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Technical Progress Report

“Restoring Sustainable Forests on Appalachian Mined Lands for Wood Products, Renewable Energy, Carbon Sequestration, and Other Ecosystem Services”

Quarterly Report

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Abstract:

This is the first quarterly Technical Report for the period October-December, 2003. A kick-off meeting was held with NETL administrators and scientists at Morgantown, WV, on December 2, 2002. The purpose of this project is to evaluate the biological and economic feasibility of restoring high-quality forests on mined land, and to measure carbon sequestration and wood production benefits that would be achieved from forest restoration procedures. During this first quarterly reporting period, five Graduate Research Assistants were recruited, an MOA was drafted between Virginia Tech and three industry cooperators, preliminary field locations for controlled studies were located, and a preliminary analysis of a carbon inventory of forest sites on mined land was made.

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Introduction:

We are pursuing our overall research goals and objectives to evaluate the biological and economic feasibility of restoring high-quality forests on tens of thousands of hectares of mined land reclaimed since the implementation of federal reclamation laws in 1978, and to measure carbon sequestration and wood production benefits that would be achieved from large-scale application of these forest restoration procedures. The following tasks were begun by the investigators during this first quarter:

1. Estimate forest productivity and carbon sequestration potential on mined lands supporting abandoned grasslands. (Burger et al.)
2. Develop classification and inventory criteria and procedures for mined land. (Galbraith et al.)
3. Develop reforestation methods and procedures for mined land. (Fox et al.)
4. Conduct economic analyses of reforestation and forest management activities for a variety of forest products and services. (Amacher and Sullivan)
5. Determine the potential of large-scale SMCRA grassland restoration to sequester carbon and create other societal benefits. (Zipper et al.)

During this first quarter of the project, emphasis has been placed on:

1. Recruiting personnel (Graduate Research Assistants).
2. Developing cooperative arrangements and creating a memorandum of agreement with our industry cooperators.
3. Locating suitable field sites for the proposed work.
4. Analyzing existing data and preparing the results for presentation.

The project had its “kick-off” meeting with NETL and Virginia Tech administrators and scientists on December 2, 2002, at Morgantown, WV. Since that time, five Graduate Research Assistants, one for each task, have been recruited. Several of the PIs met with the three industry cooperators in the West Virginia coal fields near Rupert, WV, to discuss criteria for site selection. Preliminary sites or areas have been selected in each of three states, WV, VA, and OH. A Memorandum of Agreement (MOA) between Virginia Tech and the industry cooperators that establishes the scope of industry participation has been drafted.

Experimental:

Locating Field Sites--Tasks 2 and 3:

Figure 1 depicts an example of one of three experimental blocks. The diagram shows three replications of the treatment matrix within the block. Each replication is located in a different site quality class. The treatment matrix is depicted in Figure 2 showing three forest types crossed with three levels of silvicultural input.

