

Reclaiming Mined Land for Forests and Forestry

James Burger, Brian Strahm, Daniel Evans
Department of Forest Resources and Environmental Conservation

Christopher Fields-Johnson and Carl Zipper
Department of Crop and Soil Environmental Sciences

This report summarizes ongoing research and education activities concerning reforestation of mined lands conducted during the 2009-2010 fiscal year. It is accompanied within this volume by other manuscripts that review more detailed results for certain activities, and by citations of other research and outreach reports. Activities conducted during past year follow below:

Project 1. Grading and Ground Cover for Reclaiming Mined Land for Forestry.

This extensive project was installed in 2008 with the cooperation of Red River Coal Co., Paramount Coal Co., Alpha Natural Resources, Penn-Virginia Resources, and Forest Land Group. It entails testing, the effects of mine-reclamation grading and groundcover seeding effects on hardwood reforestation success. Primary research activities have been conducted by Christopher Fields-Johnson, who is currently preparing his M.S. thesis to include results of this work. We are grateful to the OSM Applied Science Program for providing grant funding to initiate the research, and to the mining firms that prepared experimental areas for research use, Red River Coal Co. and Paramount Coal Co./Alpha Natural Resources, on their coal mining operations. Thanks also to Virginia Department of Mines, Minerals and Energy for their assistance and for accommodating these research areas on active permits.

Project 2. Use of Reclaimed Mined Land for Forest Biomass Production.

This work is being conducted for the purpose of determining the feasibility of using reclaimed mined land to produce woody biomass materials feedstocks for co-firing coal to produce electricity and/or conversion to liquid biofuels and other biobased products. We are indebted to Alpha Natural Resources for providing funding to supplement the Powell River Project general support for reforestation research; the additional funding provided by Alpha was essential to our ability to continue this research. Three separate ongoing projects are contributing to this work:

Tree Species and Density Effects on Woody Biomass Production on Unused Mined Lands:

This project was installed in early 2008 on 3 sites owned and managed by Red River Coal Co., Penn Virginia Resource Partners, and Forestland Group, respectively. Second-year results are reported here with a separate manuscript.

Hybrid Poplar Biomass Production Clone Comparison Trials: This project was established in early 2009 with funding from the Virginia Tobacco Commission. Research results from the “Reforestation Techniques for Post-SMCRA Unused Mined Lands” project below demonstrated the potential of hybrid poplar as a biomass producer, and influenced our decision to initiate this work. The Alpha Natural Resources funding for biomass research has been used to support its maintenance and management during 2010. First-year results are reported here with a separate manuscript.

Stem Form and Fertilizer Effects on Black Locust Biomass Production on Mined Lands: Early results from the “Tree Species and Density Effects” trial reported above demonstrate that black locust produces large amounts of biomass during its first and second year; and observations reveal its continued rapid growth. A problem with using black locust for biomass production on coal surface mines is its poor stem form. This trial was installed with black locust stock procured and donated by Williams Forestry and Associates. The study is comparing the performance of black locust varieties that have been selected for their superior growth form to stock procured from sources that commonly provide for coal surface mines. The study was installed in early 2010; its purpose and design are described in this volume with a separate manuscript.

Project 3. Which Topsoil Substitutes are Best for Growing Trees?

The objective of this study is to determine how mine soils weather with time and how they may become more suitable for trees. The study is being conducted on the Controlled Overburden Placement (COP) experimental site, which was established in 1982 and is the longest intact and continuously monitored experimental manipulation of topsoil substitutes and organic amendments in the world. From 1983 to 2002, the forested side of the plots were predominately under pitch x loblolly pine hybrid vegetation. In 2002 the pines were harvested, providing valuable information on the influence of topsoil substitutes and organic amendments on the potential productivity of reforestation efforts. Following this rotation, and with an increasing interest in the return of native hardwood species to the post mining landscape, the COP plots were planted with northern red oak seedlings. In October 2009, following their eighth growing season, all 180 (9 trees x 5 treatments x 4 replicates) red oak were harvested to similarly evaluate their productivity in response to the different treatments. A new, incoming graduate student will combine this information with a focus on soils in order to better understand how the properties and process of the post-mining landscape that can help facilitate the vision of the Forestry Reclamation Approach (FRA).

