FOREST PRODUCTIVITY OF RECLAIMED MINED LAND: A LANDOWNER'S PERSPECTIVE[1]

by

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Abstract. Most surface mined land in the Appalachians of Virginia, West Virginia and Kentucky is too remotely located to be used for industry, commercial development or conventional agriculture. For large corporate landowners, the most practical post mining land use is forestry. The authors of this paper are responsible for forest management on thousands of acres of surface mined land in the mountainous region of Virginia, West Virginia and Kentucky. As a result of practical experience and company sponsored research, the authors believe that productivity of reclaimed mined land in these mountain regions could be improved if coal companies reduced the amount of surface grading and subsequent mine soil compaction. Careful reclamation which produces forest land with a site index of 100 ft. (base age 50) will result in greater opportunities for the landowner, reduced grading costs to the coal company, and greater long term environmental stability.

Introduction

Public Law 95-87 drastically altered surface mining and reclamation practices. One important aspect of this law is the attention that it gives to future land use opportunities of reclaimed land. The intent of the law is to ensure that surface mined land is reclaimed to a condition capable of supporting a productive land use.

In the Central Appalachian region of Virginia, West Virginia and Kentucky, where prime farmland and economic development opportunities are scarce, forestry is the most logical and economically feasible land use for reclaimed surface mined land. Most of this land was forested before mining and whether by design or through natural succession, in the absence of continuous maintenance, hayland or pasture will ultimately return to forest.

The authors of this paper are involved in forest management activities for three separate large landholding companies

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and thousands of acres of surface mined land. In the past, hayland or pasture was designated as the post mine land use on much of this land, but for the most part, it has been economically impractical to manage these lands for this intended use. After concluding that timber production is often the only economically feasible land use for large tracts of reclaimed mined land in mountainous terrain, these companies decided to manage most of their reclaimed land for commercial forests.

In recent years the authors have begun to encourage coal companies that are mining coal on their companies' lands to select forest land over hayland, pasture or wildlife habitat as the preferred postmining land use and to create as productive a forest landscape as possible under current laws and regulations. The most commonly planted commercial tree species is white pine. Unfortunately, it has become increasingly apparent that many traditional reclamation practices have been developed for the purpose of immediate erosion control and aesthetic appeal, particularly those associated with ground cover establishment and surface grading and are not conducive to reforestation efforts or long term forest productivity.

The purpose of this paper is to call attention to the concerns of landowners for long term productivity, to illustrate the effect that reclamation can have on economic returns from reclaimed forest land, and to suggest methods to improve reclamation of forest land.

Reclamation for "long-term" vs "short-term benefits.

From the forest landowner's perspective, many reclamation regulations and practices appear to sacrifice long-term land use options for short-term gains. Each year numerous photographs of award winning reclamation projects are published in various trade magazines. In most cases, these photos depict smoothly contoured surfaces with lush ground cover. For landowners with a long term interest in timber production these award winning reclamation projects can represent lost opportunities.

The presence of tall and lush vegetation often indicates that no trees are present and probably will not be established until several years after bond release. Seedling survival is often poor when trees are planted in dense herbaceous cover. Although regulations only call for 70% to 90% ground cover (depending on State regulations), coal companies and inspectors appear to be obsessed with trying to cover every square inch of bare spoil with a thick blanket of grass during the first year of vegetation establishment. Coal companies that plant trees often become frustrated by poor survival of seedlings and the expense of replanting. Some coal companies plant hundreds of extra trees per acre to compensate for expected mortality, or plant and hydroseed low value tree and shrub species (such as black locust and autumn olive) which are more tolerant of dense ground covers. These species may satisfy bond release requirements but create future forests of low value wood products for the landowner.

Table 1. Thirty year timber harvest volume and stumpage value as affected by site quality[1/]

Volume/Value	Site Index		
	65 ft.	80 ft.	100 ft.
Cubic ft. volume	3,089	4,920	8,604
Board ft. volume	7,150	14,164	32,145
Small log value (@ $25/MBF)	$179	$354	$804
Saw log value (@ $50/MBF)	$357	$708	$1,605

[1/] Yields according to Balmer and Willston, 1983.

Smoothly contoured surfaces (typical of most award winning reclamation sites) are often heavily compacted and graded and not capable of supporting good tree growth once trees are established. This problem is particularly severe on level areas and with finer textured soils. (Brown, 1962; Deitschman, 1951; Limstrom, 1952 and 1960). Compacted soils are difficult to plant, and compacted level areas frequently have restricted drainage. White pine grows very poorly in these compacted areas. Trees can grow extremely well in deep, uncompacted mine soils, even surpassing the growth of native, unmined soils (Ashby, 1984), but compaction caused by leveling and grading can have adverse effects on tree growth for more than 30 years (Vogel, 1981).

Economic impact of site quality

Foresters traditionally measure the productivity of forest land by its "site index". Site index (SI) is simply defined as the height of dominant trees at age 50. The average SI for white pine in the southern Appalachians is 80 ft. (Doolittle, 1958). On good sites, white pine SI can exceed 100 ft. (Balmer and Willston, 1983).

A survey of 34 white pine stands on reclaimed sites in Virginia, revealed a range of site indices from 32 ft. to 118 ft. with an average value of about 65 ft. (Torbert et. al, 1988). Rooting depth was the mine soil factor most highly correlated with tree growth.

The authors believe that a SI of 100 or more (for white pine) could easily be achieved on many reclaimed sites, through efforts to reduce compaction. This level of productivity would produce much more benefit to the landowner than SI 80 (average site quality for southern Appalachians) or SI 65 (average site quality encountered in Virginia study).