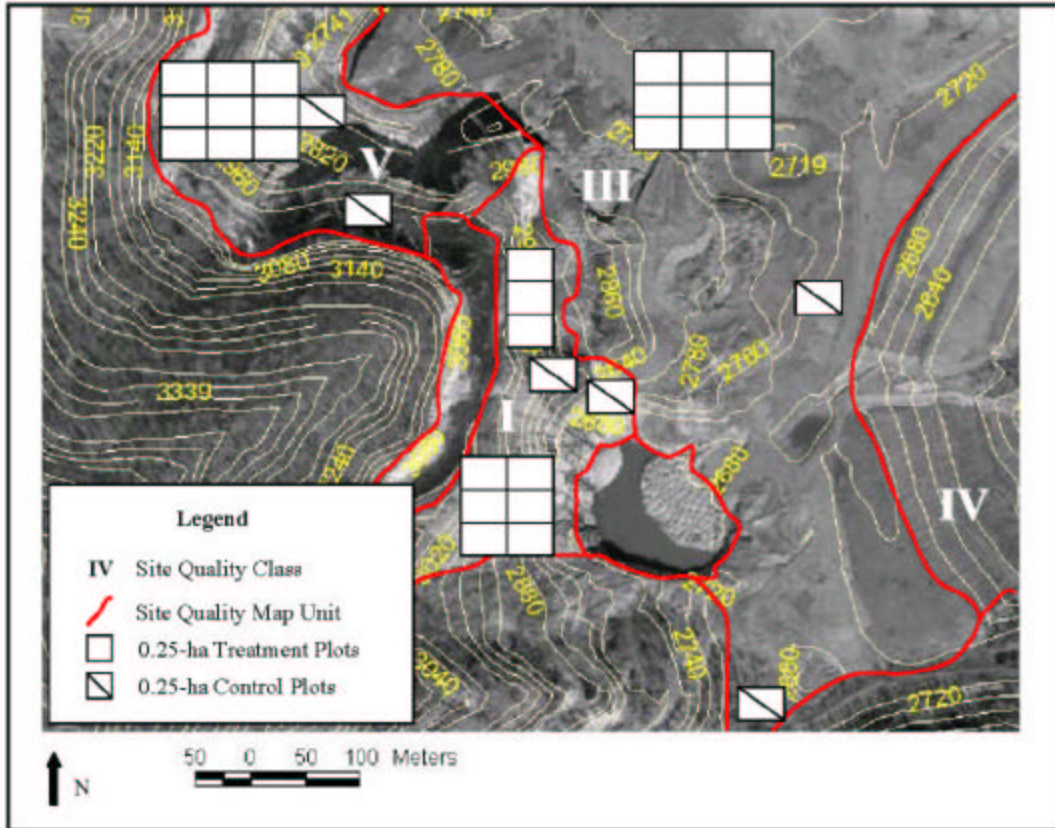


Figure 1. Example of treatment layout on a reclaimed mined site.

	Competition Control (CC)	(CC) + Tillage (T)	CC + T + Fertilization
White Pine			
Short Rotation Hardwood	Block Size = 2.25 ha (5.6 acre)		
Native Hardwoods	Individual Plot Size = 0.25 acres (0.62 acre)		

Figure 2. Hypothetical layout of a single block of treatments.

Carbon Inventory—Task 1:

Carbon sequestration by forests established on mined lands occurs through accumulation of both woody biomass and soil organic carbon; forest productivity and carbon sequestration by mined land forests are closely related. We measured the carbon content of 14 forest sites on mined land across seven states (Figure 3) in the Midwestern and Eastern coal fields of the U.S. (Rodrigue, 2001). The study sites were chosen to represent a cross-section of forest stand age and site conditions. The 14 sites ranged from 20 to 55 years old. Reference native forest sites were also measured. Carbon sequestered in the vegetation, litter layer, and soil (1 m) was measured at 4 locations within each site.

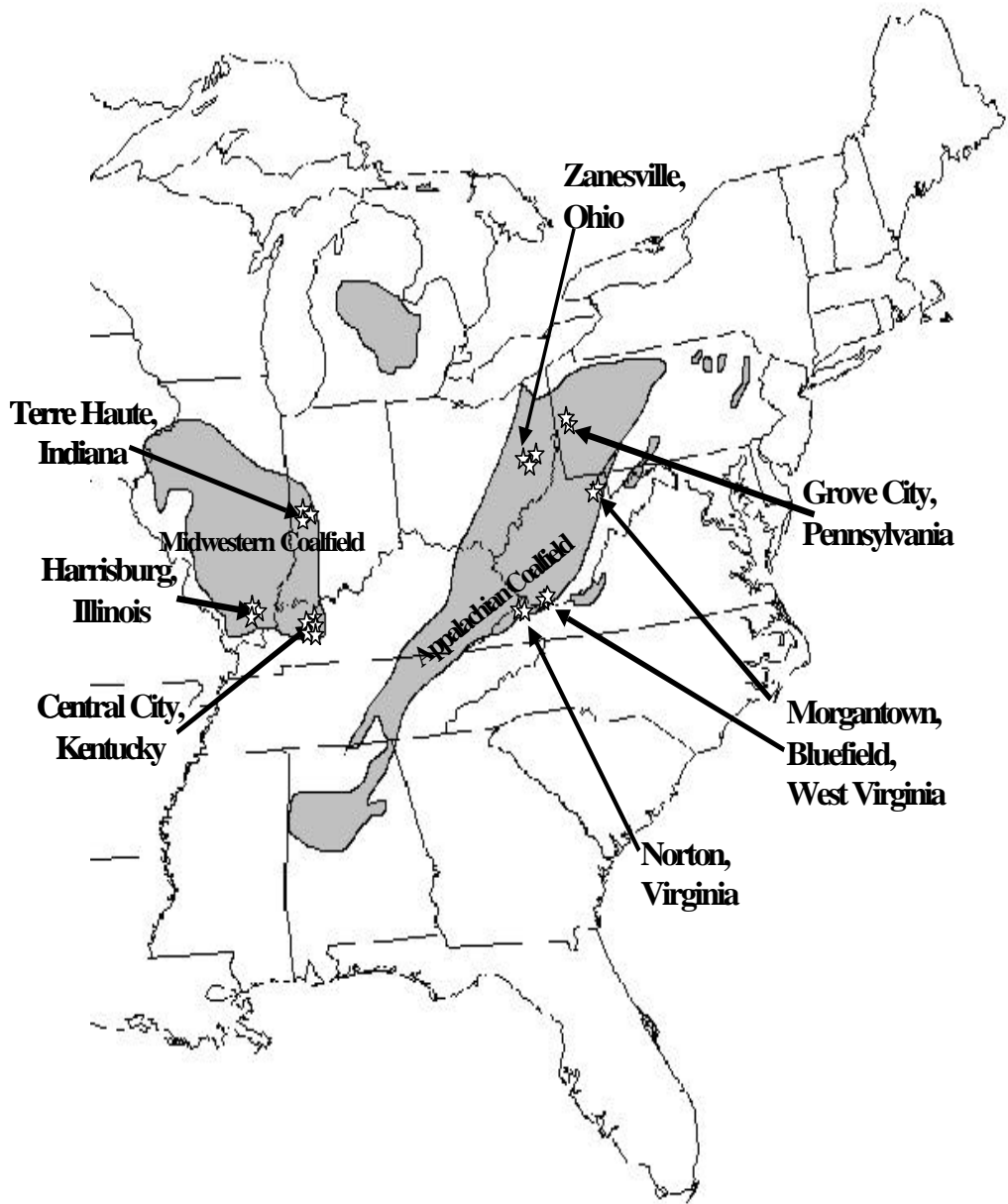


Figure 3. Midwestern and Eastern coalfield regions showing study site locations for a carbon inventory of forests on mined land.

