Strengthening Citizen Science as a tool against Invasive Species in the NY Finger Lakes Region

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Partners

The project we are working on was developed in conjunction with our partners. They have been mentors for every step of this project.

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Invasive species cause ecological harm in a variety of ways, often causing a lack of balance in an ecosystem. We focused on NYS definition

Successful qualities:
- High adaptability
- Rapid reproduction
- Climate Change adaptability

Invasive species are typically introduced to an area through human intervention
- Intentional and unintentional
Invasive Species in the Finger Lakes

- There are at least 162 aquatic invasive species in the Great Lakes basin alone, and the estimated cost of the damages they cause the region is thought to be around $5.7 billion per year.
- High number of key economic drivers that are highly dependent on the local water quality in these regions.

Our clients, iMapInvasives and NYS Finger Lakes PRISM, work to monitor invasive species. The species of priority for NYS Finger Lakes PRISM include:

1. Hydrilla
2. Water Chestnut
3. Starry Stonewort
4. Hemlock Wooly Adelgid
Hydrilla (*Hydrilla verticillata*)

- Grows an inch a day
- Forms mats as it gets closer to surface
- Extremely tolerant
- Blocks sunlight and oxygen for natives
- Impacts recreational activities

Water Chestnut (*Trapa natans L.*)

- Grows in rosettes
- Has spiny fruits that fall off
- Vines are a problem for swimmers
Starry Stonewort (*Nitellopsis obtusa*)

- Releases phytotoxins into the water
- Clusters can outcompete natives
- Dense mats can affect larger fish

Hemlock Woolly Adelgid (Adelges tsugae)

- Hemlock Woolly Adelgid (HWA)
- Destroys needles, prevents new bud growth on infected branches
- Hemlocks are important to the Finger Lakes Region

USDA Forest Service - Region 8 - Southern, USDA Forest Service, Bugwood.org
Limitations in management

- Difficult to detect which species are invasive
- Small window of detection time
- Combating invasive species is time and resource intensive
  - Limited management budgets

http://nyis.info/blog/
Early Detection Rapid Response

- The most effective method in managing and removing invasive species
- Unfortunately, early detection requires a high number of trained individuals
Background Research

Hydrilla in Cayuga Lake:

- Cornell Cooperative Extension → working for complete eradication due to finding it early enough on the invasion curve

So-Cal → caulerpa taxifolia Early detection and eradication

- Southern California Caulerpa Action Team

Early detection is hard because it needs a lot of “eyes” so this shows the need for citizen science
Citizen science

the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists.

- Used to accomplish a diverse set of goals
- Powerful tool that helps educate local communities on environmental concerns & stokes participation
  - Issues include quality of data, and recruitment
- 1 billion citizen scientists target goal set at UN Science-Policy-Business Forum for the Environment during December 2017

http://ijams.org/events/citizen-science-take-action/
Invaders of Texas was able to successfully increase citizen science engagement and legitimacy of reports.

Impacts:

- Prevented costs associated with late eradication
- Prevented costs associated with ecological damage
- Educated local citizens

[https://www.texasinvasives.org/invaders/](https://www.texasinvasives.org/invaders/)
The Gap

Previous RIT students:

● 5 years working with iMapInvasives
● High levels of awareness, low levels of reporting

Gap between knowledge and reporting, how to make long term engagement in these monitoring programs

● How can we increase participation in reporting?
● What are the reasons for a low level of participation in citizen science?
Main Project Goals

To improve citizen scientist involvement in invasive species management through early detection and long term monitoring.

Questions:

1) What are the characteristics of participants in citizen science programs?
2) How do people rate the trainings and features of the iMapInvasives app?
3) Does the type of training an individual receives influence future reporting?
4) Is there more reporting for terrestrial invasive species than aquatic invasive species why or why not?
Main Components

1. Literature Review:
   ○ Research helping inform us of best practices for long term engagement that already exist for us to compare our findings to

2. Interviews (NYS Finger Lakes PRISM):
   ○ Interviews we created for participants who were involved in the Macrophyte Sampling Program

3. Macrophyte Sampling Data (NYS Finger Lakes PRISM):
   ○ Participants raw sampling/reporting data to cross compare with interviews findings

4. Data Mining (iMapInvasives):
   ○ User associated data from iMap (types of trainings & reporting data)

5. Survey (iMapInvasives):
   ○ Survey we created for all iMap users (ratings of app/background about them)
Interview Methods

Created semi-structured interviews to investigate:

- Participant characteristics
- Participant motivations

Your involvement in the sampling program:
1) How did you get into invasive species monitoring?
   a) How did you get involved with/find PRISM?
2) How long have you been participating in this type of macrophyte, “hands on” monitoring?
3) How many times in 2018 did you sample for Macrophytes?
4) How motivated do you feel by this program? How inclined are you by this program to go
don outside and sample?
   a) Rate from 1-7 (1 being very unmotivated, 7 being very motivated)
   b) Why?

