Using Geospatial Technology to Map Invasive Plants at Flanders Nature Center & Land Trust For Future Management

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ABSTRACT

Invasive plants are one of the major threats to biodiversity and "healthy" functioning ecosystems. These species make major alterations in an ecosystem, which decreases the amount of other native species of plants that cannot compete for survival. Now more than ever, monitoring programs on invasive plant distributions are needed to guide management, which can ultimately lead to promoting "healthy" environments.

The objective of this project was to create a baseline distribution map of invasive plants and monitoring protocol that can be used by Flanders Nature Center to manage the invasive species on their property. Eight invasive species (i.e. Mugwort, Autumn Olive, Japanese Barberry, Multiflora Rose, Garlic Mustard, Japanese Knotweed, Asian Bittersweet, and Winged Euonymus) were found on the trails at Flanders Nature Center in different abundances and were mapped using a GPS unit. Using ArcGIS Online, I made an interactive map showing location and abundance of these plants. The monitoring guide I created included instructions on how to use a GPS application (i.e. TrackKit) and ArcGIS Online to replicate the procedure I used to create distributional maps to allow the land trust to assess changes in distribution and abundance from year to year. This information acts as a baseline for future management and removal of these plants around the sanctuary.

INTRODUCTION

Invasive species of plants pose a major problem in various ecosystems. These plants are not native, originating from other countries. Some species of invasive plants were brought to the United States for decoration; however, now are an ecological disturbance. Invasive plants out compete vital native plants that provide important resources to wildlife. They also reduce biodiversity and may take over entire ecosystems. In Connecticut, there are over 90 species of invasive and potentially invasive plants documented (CT Invasive Plants Council, 2014).

Mapping the distribution of invasive plant species is the first necessary, baseline information needed for management and removal of these plants to prevent future damage to the environment. Also, long term monitoring is vital to assess management success.

The goal of this project is to map the baseline distribution of invasive plant species in Flanders Nature Center and develop a monitoring protocol to be used by the sanctuary to manage the invasive species on their property. The monitoring protocol will teach land trust monitors how to use TrackKit, a smartphone GPS application used to collect geospatial data, and map the data using ArcGIS Online. This way changes in the abundances of invasive species can be observed over time.

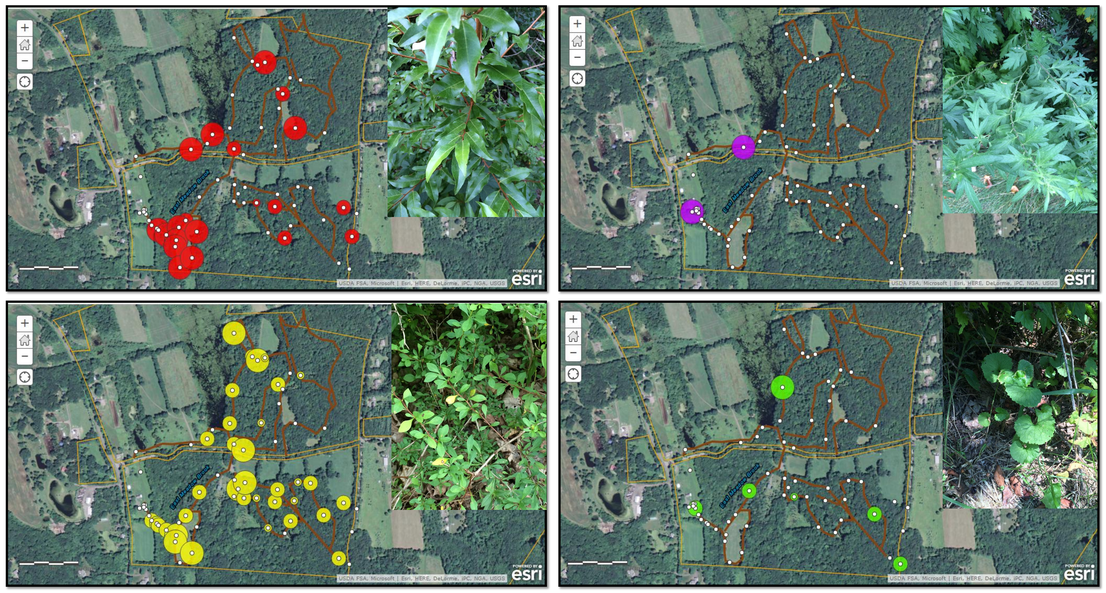
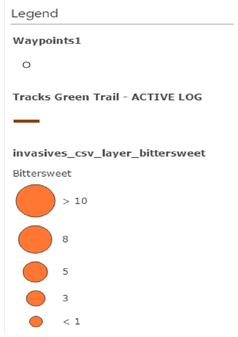


Fig 2. Size of colored-circles depict the relative abundances of (top left) Autumn Olive, (top right) Mugwort, (bottom left) Japanese Barberry, and (bottom right) Garlic Mustard.

Fig. 3 Marking trail location and collecting geospatial data on invasive plants with my trusty field assistant.



Map Legend: The white circles show all of the waypoints taken throughout the trails. The brown lines are the trails. The size of the circle symbols indicate the relative abundance levels of each species. The abundances were estimated on the following scale: a small amount of individuals = category 1, a moderate amount of individuals = category 5, and a large amount of individuals = category 10

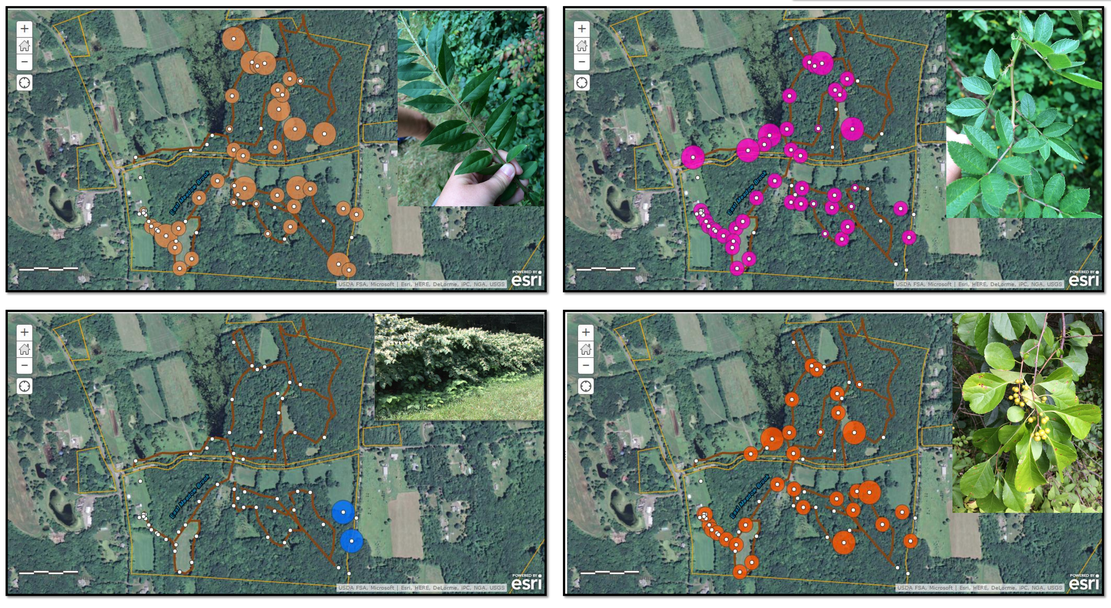


Fig 1. Size of colored-circles depict the relative abundances of (top left) Winged Euonymus, (top right) Multiflora Rose, (bottom left) Japanese Knotweed, and (bottom right) Asian Bittersweet.

MATERIALS & METHODS

Study Area and Organism

- The area studied was Van Vleck Farm at Flanders Nature Center and Land Trust.
- Flanders Nature Center is located in Woodbury, Connecticut.
- The area studied included seven trails located throughout the nature center.
- Total length of trail studied was 4.05 miles.
- The invasive plants studied: ***Artemisia vulgaris*** (Mugwort), ***Elaeagnus umbellata*** (Autumn Olive), ***Berberis thunbergii*** (Japanese Barberry), ***Rosa multiflora*** (Multiflora Rose), ***Alliaria petiolata*** (Garlic Mustard), ***Fallopia japonica*** (Japanese Knotweed), ***Celastrus orbiculatus*** (Asian Bittersweet), and ***Euonymus alatus*** (Winged Euonymus).

Mapping and Monitoring Protocol

- Data on invasive plants were collected in late August through early October, 2015.
- I searched along all seven trails and within 10 meters of the trails for the 8 invasive species listed above (Fig. 1 & 2).
- When invasive plants were found, I identified the plant to species and estimated abundance (i.e. a small amount of individuals = category 1, a moderate amount of individuals = category 5, and a large amount of individuals = category 10).
- Also, geospatial data were collected using a Garmin GPSmap 76CSx (Fig. 3).
- These data were then put into an ArcGIS Online interactive map, which shows the abundance and location of the plants.
- I described this procedure and developed instructions so that land trust monitors can monitor invasive plants along the trails and create similar distribution maps over time.

RESULTS

- ArcGIS maps depict the various abundances of the eight different species identified throughout Flanders Nature Center.
- A number of the species were found generously distributed around the sanctuary. For example, Autumn Olive, Japanese Barberry, Multiflora Rose, Asian Bittersweet, and Winged Euonymus were found distributed widely throughout the trail system with moderate to large abundances (Figs 1 & 2)
- Mugwort, Garlic Mustard and Japanese Knotweed were not distributed as widely (Figs 1 & 2).
- Nevertheless, Japanese Knotweed was found in very large abundances.
- Species that were not as prevalent in the nature center were Garlic Mustard and Mugwort, which were only found in a few locations in low abundances (Fig. 2).

MONITORING RECOMMENDATIONS AND IMPLICATIONS

- ***Japanese Knotweed*** was found in very large abundances. This plant needs to be monitored more than the others because it spreads very quickly. It has a rhizome system, which is very complex. It forms a network of stems in the soil, making it very difficult to eradicate these plants.
- ***Asian Bittersweet*** was wrapped around Milkweed plants, killing them. Milkweed is an important plant for the survival of different wildlife, such as monarch butterflies. This is an example of damage caused by invasive plants. Overall, Asian Bittersweet was found in a vast amount of areas with moderate to large abundance levels, and requires active removal and monitoring.
- Monitors should address the most abundant species first (i.e. Winged Euonymus, Multiflora Rose, Asian Bittersweet, Autumn Olive, Japanese Barberry and Japanese Knotweed).

The data collected are important for the future management of invasive species of plants around Flanders Nature Center. These baseline data are essential to determine the current status of invasive populations on the Flanders property, and also to assess management in the future. The monitors at Flanders will be given a list of instructions to gather geospatial data with the application TrackKit. With this information, the monitors are able to evaluate future changes in the abundance of invasive species that has initially been determined through this project.

ACKNOWLEDGEMENTS

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REFERENCES

CT Invasive Plant Council, 2014. Retrieved from, http://cipwg.uconn.edu/wp-content/uploads/sites/244/2014/12/CT-Invasive-Plant-List-2014Scientific-Name.pdf

The United States National Arboretum, 2008. Retrieved from, http://www.usna.usda.gov/Gardens/invasives.html