

Reclamation Techniques In Southwestern Wyoming

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Abstract

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Bridger Coal Company operates a 5.8 million tpy surface coal mine thirty five miles northeast of Rock Springs, Wyoming. Approximately 20,000 acres are under permit, with disturbance over the life of the mine projected to reach 10,000 acres. Located on the western rim of the continental divide, the mine receives less than 8.5 inches of precipitation annually. Soils in the area are coarse-textured, and problems associated with elevated salinity and sodicity are encountered.

A variety of common reclamation techniques have been modified to reflect these conditions. Soil horizons are segregated during salvage operations (the surface six inches as topsoil and the balance as subsoil). Unsuitable materials are not salvaged. Direct application of soil is used (over 130 acres in 1983) to maximize native plant regeneration and conserve soil fertility. Inter-seeding of seeding failures has proven to be significantly more successful than chisel plowing and reseeding. Broadcast seeding has been ineffective because of strong winds, and a no till drill has been modified to handle diverse seed mixes and rock conditions. The utility of fertilization under typically xeric moisture regimes is being evaluated. A research project has been initiated to assess establishment of a predominately native, diverse seed mix under irrigation, as well as to determine irrigation rates and duration.

Introduction

Bridger Coal Company mines approximately 5.8 million tpy of subbituminous steam coal at its surface strip mine located thirty five miles northeast of Rock Springs in southwestern Wyoming. The mine is adjacent to the continental divide at elevations ranging from 6,800 to over 7,100 feet. Mean annual precipitation is 8.39 inches, and the average number of frost free days is 100 (Bridger Coal Company, 1980). Bridger's permit to mine encompasses nearly 20,000 acres, with 3,675 acres disturbed and over 870 acres (or 24%) reclaimed to date (Bridger Coal Company, 1983). Life of mine disturbance is projected to reach approximately 10,000 acres.

Reclamation feasibility in southwestern Wyoming has been questioned since the resurgence of the coal mining industry in the early 1970's. The National Academy of Sciences (1974) suggested that ten inches of precipitation was necessary to sustain revegetation efforts. Bridger Coal has developed or modified a variety of reclamation techniques to reflect local conditions and provide the foundation for successful reclamation. The following information is based upon observations during the past four growing seasons.

Soil Management

Soils on the mine site are typically coarse textured, with an average pH of 7.5 to 8.0 and electrical conductivity in the 4.0 to 6.0 mmho/cm range. Problems associated with elevated salinity, sodicity, and boron levels are encountered. Bridger Coal has implemented a soil management program to assure that the best use is made of soil resources.

First, a staking program is used on the highwall to identify unsuitable native soils. Unsuitable materials should not be moved onto recontoured spoil unless soil heterogeneity is specifically desired. During soil stripping operations, soil horizons are segregated (the surface six inches as topsoil and the balance as subsoil). Soils range from six inches to sixty inches in depth, with a mine wide average of fifteen inches. Stripped soil is either stockpiled or hauled directly onto a completed regraded area. Stockpiles are recontoured to allow farming operations on the side slopes and to minimize erosion.

Direct application of soil is a key element in achieving diversity elements of bond release criteria. Bridger Coal has succeeded in using

direct application of soil on all areas reclaimed in the last 18 months, a total of 170 acres. The increased cost of longer hauls associated with direct application is offset by elimination of double handling incurred by stockpiling. This technique maximizes native plant regeneration and conserves soil fertility. Specifically, ten species have volunteered from direct applied soil that have not been successfully seeded. These species include big sagebrush (Artemisia tridentata), Sandberg's bluegrass (Poa sandbergii), Fendler's bluegrass (Poa fendleriana), greasewood (Sarcobatus vermiculatus), rubber rabbitbrush (Chrysothamnus nauseosus), plains wallflower (Erysimum asperum), scarlet globemallow (Sphaeralcea coccinea), and scarlet gilia (Ipomopsis aggregata). Direct application of soil aids in returning the shrub and forb components of the plant community, as well as in establishing understory species of the grass component.

Farming Operations

The goal of reclamation is to establish a diverse, native plant community capable of regenerating itself. Diverse techniques must be employed to achieve diversity of species in a reclaimed plant community. Seed drills used initially in reclamation, specifically the Laird Rangeland drill, were not capable of handling fluffy, trashy seeds such as winterfat (Ceratoides lanata). Consequently, only five or six species were seeded.

