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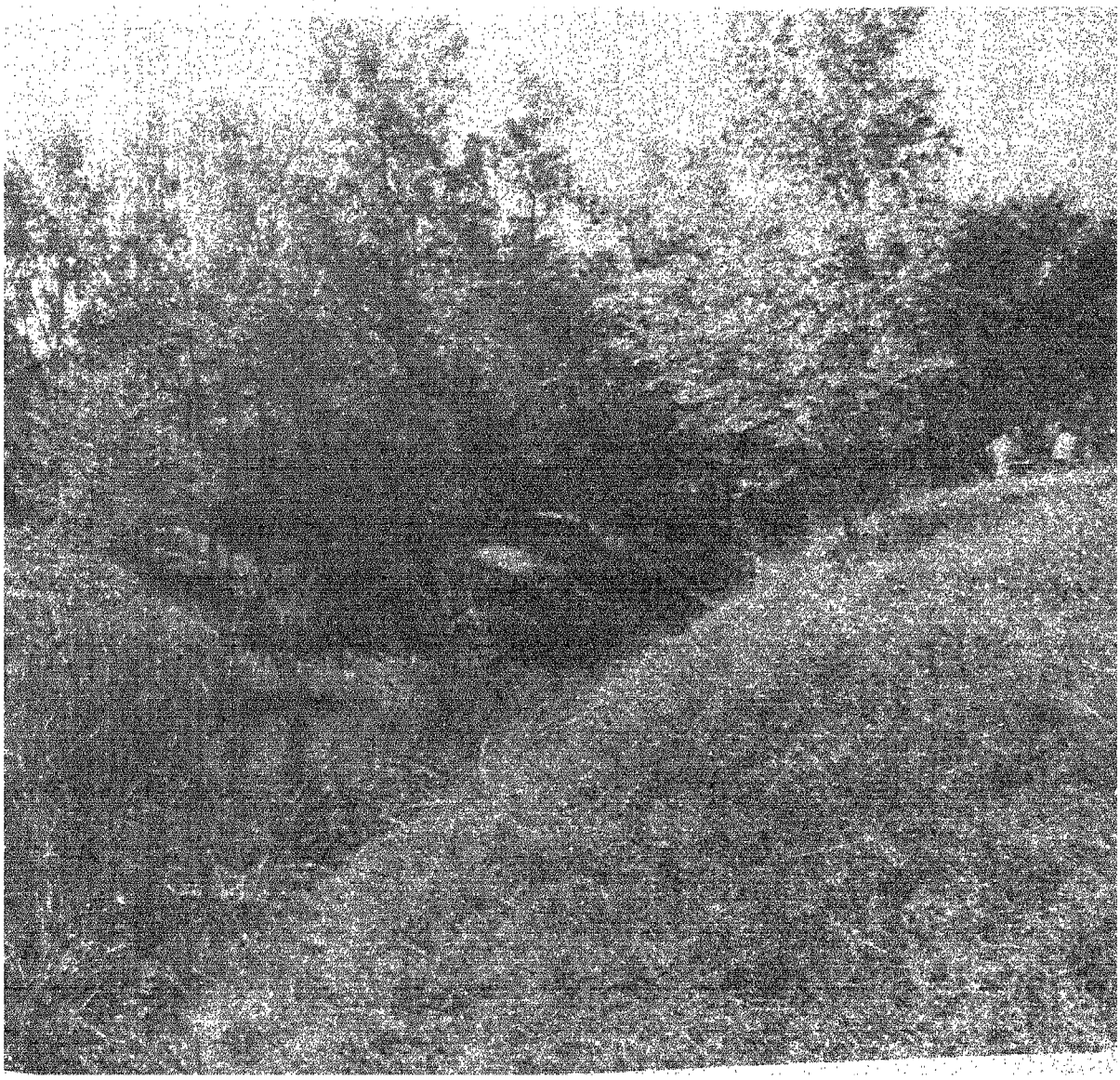
A Guide for Revegetating Coal Minesoils in the Eastern United States

by Willis G. Vogel



THE AUTHOR

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ABSTRACT

This report provides information, recommendations, and guidelines for revegetating land in the Eastern United States that has been disturbed by coal mining. Included are brief descriptions of major coal mining regions in the East, and a discussion of minesoil properties and procedures for sampling, testing, and amending minesoils. Plant species that have been used for revegetating surface-mined lands are identified and described. Selection criteria for plant species and methods and requirements for seeding and planting are explained. Some of the data on tree species used in reforestation were obtained from recent surveys of 30-year-old experimental plantings in several Eastern States.

FOREWORD

The mining of coal, especially surface mining, often is dangerous to environmental resources. Existing vegetation is destroyed, ecosystems are altered, and unreclaimed areas are visually displeasing. One of the adverse effects of mining and vegetation removal is the degradation and pollution of water resources. Erosion on raw exposed minesoils can contribute large quantities of sediment to streams. Where the overburden contains acid-bearing rocks, streams also are polluted with toxic chemical substances.

The revegetation of land disturbed by coal mining is necessary primarily for controlling runoff, erosion, and sedimentation. Simultaneously, the establishment of vegetation improves the visual quality of mined areas and aids in or contributes directly to restoring mined land to productive uses.

The principles and guidelines in this report are applicable primarily to past and current surface-mining operations; they may also apply to surface disturbances caused by underground mining. This report is not directed to the establishment of agricultural crops on areas designated as "prime farmland," though many of the revegetation principles and practices will apply.

