

Are you aware of any other citizen science programs?

○ Yes

○ No

22%

Prev   Continue

Certified Trainers Network Survey

Have you participated in those citizen science programs?

○ Yes

○ No

Please list any other programs you have participated in:

130

In which month did you attend/view the 2018 Certified Trainers Network (CTN) Initial training webinar?

○ January

○ March

○ April

○ May

○ August

○ October

○ November

Why did you attend a CTN initial training webinar? Select all that apply.

☐ Personal accomplishment

☐ Professional accomplishment

☐ To join a community of like-minded individuals

☐ To protect a local natural area

☐ Connect with nature

☐ Other (please specify)

What have you accomplished by participating in the CTN? Select all that apply.

☐ Increased personal knowledge

☐ Increased professional skills

☐ Interacted with community of like-minded individuals

☐ Increased knowledge in how to protect a local natural area

☐ Increased connection with nature

☐ Other (please specify)

What activities have you completed as a *result of* participating in the CTN initial training webinar? Select all that apply.

☐ Browsed website resources or calendar

☐ Submitted data via mobile app

☐ Submitted data online via desktop

☐ Viewed observation and distribution maps

☐ Created queries, reports or downloaded data

☐ Researched other citizen science programs

☐ Hosted training(s)

☐ None

44%

Prev   Continue

Powered by
SurveyMonkey
See how easy it is to create a survey.

131

Let's talk about the resources created for the Certified Trainer's Network (CTN) :

Please rate the following resources from **(1) not useful to (5) very useful**. These resources were all provided on the iMapInvasives Certified Trainers Network web-page or within the Google Drive Folder.

	NOT USEFUL 1	2	3	4	VERY USEFUL 5
CTN Initial training webinar	O	O	O	O	O
CTN monthly email updates	O	O	O	O	O
CTN Winter Webinar (live or recorded versions) with guest speakers on invasive species topics	O	O	O	O	O
Communication with Brittney Rogers (e.g., phone, email, text, in-person, etc.)	O	O	O	O	O
Communication with other iMapInvasives Staff (e.g., phone, email, text, in-person, etc.)	O	O	O	O	O
Communication with other CTN/invasive professionals (e.g., phone, email, text, in-person, etc.)	O	O	O	O	O
Resources on invasive species: iMapInvasives website, user manual, newsletters, etc.	O	O	O	O	O
Resources to prepare for training: Checklist for planning, Training class details form, Advanced registration spreadsheet, etc.	O	O	O	O	O
Resources for the training: PowerPoint template, Registration template, Handout templates, etc.	O	O	O	O	O

Please indicate if you did not use any of the above resources.

Thank you for rating the resources that were provided through the CTN...

56%

Prev   Continue

Looking back, did the quality of these resources influence your decision to host a training?

○ Yes

○ No

Did you attend the CTN training webinar with the **intention** of hosting an iMapInvasives training in the future?

○ Yes

○ No

Have you hosted an iMapInvasives training?

○ Yes

○ No

67%

Prev   Continue

Please indicate how many trainings you've hosted:

○ 0

○ 1

○ 2

○ 3 or more

How much time would you estimate you spend preparing for and hosting each individual training?

○ 0–1 hours   ○ 7-9 hours

○ 1–3 hours   ○ 10 or more hours

○ 4–6 hours

78%

Prev   Continue

Did you encounter any **barriers** when deciding whether or not to host a training? Select all that apply.

☐ Time constraints

☐ Struggles with online components

☐ Protocol complexity/amount of labor involved

☐ Training space: Lack of access to or knowledge of

☐ Stakeholders: Lack of access to or knowledge of

☐ Not interested in hosting trainings

☐ Other (please specify)

Please provide any additional recommendations to how we could have improved your ability or decision to host iMapInvasives training(s):

How likely are you to host another (or your first) training in the future?

not likely (1)	somewhat likely (2)	neither un-likely or likely (3)	somewhat likely (4)	very likely (5)
○	○	○	○	○

89%

Prev   Continue

Finally, I'd like to collect some brief information about you.

Which of the following best describes your racial/ethnic background? Select all that apply.

○ White

○ Hispanic/Latino

○ Black or African American

○ Asian/Pacific Islander

○ Native American/American Indian

○ Other (please specify)

What is your age?

○ 18-24 years old

○ 25-34 years old

○ 35-44 years old

○ 45-54 years old

○ 55 years and beyond

Highest Level of Education:

◯ Some middle/high school

◯ High school diploma or GED

◯ Associate/Bachelors (BA, BS, etc.)

◯ Graduate or professional degree (MS, MBA, MD, JD, PhD, etc.)

Employment status:

◯ Student

◯ Part-time

◯ Full-time

◯ Retired

◯ Other (please specify)

Map of NY's Partnerships for Regional Invasive Species Management (PRISM)

Based on the map above, which PRISM region do you work/live in?

○ Adirondacks

○ Capital/Mohawk

○ Catskills

○ Finger Lakes

○ Long Island

○ Lower Hudson

○ St. Lawrence Eastern Lake Ontario

○ Western New York

Please provide any additional comments regarding iMapInvasives or your experience with the Certified Trainers Network:

Thank you for your responses!

