APPALACHIAN REGIONAL REFORESTATION INITIATIVE AND THE FORESTRY RECLAMATION APPROACH[1]

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Abstract: The Appalachian Regional Reforestation Initiative (ARRI) is a broad-based citizen/industry/government program working to encourage the planting of productive trees on active and abandoned coal mine lands. Using a combination of private and governmental resources, the program facilitates and coordinates citizen groups, university researchers, the coal industry, corporations, the environmental community, and local, state, and federal government agencies that have an interest in creating productive forestland on reclaimed mined lands. Forestry research conducted by various academic institutions has confirmed that highly productive forestland can be created on reclaimed mine land by using a Forestry Reclamation Approach (FRA). The Office of Surface Mining Reclamation and Enforcement (OSM) and the Appalachian region states have determined that this technology can be implemented under the current state and federal regulations. Tree planting is documented throughout Appalachia in the regulatory programs in Ohio, Pennsylvania, Maryland, Kentucky, Virginia, Tennessee, and West Virginia. Although trees are being planted, the reclamation plans generally do not reflect the current technology. The mission of ARRI is to promote and encourage the use of the FRA technology in reclamation of both active and abandoned coal mine sites. Part of our effort is to provide FRA training and to explain the multiple benefits of creating productive forestland. These multiple benefits include restoration of clean water and air resources, carbon sequestration, soil conservation, wildlife and endangered species habitat, recreational opportunities, and timber production.

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[1] Paper was presented at the 2007 National Meeting of the American Society of Mining and Reclamation, Gillette, WY, 30 Years of SMCRA and Beyond June 2-7, 2007. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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Proceedings America Society of Mining and Reclamation, 2007 pp 200-205
DOI: 10.21000/JASMR07010200
http://dx.doi.org/10.21000/JASMR07010200

Introduction

The majority of the Appalachian region was originally covered with rich hardwood forests. Over the years, surface mining reclamation has resulted in forest fragmentation and a net loss of productive forestland. We cannot replace nature, but we can create an environment through the reclamation process that will enhance tree growth and natural succession. This is the focus of the Appalachian Regional Reforestation Initiative.With the advent of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), special efforts were made to address land stability and sedimentation caused by past mining practices. Reclamation practices including high soil compaction rates and aggressive ground covers resulted in dense hay land and pastureland. This type of reclamation may be aesthetically pleasing and desirable in some cases, but it is not conducive to productive forestland. Fortunately researchers began to notice that tree productivity on some pre-SMCRA sites actually had superior growth rates. Most of these sites were on areas with low soil compaction rates. Forestry researchers at Southern Illinois University conducted studies during the 1970's and 80's to examine 30-year-old tree plantations on low compaction spoil piles in the mid-west region (Ashby, 1980). They found high survival and growth rates for many hardwood species. They also documented far greater natural succession of native forest tree species in the areas planted to trees, than on adjacent unplanted areas. Research at Virginia Polytechnic and State University, and the Powell River Project, confirmed that the site index, which is a measure of forest productivity, can be significantly increased by changing current reclamation practices and adopting a Forestry Reclamation Approach (FRA) (Burger et al., 1998). The FRA will increase forest productivity and timber value, increase plant diversity through natural succession, increase soil and water conservation, provide critical wildlife habitat, and carbon sequestration. It is for these reasons that the Appalachian Regional Reforestation Initiative (ARRI) was formed.

Appalachian Regional Reforestation Initiative (ARRI)

ARRI is a broad-based citizen/industry/government group working to encourage planting of productive hardwood trees on reclaimed and abandoned mine lands. Our vision is not only to plant more trees, but also to build a productive forest ecosystem that encourages natural succession of native forest plants. We will concentrate on promoting the use of the FRA technology. By using a combination of private and governmental resources, the program will facilitate and coordinate the coal industry, university researchers, the environmental community, and state and federal government agencies that have an interest in creating productive forestland on reclaimed mined lands (Angel et al., 2005). We have identified a Core Team that includes members from each Office of Surface Mining Reclamation and Enforcement (OSM) Field Office, and members from each State Regulatory Authority in the Appalachian Region. This Core Team has the responsibility to develop reforestation partnerships and promote ARRI. We have also identified an Academic Team that includes reforestation researchers and experts from universities throughout the region. The Academic Team has the responsibility of providing continuing research and collaboration in the area of mine land reforestation.

