

I. Introduction

Background

Some natural resources such as coal, gypsum, bentonite, and uranium are in such demand that they are of more economic value than the land that covers them. In the West many of these resources are surface mined because relatively small amounts of overburden cover relatively large amounts of resource, which allows these minerals to be removed cheaply and easily.

Coal, one of the more important resources being surface mined, is an excellent example. Coal beds in the West can be as thick as 200 feet; 25-foot thick beds are common. Much of this coal is beneath 10 to 150 feet of overburden. The overburden to be removed, combined with the large amounts of coal, which is 70 to 90 percent recoverable using surface mining techniques, often makes surface mining economically appealing.

Surface mining leaves disturbed lands that must be reclaimed. In 1978, all of the states in our area of interest, except Nevada, had laws affecting surface mine reclamation. In 1977, the Surface Mining Control and Reclamation Act became public law. This federal law and subsequent guidelines set down by the Department of Interior's Office of Surface Mining have a major impact on reclamation not controlled by the states. The legal requirements for reclamation vary widely by state, but virtually all surface mining operations are legally required to reclaim the land.

The social and political climate affects reclamation practices also. Our society considers reclamation an integral phase of mining; we expect surface-mined lands to be reclaimed as a normal step in the mining process. Some mining companies have responded to this attitude by going beyond minimum legal requirements for reclamation. Even some abandoned spoil piles from surface mining 40 to 50 years ago, for example, are currently being reclaimed.

Since the early 1970's the USDA Forest Service Missoula Equipment Development Center (MEDC) has been involved in the effort to develop specialized surface mine reclamation equipment. Although there have been several new or modified machines, investigations showed that much of the equipment necessary for reclamation is already available, but land managers are often not aware of it. Young professionals are particularly unfamiliar with the availability and applications of equipment. The USDI Bureau of Land Management (BLM) in recognition of this problem, requested that MEDC prepare a report to describe equipment available for reclamation work, as well as basic applicability of the equipment and techniques for using it.

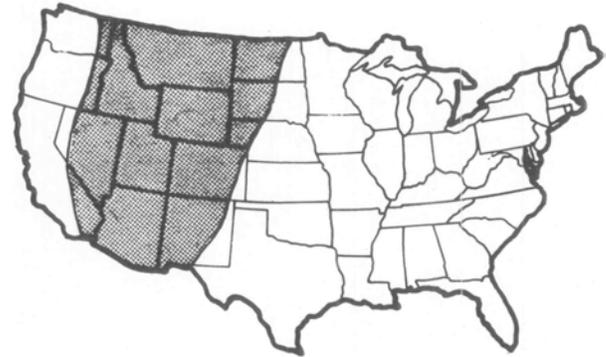


Figure 1.—Area of interest

Scope of the Report

This guide deals with reclamation equipment for the arid and semi-arid West, which incorporates the Southwest deserts, the Intermountain region, and the Northern Great Plains (Fig. 1). Many of the problems and techniques discussed however, may apply to other areas.

The area of interest is generally dry; most of the land receives less than 20 inches of precipitation a year, and much of it gets 10 inches or less annually. Temperatures range from -20°F to -30°F in the winter to over 100°F in the summer. Much of the area is subject to high winds. Soils are quite variable, but are usually shallow and relatively unproductive. Much of the area subject to surface mining is grass-or-shrub-dominated prairie to desert. The topsoil is thin and develops slowly. Vegetation has evolved to protect the soil from the harsh elements of the climate. When the vegetation is removed, the soil is easily destroyed. Water-bearing layers of rock, or aquifers, are responsible for much of the subsurface water distribution and retention in arid lands. Surface mining destroys aquifers above the mineral being extracted. This disruption of water flow is considered by some ecologists to be the most serious long-term impact of surface mining in some areas.

This report discusses reclamation equipment and techniques related to these environmental problems. Users of the report are assumed to have basic knowledge of range science, soil science, and plant ecology, but are assumed to be inexperienced in mining and reclamation.

Definitions

Reclamation is defined as creating a site that will support organisms in approximately the same percentage and number after the reclamation process is completed as it did before mining began. That means the same number and kinds of habitats or ecological niches will exist after mining

as before mining. This definition does not imply that only organisms native to the site will be used to repopulate a reclaimed area, but it does require that any nonnative species introduced must be ecological equivalents of the displaced natives.

Restoration, on the other hand, implies that the land will be returned to precisely the state it was before mining. This is nearly impossible to achieve. It would require rebuilding the soil, precise placement of trees and rocks, and use of only native plants and animals to repopulate the site.

Rehabilitation means that the site will be returned to a stable form and productivity level, according to the predetermined land-use plan. This implies land-use alternatives were considered and an acceptable option was chosen. Premining use is not necessarily post-mining use. Conversion of rangeland to farmland, reservoirs, or wildlife habitat could all be acceptable options. A key feature of rehabilitation is that a plan for post-mining use is determined before the mining is begun. The selected option should be ecologically stable and of relatively high value to society (Box, 1978).

This report deals with techniques and equipment for reclamation. Restoration is considered nearly impossible, and rehabilitation techniques will depend on land-use goals and will vary widely.

Objectives

Reclamation is an integral part of the entire mining process. Some reclamation-oriented tasks must be completed before mining starts in order to meet some legal requirements. Other reclamation tasks are accomplished throughout the mining process to reduce site disturbance. If reclamation is considered throughout mining activity, revegetation will be of higher quality, more quickly achieved, and cheaper than if reclamation is strictly a post-mining effort.

The section on mining and overburden handling presents mining equipment common to most surface mines. The equipment is described and mining techniques and major uses for the equipment are presented along with the effects if the equipment's use on reclamation. Final spoil handling and topsoil handling are emphasized.

The second section deals extensively with seedbed preparation. Soil surface conditions, both physical and biological is vital for successful reclamation, especially in the hostile climates in the arid and semi-arid West.

Finally, the third section covers species selection, seed collection, planting techniques, fertilization, and irrigation. The quicker a successful stand of vegetation is established on mined land, the less adverse impact there will be from such things as wind and water erosion, evaporation, and heat from solar radiation.

In addition, references have been included to aid further research into reclamation.