Table 1 compares the timber production and estimated value for SI 65, 80 and 100 based on Forest Service yield tables (Balmer and Willston, 1983), and the authors' experience with stumpage values. At age 30, a stand of white pine planted on a 10 x 10 ft. spacing (approximately 450 trees/acre) will yield about 3,100 cubic ft. of wood at SI 65 versus 8,600 cut ft. at SI 100. Thus, SI 100 land will yield 170% more cubic foot volume than SI 65. The differences in productivity are even greater

when sawtimber volume is considered instead of cubic volume. A 30-year old stand on SI 100 land will yield 32.1 thousand board feet (MBF) versus 7.1 MBF on SI 65 land, thus producing a 350% increase in the more productive land.

Another factor affecting economic return is stumpage price. The actual timber harvest value on SI 100 land is even greater when consideration is given to the fact that large diameter sawlogs can be sold for more money per thousand board feet than small diameter sawlogs. A reasonable stumpage price for small diameter logs on SI 65 land might be $25/MBF whereas, sawlogs on SI 100 land may sell for $50/MBF, yielding $179/acre on SI 65 versus $1,605/acre on SI 100 (an 800% increase.)

This simplified economic comparison illustrates the effect of site quality on wood production and stumpage price, and the combined effect on harvest value. When site quality is low, timber revenues may not be enough to cover the cost of property taxes, insurance, and management expenses. Reclamation practices which increase tree establishment costs or decrease long term productivity, will prevent landowners from being able to profitably conduct forest management activities on surface mine lands designated as commercial forests.

Reclamation practices for productive forest land should be different than conventional reclamation practices

Long term productivity would be greater and coal company reclamation expenses could be lowered if land reclaimed for forest was less intensively graded and seeded with a tree-compatible ground cover. The cost of planting trees could be offset if the amount of grading was commensurate with the needs of forest land. (Richards and Graves, 1984).

In 1986, Pocahontas Land Corporation and Virginia Tech established a forestry research project on a reclaimed site in West Virginia, with an experimental variance from the West Virginia Department of Natural Resources. One of the objectives of this study was to demonstrate the beneficial effects of reduced grading and the use of a ground cover prescription, composed of grasses and legumes that excluded Kentucky-31 tall fescue (Table 2). Five year results of this study were presented at the 1991 ASSMR meeting (Torbert et. al, 1991). Bond release criteria for this study site were achieved and site index was estimated to exceed SI 100. The excellent tree growth on this site was attributed to: 1) selection of an acidic, oxidized sandstone spoil (no topsoil replacement), 2) reduced final grading and no tracking-in on the final surface, and 3) use of a tree-compatible ground cover.

The reclamation practices which produced excellent 5-year ground cover and long-term land use possibilities required an experimental variance, and would probably not have qualified for any reclamation awards based on first year appearance. Nonetheless, these practices resulted in a more productive land use for the landowner, reduced reclamation costs to the coal company, and has provided greater long term environmental protection and stability to the land.

Table 2. Species and seeding rates used to establish effective grounds cover on reclaimed mine lands planted with trees[1/]

Ground Cover Species	Rate (Lbs./Acre)
Cover Crop	
Foxtail millet (late spring)	5
German millet (late spring)	5
Annual rye (early spring/fall)	15-20
Grasses	
Redtop	3
Weeping love grass	1
Perennial rye grass	5
Orchard grass	5
Legumes	
Kobe lespedeza	5
Appalow lespedeza	5
Birdsfoot trefoil	5
Ladino clover	3

[1/] Species and seeding rates according to Torbert et. al, 1986.

Landowner involvement

To be assured a viable, productive forest is created, landowners must play an active role in developing an effective reclamation plan and see it through to completion. Foresters must be able to take available technology and knowledge from research and put it into practical application. Often, the authors of this paper have seen coal company engineers or contracted reclamation personnel determining tree and ground cover species for the post mine land use of forestry without the availability of a forester for advice on tree species selection, ground cover compatibility or fertilizer rates. Attention should be given to geographical features, such as slope and aspect, and physical and chemical properties of the minespoil - all of which have an influence on tree productivity. Landowners should also coordinate and oversee tree planting to assure proper planting techniques are being adhered to and good tree survival is attained. If the landowner is spending hundreds of dollars per acre to establish productive forests, he cannot afford to take a "hands off" attitude toward the reclamation process.

Summary

The main objective of strip mine reclamation is to restore the land to a condition that will prevent environmental damage and create environmental stability. Landowners, like those the authors of this paper represent, desire a post mine land use that will generate a positive future income from their lands. Thousands of acres of surface mined land in the Appalachian region have been previously reclaimed as

hayland or pasture, but for the most part, it has been economically impractical to manage these lands for their intended use. Foresters for these landowners have argued that the best land use suitable for the majority of their land is forestry.

To create a productive forest site, a deep uncompacted minesoil must be created. Site index, as a measure of forest land productivity, is greatly influenced by the degree of compaction of minesoil during final grading. Timber production and economic returns can be increased by creating a quality site with site index 100 possible. A research project conducted by Pocahontas Land Corp. and Virginia Tech demonstrated a productive forest site could be established and bond release criteria achieved by 1) selecting an oxidized sandstone spoil for surface material, 2) reducing final grading and 3) using a tree-compatible ground cover. To assure a productive forest is established and maintained, the land owner must be involved in the entire reclamation process.

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