One of the most common ways invasive pests spread to new areas is through firewood or other wood material. For example, both ALB and EAB initially spread to North America from Asia in wooden shipping materials. Despite campaigns promoting “burn it where you buy it” many people either do not realize the level of threat or are not exposed to the message. In addition, the areas where the largest number of out of state firewood is coming in is to campgrounds, state parks, etc. which are commonly surrounded by large stands of trees, and so the job of controlling an infestation would be extremely difficult. Therefore, making sure that the message of limiting the movement of firewood is a high priority, but especially in areas where the presence of host trees coincides with large influxes of out of state wood.

In this pilot study I worked to create a method of identifying forests areas at highest risk of invasion by the ALB. I chose to focus on Worcester County for this initial analysis because it is centrally located in the state and because it contains a city that already has a known infestation. For the scope of this project I am focusing on Massachusetts forests and not trees in residential urban areas because infestations in forests are much harder to initially identify and then to eliminate. This project is meant to be a pilot study to design a method of identifying at risk areas in Massachusetts or the Northeast by using Worcester County as an initial test.

Methods
In order to assess the vulnerability of forests in Massachusetts to ALB, I built 2 raster data layers – one showing the existent vegetation types and another combining several factors that may increase the risk of invasion. This included campgrounds, plant nurseries, roads, and areas of high population densities. I looked only at forested areas – deciduous and mixed evergreen and deciduous – because the host trees of ALB are of this type. Additionally, I looked at population density of areas adjacent to forested areas because studies have found that introduction and success of invasives is correlated with human population density. Another important aspect to consider is that invasives typically thrive in disturbed habitats or edge habitats, so I selected for forested areas around roads because these forests are both disturbed and have large edges. Lastly, I located plant nurseries and campgrounds adjacent to the selected forest types.

Results
Based on this initial analysis, it appears that there are several areas throughout the county where the risk factors (campgrounds, plant nurseries, roads, and highest population density) are concentrated (Risk Factors). For the most part these areas are around high population densities. The largest area of high risk is the Worcester area, whereas vegetation type and habitat are taken into account, the area of highest vulnerability appears to be the Northwestern region of the state. Furthermore, although there are small areas of vulnerability in the areas shown to be at highest risk by the human-related factors are no longer of concern once vegetation type is taken into consideration.

Limitations
A major limitation of this pilot study is that I concentrated on forested areas, however, as is clear by the risk factors map, human activities in non-forested areas provide many opportunities for introduction. Furthermore, there are additional factors that increase the risk of introduction, such as points where industrial or commercial risk products are brought to the county (airports, train stations, etc.) I was also limited by the specificity of the vulnerability data. There is a wide variety of tree types ALB inhabit, but they do so with varying degrees of preference and success. Additionally, forests with increased heterogeneity are less susceptible to invasion. Therefore, knowledge of tree species would have enabled me to better determine Worcester, two major cities and thus areas of high human density. On the other hand, the vulnerabilities maps show that these areas of highest influence by human-related risks are not as important once vegetation type is considered. This exhibits the interaction of anthropogenic and ecological factors in determining where pests are introduced but also where they can become established.

Conclusion
The risk factors map shows that it may not be necessary to combine all of the risk factors – simply using highest population density may be sufficient. This has been shown historically in the state, as the two areas of infestation have been Boston and

Vulnerability assessment of forests to invasion by the Asian Longhorned Beetle: a pilot study of Worcester County, MA

by: Brynna Bolger

Vegetation Types

Tufts Cartographer: Brynna Bolger
Class: Intro to GIS, Fall 2012

Vulnerability in ALB Habitat

Vulnerability in all vegetation types