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ASSESSING NON-NATIVE INVASIVE VEGETATION AT RECLAIMED SURFACE MINE SITES OF THE SOUTHERN SHALE HILLS REGION OF ALABAMA

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Project Description and Objectives:

This project was designed to assess the impact non-native plants have on the reclaimed mine landscape. Using the Shale Hills Region of Alabama as a case study, we examined the environmental and habitat factors that may contribute to favorable conditions for heightened plant invasion and developed models for predicting the probability of occurrence of invasive plant species.

There were three main objectives:

1) Assess the species type and distribution of invasive plants on reclaimed mines.
2) Examine the relationship between landscape and habitat features and the probability of invasion.
3) Identify management strategies to assist in minimizing invasive species on reclaimed mines.

Applicability to Mining and Reclamation:

Throughout the world non-native plants are becoming an increasing threat to biodiversity and ecosystem functions. They also reduce returns for forest landowners by reducing tree growth, limiting natural regeneration and increasing management costs. Invasion often occurs after disturbance and with the historic and ongoing use of non-native species in reclamation these areas may serve as establishment points and sources of invasive plants to the surrounding forest.

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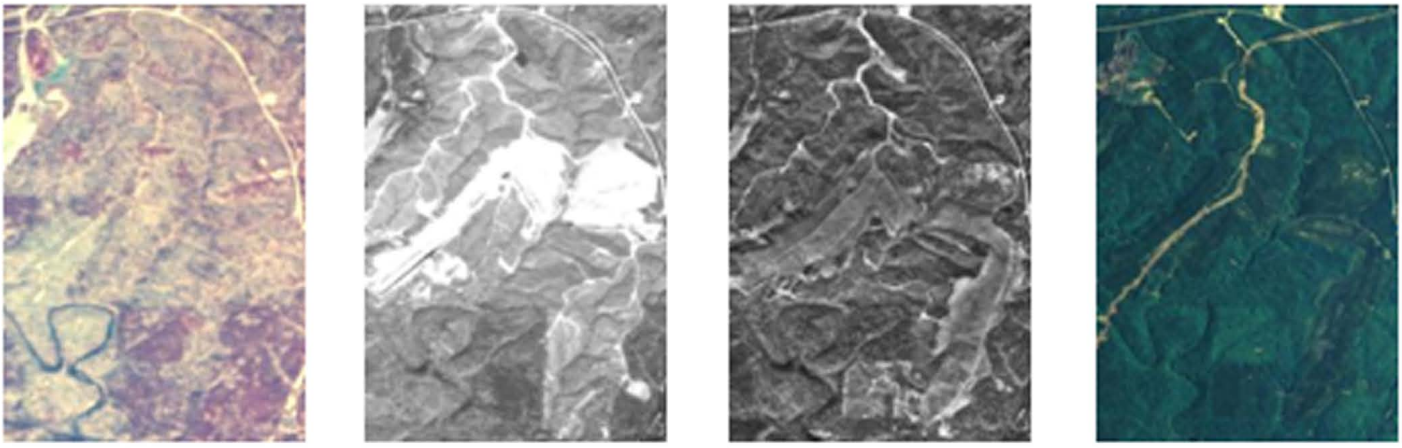

1985 1992 1998 2006

ABOVE PHOTO: Historical aerial photography was use to determine mine boundaries and land use change (1985 – harvested, 1992 – mined, 1998 – reclaimed, 2006 – reforested).

Methodology:

Mine lands were surveyed for all species defined by the United States Forest Service as invasive to the forest of the southern region. We conducted vegetation surveys, soil sampling and environmental evaluation on the mined landscape, using intensively sampled plots and less intensive transect sampling. Sampling sites were located based on remote sensing assessment and after obtaining permission from current landowners. During the summer and fall of 2010 we sampled 372 intensive habitat plots, and in the spring of 2011 we sampled 36 groups (transects) of low intensity plots for a total of 4,644 plots for herbs, vines and forbs and 23,220 plots for trees and shrubs. GIS and remotely sensed data was obtained to characterize the landscape and change in the landscape, including, land use, roads, and streams. Data was analyzed using canonical correspondence analysis, logistic regression and maximum entropy analysis.

Highlights:

The invasive community was most strongly associated with the habitat characteristics plant diversity, canopy cover, forest age and basal area suggesting that the long-term management of reclaimed mines may have the greatest impact on reducing preferential habitat for invasive plants.

Geospatial modeling of invasive plants is useful and offers potential for management, both in terms of identifying habitat types most at risk and areas that need management attention. Landscape analysis showed all modeled species, except princesstree and sawtooth oak, had a higher occurrence than the broader landscape, suggesting reclaimed mining areas may be more vulnerable to invasive plant species.

The influence of planting non-native, invasive species in this area is likely the major driver of the high diversity of invasive plants, with four of the seven dominant invasive species being planted. Adjusting the reclamation plantings to native species would reduce this. Of the three most dominant species, one is planted (Chinese lespedeza) and one is ubiquitous throughout the region at low densities (Japanese honeysuckle). The third species, privet, is of most concern.

Results/Findings:

This study found seven invasive species there were present at more than 20 plots: shrubby lespedeza (*Lespedeza bicolor*), Chinese lespedeza (*Lespedeza cuneata*), Japanese honeysuckle (*Lonicera japonica*), Chinese privet (*Ligustrum sinense*), autumn olive (*Elaeagnus umbellata*), princesstree (*Paulownia tomentosa*) and sawtooth oak (*Quercus accitimus*).

Logistic regressions with the three most common species, Chinese privet, Japanese honeysuckle and Chinese lespedeza, all had useful models for predicting occurrence. Chinese lespedeza was more likely to be found in open or pine areas with higher magnesium levels in the soil, little or no midstory and downed woody debris. Japanese honeysuckle was found in high canopy cover with little midstory and in areas of high soil magnesium and higher diversity. Chinese privet had a strong positive relationship with canopy cover.

At a landscape level invasive species in general were most likely to be predicted based on distance to forest, distance to roads and Normalized Difference Vegetation Index (NDVI) in 1987 and 2011. Based on landscape analysis Japanese honeysuckle had the highest probable prevalence at 48%, with princesstree having the lowest at less than 1%. Overall, 33% of the landscape is predicted to have no invasive plants, with 47% predicted to have one, 17% two and 3% to have three or more.

Website Information:

The final project report can be found at: **http://www.techtransfer.osmre.gov/NTTMainSite/appliedscience/2009/Projects/AAMLemkeInvasiveVegetation09FR.pdf**

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