*i*MapInvasives
Certified Trainers Network

100%

Prev   Done

Appendix 4.3. SPSS Statistics Summary Tables CTN Membership and Date of Initial Training Webinar

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Month Initial training webinar? * CTN Membership	46	85.2%	8	14.8%	54	100.0%

In which month did you attend/view the 2018 Certified Trainers Network (CTN) Initial training webinar? * CTN Membership Crosstabulation

		CTN Membership		
		Trainer	Non-trainer	Total
In which month did you attend/view the 2018 Certified Trainers Network (CTN) Initial training webinar?	Prior to May	23	4	27
	After May	6	13	19
Total		29	17	46

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	13.755[a]	1	.000		
Continuity Correction[b]	11.550	1	.001		
Likelihood Ratio	14.252	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	13.456	1	.000		
N of Valid Cases	46				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.02.

b. Computed only for a 2x2 table

Appendix 4.3. CTN Membership and Total iMapInvasives User Time

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Time as iMapInvasives User * CTN Membership	48	88.9%	6	11.1%	54	100.0

Time as iMapInvasives User * CTN Membership Crosstabulation

		CTN Membership		
		Trainer	Non-trainer	Total
Time as iMapInvasives User	Two years or less	12	15	27
	Three or more years	17	4	21
Total		29	19	48

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.583[a]	1	.010		
Continuity Correction[b]	5.145	1	.023		
Likelihood Ratio	6.897	1	.009		
Fisher's Exact Test				.017	.011
Linear-by-Linear Association	6.446	1	.011		
N of Valid Cases	48				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.31.

b. Computed only for a 2x2 table

Appendix 4.3. CTN Membership and Barriers Encountered

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Number of Barriers Encountered * CTN Membership	48	88.9%	6	11.1%	54	100.0%

Number of Barriers Encountered * CTN Membership Crosstabulation

		CTN Membership		
		Trainer	Non-trainer	Total
Number of Barriers Encountered	Two or fewer	21	8	29
	Three or more	8	11	19
Total		29	19	48

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.409[a]	1	.036		
Continuity Correction[b]	3.233	1	.072		
Likelihood Ratio	4.417	1	.036		
Fisher's Exact Test				.069	.036
Linear-by-Linear Association	4.317	1	.038		
N of Valid Cases	48				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.52.

b. Computed only for a 2x2 table

The iMapInvasives Certified Trainers Network
Submitted by: Brittney Rogers – May 15, 2019

PURPOSE:

The focus of this research was to take a new approach to iMapInvasives, a collaborative GIS based online tool, and current training methods and create a resource that helps New York State residents (and visitors) expand their understanding and awareness of invasive species. Since launching in 2010, the invasive species community utilizing iMapInvasives has grown and training requests, traditionally fulfilled by NYNHP staff, has exceeded staff capacity. The program needed a way to address statewide need for training capacity, and in a standardized way to increase efficiency, and to reach new audiences and areas of the state without staff travel, and keep the momentum going of the growing invasive species community in New York. Through sponsorship from the New York Natural Heritage Program and SUNY ESF, a Certified Trainers Network was created.

The iMapInvasives Certified Trainers Network consists of enthusiastic volunteers interested in protecting NYS natural resources. The term volunteer in this report is referring to the Certified Trainers Network (CTN) members and their trainees who are voluntarily promoting the use of iMapInvasives by conducting trainings and submitting observation reports. The CTN members and trainees are a very diverse group, ranging from high school aged students, college students, full-time natural resource professionals, off-duty professionals, retirees and everything else in between. Trainers inform their communities about invasive species and how to report invasive observations to a community science program, iMapInvasives. The CTN was adopted following a train-the-trainer model approach, giving members the opportunity to become a certified trainer through a three-step certification protocol. Through efforts of the CTN, there were 89 iMapInvasives trainings held, 12 for the trainers, and 77 for the public, natural resource professionals, specific projects or species, and even for educational purposes. These trainings reached 1,162 people, of which 298 individuals submitted 4,290 observation reports. These reports were submitted by 52 CTN members and 246 of their trainees, who represented 128 organizations. These observations include 546 animal observations and 3,743 plant observations totaling 175 different species. The total distance traveled among the CTN to their respective trainings is approximately 4,684 km. Preliminary results from the 2018 CTN Survey show trainers have spent at least 400 hours preparing for and hosting trainings. By hosting trainings, trainers encourage development of environmental stewardship practices that may in turn slow the spread of invasive species. This effort to increase the iMapInvasives program's training capacity will benefit New York's diverse invasive species networks.

For the purposes of this research, the study period began October 17, 2017 and ended March 17, 2019, though the Network will continue beyond that final date. Findings in this draft report are preliminary based on an 18-month study of the development, coordination, and assessment of New York's iMapInvasives Certified Trainers Network. This report will introduce you to a brief literary background, the efforts of creating the network, management strategies, and the results. This report concludes with recommendations to be presented to the New York Natural Heritage Program, New York State Department of Environmental Conservation, Invasive Species Council and Advisory Committee and the State University of New York

College of Environmental Science and Forestry, which will provide new insights into the capacity and retention of this program.

DEVELOPMENT AND ASSESSMENT OF TTT PROGRAM

To increase iMapInvasives training opportunities offered throughout NYS the Certified Trainers Network (CTN), following a train-the-trainer model approach, was adopted. For members of the CTN to become a Certified Trainer, a three-step certification protocol was chosen. To become a Certified Trainer, individuals were required to 1) attend a standardized initial training webinar (or review a pre-recorded version), 2) submit a certification plan, and 3) host their first training.

There were two levels of certification created as part of this network:

- Certified Basic Trainer: The member would host one or more trainings in their local community and then continue to host one or more per year to remain listed as active.
- Certified Master Trainer: The member would host three or more trainings in their local community and then host two or more trainings per year to remain listed as active.