Perspectives on this sampling program and other programs:
5) Do you know about any other projects like this monitoring program (CSLAP, Angler Diaries, any citizen science initiatives)?
   a) If yes, have you participated in any of them?
6) What did you like about the macrophyte monitoring you have participated in?
   a) Will you stay involved next season?
Interview Findings

- Participants were more likely to be retired, year round residents of the lake they studied.
Communication and flexibility were mentioned most often as favorable characteristics of programs/program managers.

Those who were involved with the Finger Lakes Institute also reported being “very aware” of other citizen science programs, meaning they are involved in other programs as well.
Perception vs Reality- Macrophyte Sampling

- People reported doing the “recommended amount” when they actually sampled more or less than what they were instructed to do
- Those with environmentally related degrees sampled more consistently than other participants

- Communication
- Volunteer Responsibility

Finding groups who have a stake in the environment → 4/10 volunteers pointed out that they never had an interest in these programs prior to owning lake property, this was not something asked in the interview but was something these participants wanted to make clear
Data Mining Methods

Questions:

1. Does type of training affect reporting behaviors?
2. What is the breakdown of training and reporting types?

Assessment of iMapInvasives user report database including different sets of information
Data Mining Findings

Breakdown of Training Style

- Trained Online: 3.7%
- Trained In Person: 96.3%
Data Mining Findings

P Value: .61
Data Mining Findings

**Unique species reported**
- Wetland: 3.8%
- Aquatic: 26.0%
- Terrestrial: 70.2%

**Reports per species type**
- Wetland: 44.7%
- Aquatic: 5.8%
- Terrestrial: 49.4%
Survey Methods

Questions

1. What are barriers to engagement?
2. Where are there areas for growth within the iMapInvasives experience?

Analyzing the data

- Minitab
  - Chi Square Test of Association
  - 2 Proportion Testing as a Post Hoc Analysis
Survey Findings

Main Motivators:
- gain personal skills
- accessibility of the app

Younger users are significantly more likely to be engaged with the app.
Synthesis of findings

Interpreted the data through a lens of behavioral psychology

How do our findings from research, surveys, interviews and data mining synthesize to create recommendations?
Engagement Recommendations

Factors affecting engagement

1. Roles of volunteers within project
2. Engaging in social aspects
3. Background/interests of Volunteers
4. Amount of commitment time/effort needed
5. Confidence of Volunteers in their ability to help
6. Age
Volunteer Roles

Literature:

● Options for how to complete work (Louv 2012)
● Unique roles can increase volunteer responsibility (Gallo 2011)

Our Findings:

● Options for sampling frequency → ability to “move up” in roles and do more if they want to
● Areas of concern on lakes vs. sampling in convenient locations
● Peak growth times depending on species
Social Aspects

Literature:

- Bringing family/friends along (Louv 2012)
- Frequent administrator-volunteer communication (Nov 2011)

Our Findings:

- Many cited working with family/friends
- Open communication with program leader
- Wanted more volunteer communication mechanisms (web interface)
Volunteer Backgrounds/Interests

Literature:

- Science background may feel motivated due to contribution to science (Land-Zandstra 2012)
- Personal interest in helping oneself or contributing to a community effort (Land-Zandstra 2012)

Our Findings:

- Environmentally related backgrounds sampled more consistently
- But 4/10 participants pointed out their stake in the environment as a major motivator
Commitment and Effort

Literature:

- Most people want to participate at some level, not full time (Alexandria 2014)

Our Findings:

- Flexibility being cited as a favorable trait
- Combine with the ability for roles in projects for long term engagement
Confidence

Literature:

- Trainings, workshops and assigning specific jobs are keys to success for these programs (Louv 2012, Vickie 2015)

Our Findings:

- All participants reported being confident in sampling methods and most ID due to trainings and workshops
- 4/10 felt they needed additional training for invasive species & native (especially look-alikes)
Age

iMapInvasives users: Younger 19-34

Macrophyte sampling participants: Retired or Semi-retired (50-70)

- Provide more trainings to older populations for the app
- Promote hands on sampling to younger audiences
- Promote bringing younger family members to sample if possible
Overall Engagement

Creating these programs is hard

Many aspects to consider, objectives to reach, data to collect

Vital to protect our ecosystems

- Time & Cost

Important to understand all the relationships in these programs to help build on what we already have
Future for this project

Over the next 4 years RIT will continue with this project, finding new avenues to investigate the problem of knowledge vs participation

1. Focusing on HWA (MAC program → HWA Program)
2. MAC Sampling
3. Gather iMap 3.0 data (draw comparisons)
   a. User data
   b. Survey data
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Questions?
References:


