

Invasive Plants: Roadside Effects on Species Distributions & the Search for a Chemical Disrupter on Growth

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ABSTRACT

Throughout my hometown in northwestern Connecticut, I have seen forested areas being overrun by invasive species; species that are not native to the United States and are outcompeting native species. Indeed, this is an issue seen throughout the world. I studied how road edges affected the distribution of invasive plant species into forested ecosystems and searched for an effective removal method.

- Focal questions: (1) are roads aiding the spread of invasive plants and (2) is there a way to either prevent or slow this process?
- Focal species: Common Reed (*Phragmites*) (Fig 1a) and Goutweed (*Aegopodium podagraria*) (Fig 1b).
- Study was conducted in Aton Forest, a preserve in northwestern Connecticut.
- Observed occurrence of Common Reed and Goutweed along a 100 meter roadside transect and 10 perpendicular transects into the forest.

Goutweed is observed is abundant along the roadside, however along the perpendicular transects toward forest abundance is negligible after five meters. Common Reed is abundant only around the first 40 meters of the roadside transect and 4 perpendicular transects. As elevation Common Reed density decreases.

Through my literature search, I recommend a pH adjustment to control the spread of Common Reed. By adjusting the pH of the soil, certain plants are not able to efficiently exchange nutrients from to the roots of the plant submerged in moist soil because the stomata are signaled to close. Interfering with nutrient exchange would isolate the rhizomes in place and limit reproduction of that plant.

INTRODUCTION

Invasive plant species have become a serious issue in the United States. For instance, Common Reed (*Phragmites*) (Fig 1a) were recently named the “Invasive Species of the Month” by the Maryland Department of the Environment because of its ability to spread aggressively over large areas of land in little time (MDE). Invasive plant species are non-native species introduced to a new ecosystem and possess an advantage over native counterparts (USDANRCS). If invasive species’ populations are ignored long enough, the species distribution can expand over large areas.

Consequently, land managers are often concerned with two factors when it comes to managing invasive plants: 1) how do human-made features (e.g. roads) affect the spread of invasive plants on properties and 2) how can we manage them by disrupting the growth of invasive plant species? Accordingly, my research addressed the following questions:

1. Are roadsides facilitating the spread of invasive plant species into forested areas?
2. Is there a chemical method to actively manage the spread of certain species?

I addressed the first question by evaluating the change in coverage of two invasive plant species along a roadside as well as along transects moving toward the forest Aton Forest in Norfolk, Connecticut. For the second question, I conducted an experiment on Common Reed, attempting to block the growth of rhizomes by increasing the pH past optimal levels using a natural inhibitor.



Fig 1. Photos of (a) Common Reed (*Phragmites*) and (b) Goutweed (*Aegopodium podagraria*), the focal invasive plant species of this study.