Initial Training Webinar:

All members of the CTN are required to attend a standardized initial training webinar or review a previously recorded version of the training. To maximize efficiency and take advantage of existing technology, multiple TTT programs have utilized online or webinar-based trainings to disseminate information (Stratos et al. 2006, Lee et al. 2012, Yarber et al. 2015). Each initial webinar training was less than two hours, which only varied based on the number of attendees and how interactive they were verbally and through the chat feature. All attendees were encouraged to introduce themselves, discuss their interest or purpose for joining the CTN, and share any ideas for hosting future trainings throughout the webinar. A total of 231 people
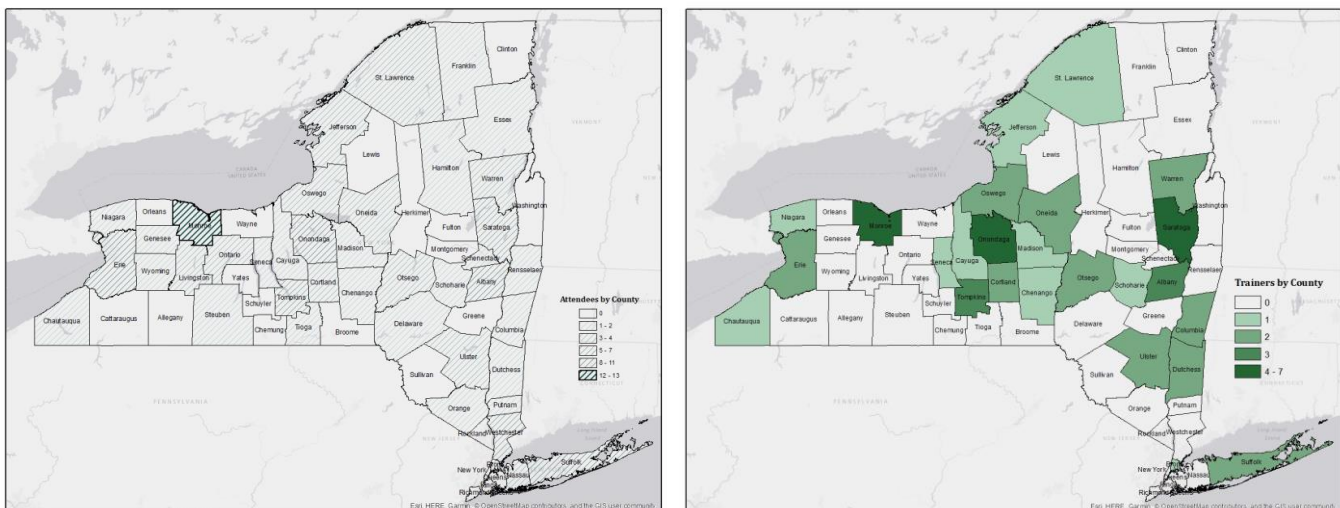
Figure ES.1. Map of counties with CTN members, left. Map of counties with CTN Certified Trainers, right.

registered for the initial trainings. Of the registrations received, 143 (60.4%) attended the training they registered for. Some of the absentees attended a later webinar or did not participate at all. Literature showed that without a fee or other requirement to attend the webinar, many registrants would not attend the event, but a 60.4% attendance rate is good. Trainings were offered Monday to Thursday with the start time varying between morning (9:00AM – 9:30AM), afternoon (12:30PM – 2:00PM) and evenings (4:00PM – 6:00PM). The morning sessions produced the highest number of trainers 22 (49%) and the afternoon sessions had the highest number of total attendees, 54 (40%).

Member Certification:

At the end of the 18-month cycle, 131 (92%) of the members remained in the CTN and will be considered for this research. Of the 12 removed members, 10 left their employment positions while one person asked to be removed from the CTN for personal reasons. Three Certified Basic Trainers who left their positions are still included in the final data analysis. A total of 53 trainers (37%) resulted from the 18-month program, 31 Certified Basic Trainers (58.5%) who hosted one to two trainings, and 22 Certified Master Trainers (41.5%) who hosted three or more trainings. A thorough literature review (as part of this research) suggests that TTT training implementation rates are typically very low, ranging 16–20% (Orfaly et al. 2005, Burr et al. 2006, Ray et al. 2012). However, this study exceeded those expectations at 37% implementation. The 53 Trainers in this study hosted a total of 77 in-person trainings across NYS during the 18-month study period. Through the efforts of the Network, these trainings were hosted in 52 cities and boasted 1,020 trainees. Of those 77 trainings, 31% were facilitated in collaboration with 2–4 trainers. This has helped to create new organizational partnerships and allow for members to interact with each other.

Administrative Time:

Although the CTN was designed to address the iMapInvasives staff time capacity to cover the increased demand for trainings, a considerable amount of administrative time was still dedicated to working with the Network throughout this study period. An average of 3.2 hrs was spent on each training, which included communication with trainers regarding the event, adding information to an online calendar and social media, downloading and editing registration spreadsheets, creating new users, sending updated registration back to the trainers, creating and adding users to the training classes, and following up with attendees and trainers after the training concluded. Administrative time spent uploading training information online to social media or calendars is based on only 30 trainings as not all trainings were open to the public or requested to be shared. The average time spent per month was approximately 14.3 hrs but varied with a minimum of 3.2 hrs in October/November 2017, December 2018, and a maximum of 38 hrs in June 2018. Preliminary results from the 2018 CTN Survey show trainers have spent at least 393 hrs (5.1 hrs each) preparing for and hosting trainings. This volunteered trainer time does not incorporate other time requirements, including initial training, advanced trainings, travel to and from trainings etc.

During this development period, additional graduate student administrative time stretched well beyond 20 hrs per week throughout this entire study period. Since environmental education

is an effective instrument to raise awareness, attitude, and encourage behavioral change in activities for environmental conservation, proper management and coordination of the CTN members was very important. Some of the management strategies included recruitment, training, communication, recognition and assessment of the program. Many of these strategies were implemented based on other successful community science programs and volunteer programs that focus on natural resource education or restoration, like the Cooperative Extension Master Naturalist Programs. Additional time was spent conducting tasks like communicating with potential members, trainers, and their trainees, creating and updating resources, planning initial and advanced trainings, publishing newsletters and more.