ARRI has identified several barriers that must be eliminated:

- Cultural Barriers – We will work to change the perception that tree planting is more expensive and risky than reclamation to pastureland. This will require re-education of mining companies and regulatory authorities from the top management all the way down

to the inspectors and equipment operators in the field. We must change the perception of what good forestry reclamation should look like.

- Technical Barriers – We will work to promote the use of FRA technology, and to encourage additional research as needed.
- Regulatory Barriers – OSM and the Appalachian region states have determined that the FRA technology can be implemented under the current State and Federal regulations. However, we will continue to review State and Federal regulations to identify and resolve impediments to reforestation. We will work to change the perception that the regulations impede effective reforestation techniques.

The goals of ARRI are to:

- Plant more high-value hardwood trees on reclaimed coal mined lands in Appalachia
- Increase the survival rates and growth rates of planted trees
- Expedite the establishment of forest habitat through natural succession

Current forestry research conducted by the University of Kentucky and Virginia Polytechnic and State University, has confirmed that highly productive forestland can be created on reclaimed mine land by using a Forestry Reclamation Approach (Burger et al., 2005). The FRA has taken lessons learned from past mining practices and modified current mining practices to create more productive forestland. The FRA discussed here is a general guideline. Each State will be encouraged to develop a FRA that fits the unique environmental conditions within that State.

Forestry Reclamation Approach

1. Create a suitable rooting medium for good tree growth that is no less than four feet deep and comprised of topsoil, weathered sandstone, and/or the best available material

The selection of the best growth medium will depend on the local environmental conditions and the best available soil material. In Ohio and parts of Pennsylvania, large deposits of topsoil are available. Topsoil is a valuable resource and it should be conserved and replaced when possible. However, in the mountainous coal mining areas of the other States in the Appalachian Region, topsoil is limited and alternate growth media have been shown to support productive forestland. During mining operations, all highly alkaline materials with excessive soluble salts and all highly acidic or toxic material should be covered with four to six feet of a suitable rooting medium that will support trees. Growth media with low to moderate levels of soluble salts, equilibrium pH of 5.0 to 7.0, low pyretic sulfur content, and textures conducive to proper drainage are preferred (Burger et al., 2005). Native hardwood diversity and productivity will be best on soils with a sandy loam texture where the pH is between 5 and 7. These types of soils can be formed from overburden materials comprised of weathered brown or unweathered gray sandstone, especially if these materials are mixed with natural soils. Shale may be used in combination with sandstone; however, high concentrations of shale and other fine-grained spoil materials should be avoided because they compact easily and have poor internal drainage. Many times these materials have higher pH values, which encourages heavy ground cover and inhibits

tree growth. On remining sites, topsoil/sandstone may not be available in sufficient quantities. In these cases a combination of spoil materials will be required to create the best available growth medium.

2. Loosely grade the topsoil or topsoil substitutes established in step one to create a non-compacted soil growth medium

The use of pans and other rubber tire equipment must be eliminated during final grading. The practice of tracking-in with dozers to create a smooth and compacted final grade is not advisable, and is an unnecessary expense. The majority of the backfill should be placed and compacted using the currently accepted practices to ensure mass stability. The difference is only during the replacement of the growth medium in the last four to six feet. In area mining, haul trucks are used to dump the growth medium in a tight arrangement, and final grading is accomplished with one or two light passes with a dozer to strike off the tops of the dump piles. Likewise, in a dragline operation, the growth medium is placed in piles and a dozer lightly grades the area leaving a rough, non-compacted growth medium. In steep slope mining areas, the majority of the backfill is placed and compacted as usual, but the final four to six feet of growth medium is dumped and lightly graded to achieve the required final grade. This low compaction technique will actually reduce erosion, provide enhanced water infiltration and restore the hydrologic balance, and allow trees to achieve good root penetration. Research conducted by the University of Kentucky, at the Starfire Reforestation Project, has shown that reduced compaction rates result in superior tree survival and growth rates (Graves et al., 2005). Ripping can alleviate compaction, and research has shown that this will increase tree growth. However, this is an unnecessary expense that can be avoided by limiting compaction during final grading.