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CONVERSION TABLE - ENGLISH TO METRIC

English Unit	Metric Unit	Conversion Factor
	Length	
inch, in	centimeter, cm	2.54
foot, ft	meter, m	0.305
mile, mi	kilometer, km	1.609
	Area	
square feet, ft^2	square centimeters, cm^2	929.030
acre, acre	hectare, ha	0.405
	Weight	
pound, lb	kilogram, kg	0.454
short ton, ton	tonne, t	0.907
short ton, ton	kilogram, kg	907.184
	Volume	
gallon, gal (liquid)	liter, l	3.785
cubic yard, yd^3	cubic meter, m^3	0.764
	Yield or Rate	
pounds/acre	kilogram/hectare	1.121
short tons/acre	tons/hectare	2.242
cubic yards/acre	cubic meters/hectare	1.886
gallons/acre	liters/hectare	9.346
	Temperature	
Fahrenheit, °F	Celsius, °C	0.555(F-32)

SECTION 1

INTRODUCTION

ENVIRONMENTAL IMPACTS OF COAL MINING

Coal is a major fuel for generating electrical energy in the Eastern United States. But the surface effects of mining coal often cause environmental damage. Ecosystems in mined areas, especially where surface mined, are drastically altered and traditional land use patterns are disrupted. Existing vegetation is destroyed on the mined sites, and soil and soil organisms often have been buried or mixed with the other geologic materials that were overturned in the mining process. The habitat for wildlife is altered or eliminated, at least temporarily, and the unreclaimed mined sites are esthetically unpleasant.

Perhaps the most serious impact of coal mining on the environment in the Eastern United States is the degradation and pollution of the water resource, especially in the mountainous Appalachian Region. Hydrologic patterns in mined areas are changed. Results of hydrologic studies have shown that during surface mining and before reestablishment of vegetation, the peak flows are higher in streams in mined watersheds than in unmined. Erosion on raw exposed mined land contributes large quantities of sediment to streams and rivers. The environment for aquatic life is drastically altered, and many of the fauna are killed. Where mined land is acid, streams are further polluted with chemical substances that are toxic to aquatic plants and animals.

REASONS FOR REVEGETATING MINED LANDS

In the East, revegetating lands disturbed by mining is necessary primarily for controlling runoff, erosion, and sedimentation. In fact, results of hydrologic research have shown that after surface-mined areas are fully revegetated, peak flows are actually lower in streams in mined watersheds than in nearby unmined forested watersheds. At the same time, the establishment of vegetation improves the visual qualities of mined areas and usually is oriented toward returning the mined land to a productive use. Some land uses, such as pasture, hayland, wildlife habitat, and production of some agronomic crops, can sometimes be restored or enhanced with the same plant species that are used to establish the initial vegetative cover. Where reforestation and wildlife habitat are the land use goals and erosion control is needed, herbaceous species are planted primarily for immediate erosion control, and trees and shrubs are planted to satisfy the long-range land use objective. Thus, all three revegetation objectives--erosion control, land productivity, and esthetics--are accomplished.

PURPOSE AND SCOPE OF REVEGETATION GUIDE

The primary purpose of this guide is to provide information, principles, and guidelines for vegetating lands disturbed by coal mining in the eastern half of the United States. These lands include many of the current surface-mining operations and surface areas disturbed by underground mining, as well as unreclaimed abandoned or orphan mines and mine refuse piles. The guide was prepared with the assumption that it will be applicable primarily where mining and grading of the surface are completed and the mined areas are ready for the various steps of the revegetation program--sampling and analyses of minesoil, application of amendments, seedbed preparation, plant species selection, and planting of vegetation. The guide does not provide specific requirements or treatments for reclaiming mined areas designated as "prime farmland," though some of the revegetation principles will apply.

Identified and described are plant species that have been used for revegetating mined lands. The selection and establishment of vegetation for conservation purpose, mainly erosion control and watershed protection, are emphasized. But, guidelines and principles also are given for selecting and establishing vegetation for other land uses such as forestry, wildlife habitat, and some agricultural uses. Procedures and principles for sampling, testing, and amending minesoils are discussed. Ideally, each of these steps will be anticipated by mine operators and included in their premining reclamation plan.

The information in this guide is derived from numerous sources, including research and administrative publications of Federal and State agencies and private organizations; direct communications with reclamation specialists in the surface-mining industry and with others engaged in surface-mine reclamation research, administration, and application; and first-hand research and experience by the author and his colleagues. Some of the reforestation recommendations are based on recent surveys of experimental tree plantings that were made about 30 years ago by the Forest Service and several State agricultural experiment stations. References containing information pertinent to revegetating coal surface mines are listed in the bibliography. Included in these references are revegetation guides published by government agencies or private organizations for specific States. Persons involved in surface-mine reclamation also should refer to guides for their respective State.

REVEGETATION PLANNING AND REGULATIONS

Mine operators should be aware of Federal and appropriate State regulations that pertain to the revegetation of lands disturbed by coal mining. For example, Section 780.18 of the regulations promulgated under the Surface Mining Control and Reclamation Act of 1977 requires that each permit application contain a plan for revegetating the mined area. The plan should include a schedule of revegetation activities such as the plant species to be used, the amount of seed or number of seedlings per acre, the planting and seeding methods, mulching materials and methods, and fertilizers and lime and application rates.

The regulations also include requirements for contemporaneous or timely reclamation, period of operator responsibility, topsoil removal and redistribution, tree and shrub stocking standards, ground cover, and land use considerations. These requirements may vary by State but will be at least as stringent as the Federal requirements. Thus, operators should consult State and Federal regulations as their first step in revegetation planning.