It is assumed that some of these tasks will be less time consuming with new iMapInvasives 3.0 functionality updates which provides users with the ability to create their own usernames, potentially freeing up 1.3 hrs per training, though ensuring users are listed in the correct projects and organizations will be additional tasks. There will also be additional administrative tasks to update and maintain the CTN based on the recommendations of this report, especially with the anticipation that this program will continue to grow so long as the CTN remains a priority to the program.

CTN Survey:

In addition to the original scope of the work, an additional survey was distributed to the CTN members. This survey is being conducted of the CTN to learn the best ways to improve the program and to also better understand which aspects are the most important to the members. The survey concluded mid-May and final analysis will be updated in this report as the MS thesis is finalized. Some preliminary results from the CTN Survey show that 72% of trainers Increased personal knowledge and professional skills, while 52% benefited by interacting with a community of like-minded individuals through their participation in the CTN. Of the current responses, 93% of members are aware of other citizen science projects, and 78% have participated in projects like iNaturalist, eBird, and the Empire State Pollinator Survey, along with 24 others. This could be an interesting development in iMapInvasives by collaborating with other community science projects to recruit trainers, increase interest in training classes and other programs being offered around NYS.

TRAININGS AND INVASIVE SPECIES OBSERVATION RESULTS

To evaluate the effectiveness of the CTN as a statewide program, we studied the trainer locations, training locations, and observation reports submitted by trainers and trainees within New York State boundaries. The CTN is designed to provide training on aspects of iMapInvasives and general education and outreach information on invasive species or environmental topics. By also evaluating the effectiveness of this program spatially, using Esri geographical information systems (GIS) tools, we are better equipped to identify areas where trainings and observations have already occurred during this project and areas in the state that will need additional attention in the future.

Through efforts of the CTN, there were 89 iMapInvasives trainings held, 12 initial training webinars for the CTN, and 77 for the public, natural resource professionals, specific projects or species, and even for educational purposes. These trainings reached 1,162 people, of

which 298 individuals submitted 4,290 observation reports. These reports were submitted by 52 CTN members and 246 of their trainees, who represented 128 organizations. Observations were submitted in 60/62 NYS counties. These observations include 546 animal observations and 3,743 plant observations totaling 175 different species. The most common reports (483–183) included species like *Lonicera spp.* (honeysuckle, species unknown), *Rhamnus cathartica* (common buckthorn), *Adelges tsugae* (hemlock woolly adelgid – which was not detected), *Rosa multiflora* (multiflora rose), *Alliaria petiolata* (garlic mustard), and *Celastrus orbiculatus* (oriental bittersweet).

Observations submitted by CTN members (trainers and non-trainers)

Of the 12 CTN initial training webinars that were held, members from 11 classes submitted observations (trainers and non-trainers). A total of 1,348 observations were reported by 52 members of the CTN. Of 131 CTN members, 39.7% have submitted observations. Of the 53 members who hosted trainings, 77% have submitted observations, which was lower than expected. The average number of observations is 25.9 per person. This average is slightly skewed because one trainer has 537 observations, with the next highest reporter submitting 81. Trainer ID #6000 attended Training #318 and has since submitted 537 observations reports, which spread across 23 counties in NY, mostly in the Capital Mohawk PRISM.

These 1,348 observations include 146 invasive species detected and four invasive species reported as not detected (Table 1). The top six species with over 50 records includes *Adelges tsugae* (hemlock woolly adelgid – which was not detected), *Ailanthus altissima* (tree-of-heaven), *Lonicera spp.* (honeysuckle, species unknown); *Rosa multiflora* (multiflora rose), *Rhamnus cathartica* (common buckthorn), and *Reynoutria japonica var. japonica* (Japanese knotweed). In total, 744 observations were species regulated in NYS, three of the top species with more than 50 reports are regulated. An additional contribution of the CTN members include 27 "significant species" reports, which refers to species who were reported in a county for the first time.

The importance of the contribution of members who took the CTN initial training, but did not host a training, was not something initially considered while creating the CTN program. The CTN members, non-trainers, submitted more than 190 observations to the database. Many of the non-trainers also attended the advanced trainings offered by iMapInvasives staff or were in close contact with staff about their plans to host trainings in the future. There could be improvements with working with members to initiate better reporting percentages and increase the number of members who have hosted trainings. Results from the CTN Survey should answer many questions and generate suggestions to improve these areas.

Certified Trainers Network Members and Observations	
Total Trained	143
Reporters	36.4%
Total Obs.	1,348
Obs. per reporter	25.9
Confirmed	958
State Regulated	744
Species Diversity	150
Significant	27
Animal	15.7%
Plant	84.3%

Table ES.1: CTN members and observations

CTN Trainings – Observations submitted by Trainees

The CTN hosted 77 in-person trainings and trainees from 52 classes submitted observations. A total of 2,942 observations were submitted from 246 trainees out of 1,020 (24.1%) training attendees. The average number of observations per person was 12.0. This is lower than the average of all iMapInvasives program reporters (at 23.8); however, it is important

to note 86% of trainees became users after the initiation of the CTN while more than 50% of all iMapInvasives users have been users since before 2014, giving them the advantage of additional field seasons to report observations.

The top seven training classes with >100 observations submitted were trainings as part of college courses at Cornell University (2), SUNY Morrisville (2), and SUNY Cobleskill (1) and the others were for two Friends of Recreation, Conservation, and Environmental Stewardship (FORCES) Steward trainings. The FORCES Program was launched in 2008 via New York State Parks (NYSOPRHP) in the Central Region with the intention of boosting and growing volunteerism within the state. Each of these trainings included captive audiences, where trainees were obligated to attend and potentially obligated to submit observations. The training class with the highest number of observations was one of the 2018 spring blitz trainings in the Capital Mohawk PRISM, Training #321, which resulted in 1,083 observations being submitted. Among those, 758 were mobile application reports from one student and 158 from another, both attending Siena College and conducting research at the campus and a local bike path, while one other trainee who attended Training #321, submitted 152 reports primarily searching for and reporting not-detected HWA submissions. This trainee, ID #7260, also later became a trainer in August 2018.