3. Use native and non-competitive ground covers that are compatible with growing trees

Ground cover vegetation used in reforestation requires a balance between erosion control and competition for the light, water, and space required by trees. Fast growing and competitive grasses such as Kentucky-31 tall fescue and aggressive legumes such as sericea lespedeza, crown vetch and sweet clovers should not be used where trees will be planted. Seeding rates should be reduced to limit ground cover competition to planted tree seedlings. Most ground cover species under certain conditions will compete with tree seedlings. However, slower growing grasses such as red top and orchard grass, and legumes including birdsfoot trefoil and white clover are more compatible with growing trees. Using these species in a mix with other appropriate species will increase seedling survival, provide erosion control and allow development of the native forest plant community through natural succession. Fertilizer rates should be low in nitrogen to discourage heavy ground cover growth while applying sufficient rates of phosphorus and potassium for optimal tree growth (Burger et al., 2005).

4. Plant two types of trees – early succession species for wildlife and soil stability, and commercially valuable crop trees

Early succession trees and shrubs such as redbud and dogwood act as nurse plants for the higher quality hardwoods and provide wildlife food and cover. Crop trees should be selected according to the soil and environmental conditions. Research has shown that commercially valuable hardwoods can be successfully grown including red oak, white oak, white ash, black cherry, sugar maple and yellow poplar (Burger et al., 2005). Conifers such as white pine and loblolly pine have also been shown to thrive on FRA sites and produce harvestable timber. By planting both early succession and late succession tree species and increasing natural succession,

a shorter amount of time is required to reach a mature forest with a species composition similar to the native forest.

5. Use proper tree planting techniques

The importance of proper tree planting cannot be over stressed. The best planting stock available should be selected and maintained in cold storage until actual planting. Tree seedling roots exposed to air for as little as 15 minutes can significantly increase the mortality rate. Care should be taken to separate seedlings and roots should never be pruned. The seedlings must be kept moist and immediately placed in the planting bag. The planting hole must be made as deep as possible, to accommodate the entire root system. The planting hole must be completely closed leaving no air pocket, and tamped in with the heal. In most cases, the extra cost of hiring professional tree planters will be well worth the investment.

Forestland Multiple Benefits

The environmental benefits of reforestation include:

- Increased plant diversity through natural succession of native forest plants
- Endangered species habitat and enhanced wildlife habitat for managed game
- Soil and water conservation
- Recovery of the hydrologic balance
- Carbon sequestration (refers to the ability of forestland to remove carbon from the atmosphere, and store it as biomass and soil organic matter).

Reforestation provides a wide range of economic benefits to landowners, the local community, and coal mining companies:

Landowner
- Increased timber value
- Tax incentives
- Leasing for recreational areas
- Carbon sequestration credits

Community
- Jobs for the local economy
- Local sales tax revenue

Coal Mining Companies
- Reduced grading costs
- Reduced fertilizer and seeding costs
- Reduced maintenance costs
- Reforestation using FRA provides an economically viable post mining land use option that will result in timely bond release

Conclusion

Forestland enriches us all by providing numerous environmental and economic benefits. Forestland is also a renewable resource. By working together, State and Federal government agencies, the coal industry, landowners, university researchers, and local citizens, can indeed create highly productive forestland on reclaimed mine land by using the Forestry Reclamation Approach. We invite any and all interested parties to join the Appalachian Regional Reforestation Initiative and become Reforestation Champions.

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