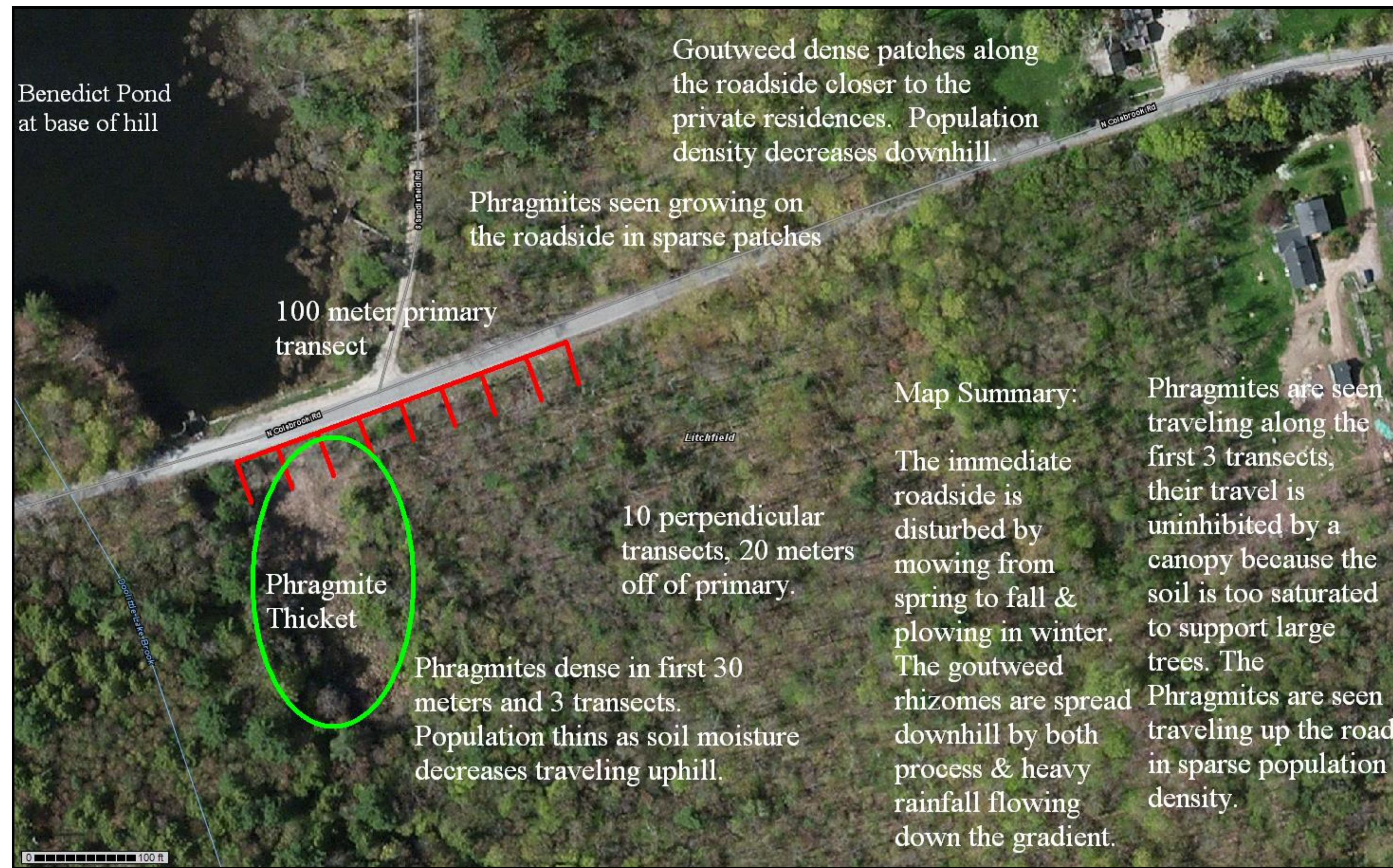


Fig 2. Map of Aton Forest and survey transects.

MATERIAL AND METHODS

Study Area and Organisms

- Research was conducted on the outskirts of Aton Forest Research Field Station, Norfolk, Connecticut (Fig 2).
- The primary transect occurred along a roadside, which increased slightly in elevation.
- Common Reed (*Phragmites*) (Fig 1a) and Goutweed (*Aegopodium podagraria*) (Fig 1b) were the two focus invasive species of this study.

Roadside Surveys

- Invasive plant surveys were conducted along two types of transects: 1) a 100-meter primary transect along a roadside and 2) ten 20-meter perpendicular transects that went into the forest (Fig 2).
- Coverage/occurrence of invasive species was recorded every one meter along all transects within a plot of 1 m² area and 2 m high.
- A wooden frame 1 m x 1 m was used to give a definite area.
- Data collection occurred from September to October, 2015.

Chemical Experiment Procedure

I chose to focus on the Common Reed because of the presence of dense coverage by this species devoid of other vegetation at the Aton Forest, which allows for large scale management (Fig 3a). The Common Reed have adapted to a pH range 3.7-8.7 (Idaho Plant Materials Program). When established the reed is difficult to kill because the plant even when appearing dead very likely still has viable rhizomes (U.S. Fish and Wildlife Service). By adjusting the pH of the soil to highly basic the stalks and leaves (containing stomata) will not be able to transfuse air to the rhizomes under water, stunting active spread by suffocating rhizomes.

My Technique:

- Dissolve calcium carbonate (limestone) in water (the solution has a pH of 11) (Fig 3b).
- Add the solution to a sample of soil suspended in water.
- Then use a pH strip to determine if the resulting pH is between 10 and 11.

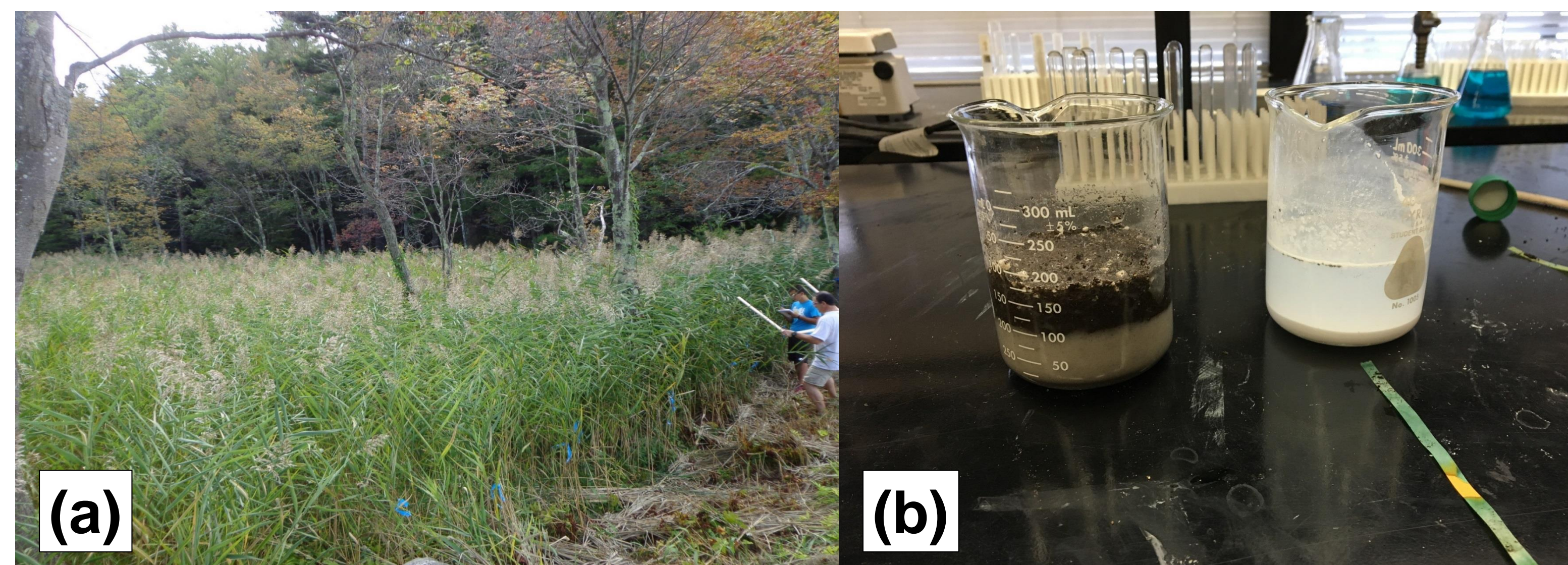


Fig 3. (a) Thicket of Common Reed (*Phragmites*) at Aton Forest and (b) soil pH adjustment experiment.

RESULTS SUMMARY

Common Reed

The observed spread of these plants was primarily in a low wetland region. The Common Reed was observed traveling back into the adjacent forest of the first 3 transects (Figs 2 & 4); however the area was clear of over hanging trees. When the elevation began to increase the reeds were seen growing along the immediate road edge and in some cases through the cracks in the asphalt. The population became drastically less dense after the third transect (Fig 4).

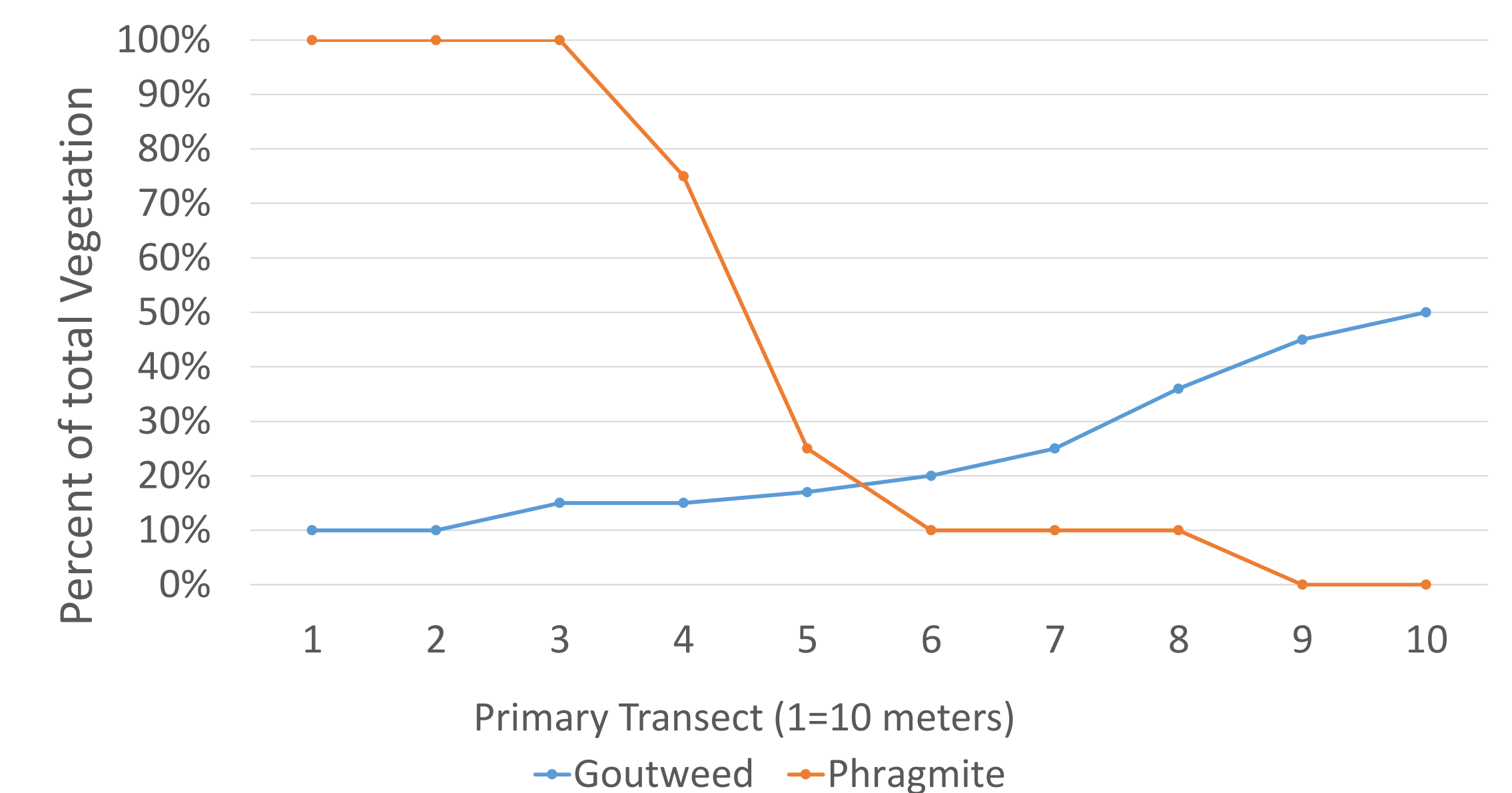
Goutweed

Based on recorded observations of occurrence, Goutweed rhizomes are not spreading into the adjacent forest because the overhead coverage limits the sunlight needed for growth. The perpendicular transect data revealed that occurrence became negligible within the first 5 meters into the forest for all transects (Fig 2). The two meter roadside is the perfect environment for goutweed to spread because there is little overhead coverage and when the ground/rhizomes are disturbed (Fig 4).

Chemical Experiment

Results from lab data show that by adjusting the pH of soil Common Reed would not be able to transfer nutrients from the air to submerged rhizomes, killing the plant from the inside; therefore, preventing aggressive colonization of wetland and spread through human disturbance.

Fig 4. Coverage of Invasive Species along Primary Transect



CONCLUSIONS

Overall, Goutweed and Common Reed were observed to be somewhat abundant along the primary road; however their coverage decreased noticeably when approaching the forest. Accordingly, both species are capable of persisting in areas of high human disturbance, such as the roadside. The perpendicular transects reveal with no human intervention and the addition of overhead vegetation, the two invasive species are not able to effectively spread. Current management by roadside state services is ineffective because mowing these plants aids in their reproduction.

Because both spread by rhizomes primarily, simply tearing the stem from the soil does not mangle invasive spread. This disturbance by humans is actually the main cause of relocation of invasive species because the rhizomes attached to stem become active runners establishing a new plant (D.C.R.). Opposed to aggressive physical removal which is ineffective, by attacking the plants ability to reproduce the adjusted pH of the soil will stunt the growth of new runners isolating the plant and eventually killing the population in areas of treatment.

ACKNOWLEDGEMENTS

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REFERENCES

- (USDANRCS) United States Department of Agriculture Natural Resource Conservation Service, Contribution by Idaho Plant Material Program
- USDA Plant Data Base
- D.C.R. Office of Water Resources, Lakes and Ponds Program
- (MDE) Maryland Department of the Environment