These 2,942 observations include 111 invasive species and 4 different invasive species reported as not detected. The top eight species with over 100 records includes *Lonicera spp.* (honeysuckle, species unknown), *Rhamnus cathartica* (common buckthorn), *Rosa multiflora* (multiflora rose), *Acer platanoides* (Norway maple), *Alliaria petiolata* (garlic mustard), *Celastrus orbiculatus* (oriental bittersweet), *Lonicera morrowii* (Morrow's honeysuckle), and *Adelges tsugae* (hemlock woolly adelgid - NOT Detected). In total, 1,840 observations were species regulated in NYS, seven of which had over 100 reports. An additional contribution of the trainees includes 7 significant species reports.

Trainees and Observations	
Total Trained	1,020
Reporters	24.10%
Total Obs.	2,942
Obs. per person	12
Confirmed	1,530
State Regulated	1,840
Species Diversity	111
Significant	7
Animal	11.60%
Plant	88.70%

Table ES.2: CTN trainees and observations

iMapInvasives Observations: Comparison to program population prior to CTN

Prior to the initiation of the CTN between 2014-2016, iMapInvasives offered an average of 30.3 trainings per year, with 351 reporters who represented 102 organizations. During the 18-month study period (not including any other NYNHP staff facilitated trainings) the CTN members and their trainees encompassed 89 trainings, with 298 reporters who represented 128 organizations. This is a 97.8% increase in average trainings, and a 25.1% increase in organizations represented by those who reported observations. At first, it appears that there is a -15.3% decrease in users submitting observations annually, but it is important to point out that this does not include reports from the previous users who reported data or new users who were trained outside of the CTN by NYNHP staff. During this 18-month study, 597 users submitted observations to iMapInvasives, 49.9% of those users are members of the CTN and their trainees. Trainings held by the CTN trainers also show an increase in the number of specific trainings, whether for species or projects, for educational purposes, and for natural resource professionals.

Location and Distance:

When analyzing the success/importance of the CTN as a statewide program, it is important to document the location of trainers, trainings, and trainee observations as well as the potential distances travelled through each of these areas (Figure 4). For this study, trainer and training locations were only brought down to the city/town level to keep personal home and work locations confidential. Trainee's locations are undisclosed and contain only an origin point assigned to the first training they attended. All subsequent records they've submitted, which are at a scale or accuracy of ~1.5 m from where they were reported to be observed. It is important to note that most distances are measured as a straight line from origin to destination, rather than considering actual roads and directional traffic.

Trainers and Trainings:

To facilitate trainings across NYS, trainers travelled a total of 112 times, as 31% of the trainings were in collaboration of one to four trainers. These trainers often represented multiple organizations with different professional backgrounds. CTN members live/work in 86 cities or towns in 45 counties across NYS, with Monroe, Onondaga, Erie, and Suffolk Counties the most prevalent at 33.6% combined. CTN members who became Certified Master/Basic Trainers were from 34 cities/towns, 25 counties. Trainings were held in 52 cities/towns, 30 counties. Each PRISM had at least one training in the region through the CTN, though 37 of the trainings were in the Finger Lakes PRISM, which includes 20 trainers and 26 members, a total of 46 total CTN members. The average distance (straight line, not road travel) between a trainer and the training they facilitated was 42.6 km, the minimum being 0.52 km and maximum of 351.1 km. In comparison, the distance between the NYNHP staff at the Central Offices in Albany, NY and the furthest training location, where three trainings were held, was 575 km or 5.5 hrs drive time in each direction. There were 11 separate trainings held in the Syracuse area, which is lower than the maximum distance between a trainer and the trainings but is still 233 km or 2.3 hrs drive time in each direction. The total distance traveled among the Certified Trainers to their respective trainings is approximately 4,684 km; the equivalent of driving from Albany, NY to Wichita, Kansas and back, or just over 43 hrs of driving.

Observations: Distance of trainers to observations, and training to trainee observations

For trainers, the distance is from their city/town (a central point in the polygon) to the GPS coordinates recorded with the observation record. The average distance (straight line, not road travel) between a trainer and each observation they submitted to iMapInvasives database 52.4 km, the minimum being 0.25 km and maximum of 407.9 km.