To remedy this, Bridger Coal purchased a Tye "Pasture Pleaser" no till seed drill. The drill has three seed boxes, with fairly standard wheatgrass and legume boxes. The third, a shrub box, is specially equipped with agitator discs and large picker wheels to handle trashy seed. In addition, the large

seed tube from this box can be left unbolted from its brackets, distributing seed across the entire furrow. The result is shallow planting depths that are desirable for most of these species. Bridger Coal has therefore been able to use eighteen to twenty species in each of its four seed mixes: shallow loamy, sands, saline upland, and saline lowland. Studies by DePuit and Coenenberg (1979) have indicated that increasing the number of species in a seed mix increases the diversity of the resulting plant community.

An additional technique that has proven successful during the last three years is interseeding. Interseeding involves seeding with a no till drill directly into an existing reclaimed surface, rather than chisel plowing and reseeding. The advantage lies in minimizing disturbance to the soil and in keeping existing vegetation intact. During the fall of 1981, portions of a reclaimed area were either interseeded or chisel plowed and reseeded. By 1984, the interseeded area showed 180 plants/m², compared with 53 plants/m² on the area chisel plowed and then reseeded (Bridger Coal Company, 1984). Interseeding can also be useful as it provides a second age group of plants within the community.

Broadcast seeding has had limited success at Bridger Coal, primarily because of wind erosion. Broadcast seeding is intended to provide the shallow planting depth necessary for native species, as well as improving reclamation aesthetically by eliminating the appearance of drill rows. A modified broadcast seeder was used on 150 acres. Average first year seedling density resulting from the broadcast seeder was 15.2 seedlings/m². Average first year seedling density on 130 acres seeded with a drill was 47.4 seedlings/m².

Shrub Establishment

Proposed state regulations require establishment of one shrub per square meter in a mosaic pattern on 10% of the mine's reclaimed area. This standard has been met on 48 acres (or 6% of reclamation to date) and has nearly been met on several additional areas.

Three varieties of sagebrush, fourwing saltbush (Atriplex canescens), Gardner's saltbush (Atriplex gardneri), winterfat, rubber rabbitbrush, greasewood, and spiny hopsage (Grayia spinosa) are currently used in different seed mixes to promote shrub establishment for wildlife habitat. Fourwing saltbush, Gardner's saltbush, and winterfat have been especially successful in reclamation seedings.

Direct application of soil also maximizes shrub establishment by increasing the survival of propagules that remain in the soil at the surface of reclamation. Sagebrush, rubber rabbitbrush, and greasewood have been established with this technique.

Irrigation

A cooperative research project with the University of Wyoming has been initiated to assess the establishment of a predominantly native, diverse seed mix under irrigation. The objectives of the research include determining optimum irrigation rates for initial vegetation establishment; determining optimum seasonal scheduling and duration; and defining interactive effects of varied treatments on initial and ultimate vegetation density, productivity, species composition, and diversity. Preliminary results from this project should be available in 1985.

Fertilization

Analysis of a poor reclamation area seeded in 1981 revealed total nitrogen and phosphorous levels (.03% N and 2.1 ppmP) below desirable plant available levels (Bridger Coal Company, 1981). Fertilizer at 150 lbs./acre of 18-46-0 was applied this spring and the area was interseeded. Initial results are encouraging. However, the utility of fertilizer in this area is probably limited to average or above average precipitation years.

Summary

Many of the initial concerns over reclamation feasibility in a semiarid desert environment have been laid to rest. Improvements have occurred in soil management, shrub establishment, and farming operations. Experiments are underway with various techniques such as irrigation and fertilization.

Wyoming Department of Environmental Quality personnel have evaluated all reclaimed areas at Bridger Coal annually since 1982. The percentage of reclamation rated good or fair increased from 38.3% in 1982 to 54% in 1983. The percentage of disturbance reclaimed has nearly doubled in less than five years, from 13.3% in 1979 to 26.5% in December of 1983. Reclamation has been successfully achieved in areas receiving less than ten inches of precipitation.

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