Results and Discussion:

The only preliminary results we have for this first reporting period are for the carbon inventory associated with the Task 1 objective. The data in Figure 4A show an exponential increase in the rate of carbon sequestration as forest site index increases (as site quality improves).

Sequestration rate varied from 3 to 8 Mg ha⁻¹ yr⁻¹ between site indices 17 and 29. All these sites were mined and reforested pre-SMCRA. Post-SMCRA reclamation can degrade forest sites to Class V levels, which corresponds to a site index of 12 m. This demonstrates the importance of inventorying, mapping, and increasing site quality through forestry practice to maximize forest productivity and carbon sequestration. Our preliminary work also demonstrated the carbon sequestration potential of these mined land forests can exceed that of adjacent native forests.

Our preliminary data shown in Figure 4B show that forests on average quality mined sites will reach carbon levels equivalent to non-mined sites after 65 years. These results will be fully interpreted and presented at the Second Annual Conference on Carbon Sequestration in Alexandria, Virginia, May 5-8, 2003.

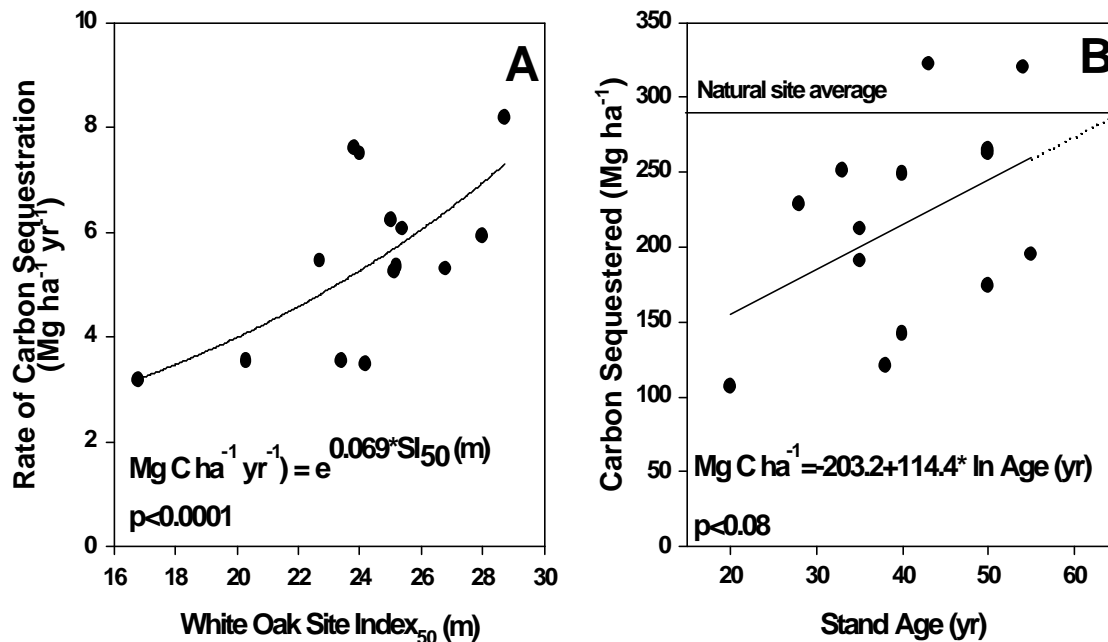


Figure 4. Rate of carbon sequestration across a forest site quality gradient (A), and total carbon sequestered on mined land as a function of forest age (B).

Conclusion:

1. Five Graduate Research Assistants were recruited to work on the project.
2. A Memorandum of Agreement was drafted between Virginia Tech and three industry cooperators that details the input and contributions from our industry cooperators.
3. Preliminary field locations for the controlled experiments have been determined.
4. A preliminary data analysis and interpretation has been made of a carbon inventory of forest stands on mined land. These data will be presented at the Second Annual Conference on Carbon Sequestration in Alexandria, VA, in May, 2003.

References:

Rodrigue, J. A. 2001. Woody species diversity, forest and site productivity, stumpage value, and carbon sequestration of forests on mined lands reclaimed prior to the passage of the Surface Mining Control and Reclamation Act of 1977. M.S. Thesis. Virginia Polytechnic Institute and State University. 299 p.

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- ◆5. Signed _____ Date February 10, 2003
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