For trainees, there is no specific location data to where they live/work, so an origin point of the first training they attended is assigned as their location, all subsequent observations they've submitted are measured from that location, regardless whether if they took another
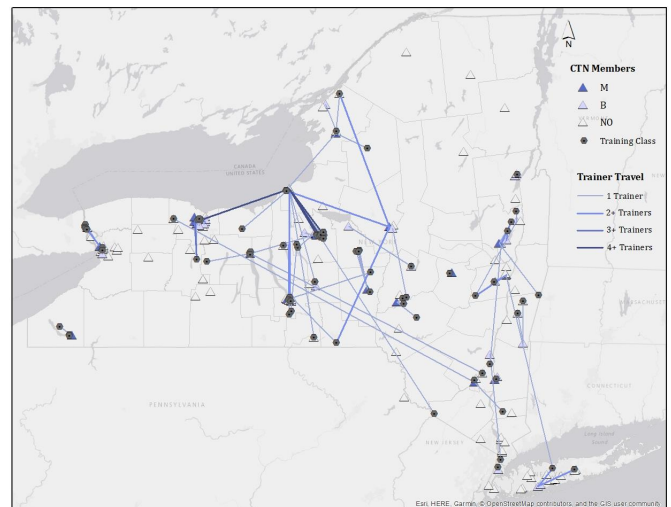
Figure ES.2: Map depicting CTN trainer travels to trainings across NYS.
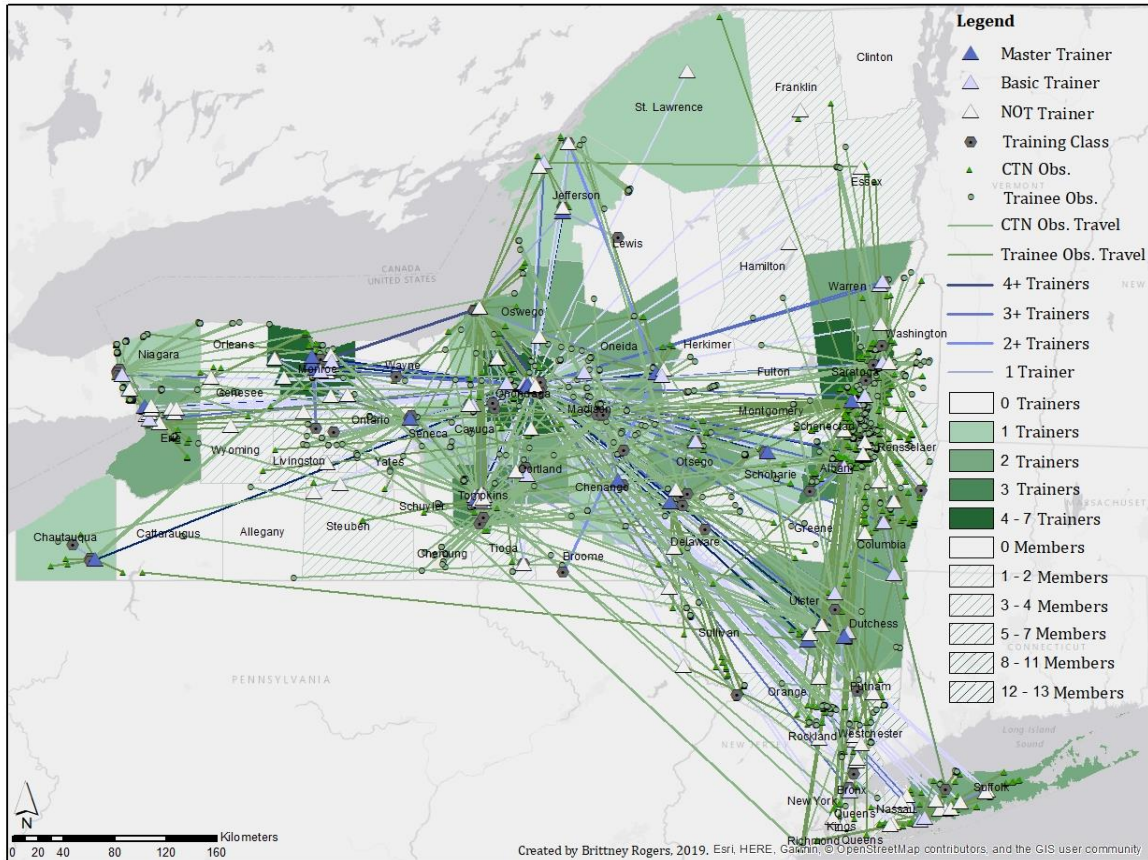
Figure ES.3: CTN impact on NYS including location of CTN members and trainers by county, trainers and training locations by a central city point and spider lines connecting trainers to trainings and observations to the reporter.

training elsewhere after their first training. The average distance (straight line, not road travel) between a training and each trainee observation they submitted to iMapInvasives database 39.7 km, the minimum 0.68 km and maximum of 481.7 km. This maximum distance was travelled by trainee ID #7260, before joining the CTN. It should be assumed that some travel occurred by the trainee to attend the training, and the same for the observations they submitted, but it is still important to understand how far away from training locations users are making observations.

More in depth spatial analyses should be conducted to learn about the trainings, trainees, and their travels while using iMapInvasives. This analysis could include the difference between public or private lands, distances from rare or protected species populations, roadways, recreation trails and more. This would also help improve efforts for future training locations choices.

LESSONS LEARNED AND RECOMMENDATIONS:

A goal of this project was to create a self-sustaining program. This program was initiated October 17, 2017 (the first pilot CTN initial training) and for the purposes of this document concluded on March 17, 2019 (for a full 18-month period), though the CTN is still active and will continue into the foreseeable future. This goal was not entirely accomplished because

without coordination and additional efforts of iMapInvasives staff, this network would not continue (Brudney 1999, Cuskelly et al. 2006, Knepper et al. 2015). Resources and most initial requests were fulfilled during this period, but it is clear that it will be important for staff to continue working with the CTN.

The continued maintenance of this program could be less focused on recruitment, though members who do not renew their certification would need to be replaced. This could be accomplished by offering a minimum of two initial training webinars each year, more may be necessary in the immediate future. Effort to retain trainers and trainees would be the bulk of the maintenance, consisting of communication strategies like social media, newsletters and website updates, creating new and updating resources and hosting seasonal advanced trainings. It is estimated that this program could be maintained at ~10-20 hours per week, fluctuating during different seasons when trainings are being offered.

While the initiation of the CTN was successful based on results summarized in this report, it is important to continue to maintain and assess the program for success in the future. This report concludes with several recommendations intended for the CTN and the iMapInvasives program. Rather than produce a full-fledged product based on a one-time interaction with stakeholders, these recommendations allow for iteration of the design, thereby creating a more effective program to engage with stakeholders in multiple cycles of feedback and refinement.