Project 4. Reforestation Techniques for Post-SMCRA Unused Mined Lands.

Research is being conducted to determine silvicultural methods and economic benefits of converting grasslands to productive forests. This project was initiated with US Department of Energy funding in 2004. Half-acre plots of three planted forest types (hybrid poplar, white pine, and mixed hardwoods) were each treated with three levels of management (weed control, weed control + tillage, and weed control + tillage + fertilizer). Three of the nine replications of this experiment are located on or near the PRP. Hybrid poplar growth on these plots far exceeds other species and influenced our decision to become engaged with the hybrid poplar clonal trials study, as described above. Christopher Fields-Johnson is reporting 5-year results for this study in his M.S. thesis. In addition, we are working with The Nature Conservancy to aid their reforestation of a former Pittston Coal Co, site at Hazel Mountain, Virginia, near the border of Wise, Dickenson, and Russell Counties.

Project 5. American Chestnut Restoration.

Hybrids of chestnut that are botanically indistinguishable from American chestnut (*Castanea dentata*) and have the blight-resistance of Chinese chestnut (*Castanea mollissima*) are being developed by the American Chestnut Foundation. Reclamation of mined land in the Appalachians can aid the introduction of these hybrids because of the coincidence of the Appalachian coalfield with the central range of the American chestnut and because of the large areas of land opened up by mining that are available for afforestation. We have two ongoing field trials in place that test the effect of mine reclamation and planting methods on chestnut re-establishment success. Those results are reported here in a separate manuscript.

Project 6. Education Programs and Demonstration Forests.

During the past year, one of our group served as the co-chair of the 4th annual Appalachian Regional Reforestation Initiative Conference in Pittsburgh, PA, (June 2010); and we led a field program for Virginia Department of Mines, Minerals and Energy and US Office of Surface Mining personnel at Powell River Project Research and Education Center in September 2009. We also completed several outreach publications, as listed below.

Publications:

- J. Showalter, J. Burger, C. Zipper. 2010. Hardwood seedling growth on different mine spoil types with and without topsoil amendment. *Journal of Environmental Quality* 39: 483-491.
- J.A. Burger, D.M. Evans. 2010. Ripping compacted mine soils improved tree growth 18 years after planting. p. 55 - 69, in: *Proceedings, National Meeting of the American Society of Mining and Reclamation*.
- J.A. Burger, C.E. Zipper. 2010. Reforestation Guidelines for Unused Surface Mined Lands in the Eastern United States. *Virginia Cooperative Extension Publication* 460-144.
- V. Davis, J. Franklin, C. Zipper, P. Angel. 2010. Planting Hardwood Tree Seedlings on Reclaimed Mine Land in Appalachia. *Appalachian Regional Reforestation Initiative, Forest Reclamation Advisory Number* 7.
- D.M. Evans, C.E. Zipper, J.A. Burger, C. Fields-Johnson. 2010. Tree species and density effects on woody biomass production on unused mined lands: Establishment and two-year results. p. 276 -291, in: *Proceedings, National Meeting of the American Society of Mining and Reclamation*.
- C. Fields-Johnson, J. Burger, D. Evans, C. Zipper. 2010. Response of improved American chestnuts to planting practices on reclaimed surface mined land. p. 319 -336, in: *Proceedings, National Meeting of the American Society of Mining and Reclamation*.
- C. Fields-Johnson, C. E. Zipper, J.A. Burger and D.M. Evans. 2010. Second year response of Appalachian mixed hardwoods to soil surface grading and herbaceous ground cover on reclaimed mine land. p. 305 -318, in: *Proceedings, National Meeting of the American Society of Mining and Reclamation*.