Eight Recommendations for the Certified Trainers Network:

- Continue to expand CTN through additional networks:
- Ensure that trainers are hosting their allotted trainings per year:
- Increased communication strategies for retention of trainers and their trainees:
- Continuation of monthly updates to trainers:
- Plan seasonal trainings and publicize, hosted by CTN:
- Continue to host CTN initial training webinar:
- Creation of iMapInvasives Training/CTN Handbook:
- iMapInvasives Resources:

Seven Recommendations to the NYNHP iMapInvasives program:

- Standardization for trainers, reporting trainings and attendees:
- Improve online training:
- Increased communication strategies for retention of users:
- iMapInvasives User Competition and Appreciation:
- Create behavior changes and reinforce social norms:
- Improved confirmation of observations/reporting:
- Hyperlocal or Regional Reporting (County/PRISM):

This report recommends that all efforts be designed with the users in mind and in ways that are inclusive and that support user diversity.

CURRICULUM VITAE

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EDUCATION

SUNY College of Environmental Science and Forestry; Syracuse, New York   07/2019
     Master of Science in Environmental and Forest Biology
         Environmental Education and Interpretation

SUNY Oswego; Oswego, New York   05/2013
     Bachelor of Arts in Zoology

RELATED EXPERIENCE

iMapInvasives/New York Natural Heritage Program; Syracuse, New York
Position: Senior Research Aide   05/2019–CURRENT
Responsibilities: Lead the iMapInvasives Certified Trainers Network and actively engaged users by developing training and communications materials for iMapInvasives 3.0. Built "community support" through webinars, emails, and social media. This position was funded through The Research Foundation for the State University of New York, located at the College of Environmental Science and Forestry.

Position: Research Project Assistant   05/2017–05/2019
Responsibilities: Develop and implement network of trainers to serve needs of New York State invasive species database; host regular trainings and interpretive programs for diverse audiences; creation of tools and resources for trainers; website maintenance; analysis of user reported observation data; assist in statewide efforts for invasive species management; attend partner meetings; conduct regular research and provide white paper with recommendations for improved volunteer retention in citizen science projects and focus of future statewide invasive species efforts.

SUNY College of Environmental Science and Forestry; Syracuse, New York
Position: Instructional Support Assistant   *05/2018*
Responsibilities: Instruct course at Cranberry Lake Biological Station as part of the undergrad course, Ecological Monitoring and Biodiversity Assessment (EFB 202). The course introduced students to the importance of scientific journaling and genuine observation in nature.

Position: Instructor   08/2018–12/2018
Responsibilities: Develop and instruct new 1-credit course, An Introduction to Citizen Science (EFB 496-696) offered to both graduate and undergraduate students. The course introduces students to the theory and practice of citizen science and related academic literature.

Cornell University/New York Sea Grant; Newark, New York 05/2013–09/2018
Position: Extension Aide, Watercraft Inspection Steward Program Leaders Trainer
Responsibilities: Training watercraft inspection steward program leaders across NYS, grant writing and application (two application awards), public outreach and education including development and implementation of public programs; development and staffing of interactive displays at highly attended public events such as the NYS Fair, one-on-one interaction with partners and stakeholders with diverse backgrounds; data collection, manipulation and analysis using developed protocol; development and publication of written educational (websites, newspaper articles, educational handouts, fact sheets, blogs etc.) and reporting documents; interpretation of watershed habitats and ecosystems including native and invasive species; planning and implementation of training activities for NYSG and other organizations; New York's Great Lakes focused resource creation, design and management.

Kindred Kingdoms Wildlife Rehabilitation, Inc.; Pennellville, New York
Position: Volunteer 04/2014–09/2018
Responsibilities: Restraint, capture, treatment and release of injured native wildlife and/or patients. Basic care of wounds, administering medications, feeding, and cleaning. Educational program support.

Wildlife Center of Virginia; Waynesboro, Virginia
Position: Education Outreach Externship 02/2014–04/2014
Responsibilities: Public outreach and education for K-12 and adult audiences; design and construction of display kiosks, developed and disseminated materials to the public; rehabilitation of native species; learn and use falconry techniques and handled education raptors and reptiles.

New York State Department of Environmental Conservation; Oswego, New York
Position: Endangered Species Monitor 09/2013–10/2013
Responsibilities: Short term contract to monitor the endangered species, bog buckmoth (Hemileuca spp.); independently obtained counts from transects set by using compass bearings at Mud Pond and Selkirk Fen; continuously repeated counts during peak flight times; weather and other observations were also recorded for more accurate data; prepared data for analysis and presentation to Central New York Land Trust.

Calgary Kennels; Oswego, New York
Position: Animal Caretaker 11/2012–05/2013
Responsibilities: Independently worked on site; secretarial duties; domestic animal handling and exercising; administering prescribed medications; cleaning and disinfecting kennels; provided animals with daily diet.

North Carolina Tiger Rescue; Pittsboro, North Carolina
Position: Volunteer 03/2012–03/2012
Responsibilities: Built new enclosures and contributed effort in expanding old enclosures for large felines; learned about importance of enrichment and facility processes, contributed to onsite education efforts.

Doug's Automotive, LLC; Mexico, New York
Position: Part-time Secretary, Grounds keeper and Mechanic   06/2008–05/2013
Responsibilities: Secretarial work including bookkeeping, appointments, answering phones, on-site landscaping, grounds maintenance and basic automotive repair tasks.

PROFESSIONAL PRESENTATIONS *(2016 Forward)*

NEW YORK NATURAL HERITAGE PROGRAM Executive Summary of the iMapInvasives Certified Trainers Network; Invitation, 2019

NORTHEAST NATURAL HISTORY CONFERENCE, Developing and Maintaining the iMapInvasives Certified Trainers Network; Springfield, Massachusetts; Abstract Accepted, 2019.

SUNY COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY, The Importance of Outreach and Education in Invasive Species Programming, Syracuse, NY; Invitation, 2019.

CITIZEN SCIENCE ASSOCIATION, Following A Train-the-Trainer Model Approach for Branching Out, Raleigh, North Carolina; Abstract Accepted, 2019.

AGRICULTURE, FOOD & ENVIRONMENTAL SYSTEMS IN-SERVICE, Lessons Learned from iMapInvasives, Ithaca, NY; Invitation, 2018.

NYS OUTDOOR EDUCATION ASSOCIATION, iMapInvasives in the Classroom, Huguenot, NY; Abstract Accepted, 2018.

NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION REGION 7, Using Citizen Science to Improve Invasive Species Regional Efforts, Cortland, NY; Invitation, 2018.

FINGER LAKES TRAIL CONFERENCE SPRING WEEKEND, Mapping Invasive Species on the Finger Lakes Trail, Danby NY; Invitation, 2018

SUNY COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY, Invasive Species and Citizen Science, Syracuse, NY; Invitation, 2018.

NEW YORK SOCIETY OF AMERICAN FORESTERS ANNUAL CONFERENCE, Incorporating iMapInvasives into Forestry, Syracuse, NY; Invitation, 2018

INVASIVE MUSSELS COLLABORATIVE Approaches to Watercraft Inspection and Decontamination Programs, Webinar; Invitation, 2017

GREAT LAKE SEA GRANT NETWORK CONFERENCE, Watercraft Inspection Stewardship Efforts in NYS, Cleveland, OH; Abstract Accepted, 2017

SILVER LAKE ASSOCIATION ANNUAL MEETING, The Importance of Aquatic Invasive Species Prevention Efforts, Castile, NY; Invitation, 2017

AGRICULTURE, FOOD & ENVIRONMENTAL SYSTEMS IN-SERVICE, Standardizing Watercraft Inspection Program's in NYS, Ithaca, NY; Invitation, 2016

PENNSYLVANIA LAKE MANAGEMENT SOCIETY ANNUAL CONFERENCE, Standardizing Watercraft Inspection Program's in NYS, State College, PA; Invitation, 2016

NEW YORK STATE FEDERATION OF LAKE ASSOCIATIONS, Watercraft Inspection Steward Program Leaders Workshop, Hamilton, NY; Invitation as In-Conference Workshop Coordinator, 2016

GRANTS AND PUBLICATIONS

Grant 2019, Office of Instruction and Graduate Studies, Graduate Student Travel Grant,
     Award; $500
Grant 2018, SUNY ESF Alumni Association,
     Award; $250
Grant 2017-2018; Enhancing Watercraft Inspection Steward Training, Outreach and Education,
     Award; $83,000
Grant 2016-2018; Statewide Standardized Training for Watercraft Inspection Steward Programs,
     Award; $100,000
Editor, Co-author: NY iMapInvasives Sharing Information for Strategic Management,
Newsletter Issue 2
     < https://www.nyimapinvasives.org/newsletters>
Editor, Co-author: NY iMapInvasives Sharing Information for Strategic Management,
Newsletter Issue 1
     < https://www.nyimapinvasives.org/newsletters>
iMapInvasives Certified Trainers Network webpage
     <www.nysgdunes.org>
Eastern Lake Ontario Dunes and Wetlands Area website
     <www.nysgdunes.org>
New York's Great Lakes Clearinghouse website
     <www.nyseagrant.org/nygreatlakes>
New York's Great Lakes Ecosystem Education Exchange website
     <www.nyseagrant.org/educationexchange>
Co-author: How Nesting Birds Avoid Predators. Eastern Lake Ontario Dunes and Wetlands.2014
     <http://www.seagrant.sunysb.edu/lodune/pdfs/NestingBirdsAvoidPredators.pdf>
Co-author: NYSG Launch Steward Program Final Reports. 2013, 2014

ADDITIONAL SUPPORTING INFORMATION

Professional Member Affiliation:
National Association for Interpretation
New York State Outdoor Educator Association
North American Association of Environmental Education
Citizen Science Association

Professional Certificates:
Certified Interpretive Guide, National Association for Interpretation
Project Wild Educator Professional Development Training, NYS Department of Environmental Conservation
Project Wet Educator Professional Development Training, NYS Department of Environmental Conservation

Project Learning Tree Educator Professional Development Training, NYS Department of Environmental Conservation
Foundations of Interpretation, Indiana University Eppley Institute for Parks and Public Lands

Software/Tool Proficiency:
Microsoft Office Suite; Word, PowerPoint, Publisher, Outlook, Excel
Adobe Creative Cloud; Dreamweaver, Illustrator, InDesign, Premiere Pro
Esri; ArcGIS, ArcMap, Story Maps, Survey 123
Website Building; WordPress, Wix
Webinar; WebEx, Zoom, BlueJeans
Survey Tools: Qualtrics, Survey Monkey, Google Forms

Related Skills:
Ability to implement interpretive programming; accurate data collection, manipulation and basic analysis; plant collection and identification with familiarity in native flora and fauna in Great Lakes Ecoregion; invasive species control and management (non-chemical); exposure to multiple functioning partnerships (including eight Partnerships for Regional Invasive Species Management, Eastern Lake Ontario Dune Coalition); Internet-based networking experience (social media such as Facebook, Instagram, Twitter, Meet-Up, YouTube, Blogs etc. and databases such as Survey 123 and Open Data Kit); K-12 formal and non-formal programming; experience with multiple citizen science projects through Cornell Lab of Ornithology

Related Graduate Coursework
Advanced Interpretation	Intro. to Citizen Science
Environmental Journalism	Insect Ecology Seminar
Envi. Policy and Governance	Personal Envi. Interpretation Plant Ecology,
Envi. Thought and Ethics	Global Change
Forest Entomology	Presenting Research to Public
Fundamentals of GIS	Private Land Conservation

Related Undergraduate Coursework:
Animal Ecology	Insects and Society
Animals and Society	Mammalogy
Entomology	Plants and Society
Environmental Science	Research: Tree Ecology
Environmental and Pop. Bio.	Research: Aquatic Ecology
Invertebrate Zoology	Vertebrate Zoology