

areas surveyed, the mineral deposit being mined was over 9 feet thick. This means great value from an acre but difficulty in reshaping the land to its original contours. Grading enough to satisfy intended land use is more practical. Some thin deposits might better have been left unmined where restoration costs would be proportionately high.

Age of surface mines.—Of the 693 sites sampled in 1966, 10 were mined more than a century ago. But most spoil banks and other disturbances are less than 10 years old, indicating a rapid rise in surface-mining activity. The acreage mined has more than doubled in the last 20 years.

Duration of surface mining.—More than half of the sites sampled were quarries or pits that had been operated for more than 10 years. Only a third of the sites had been operated for less than 5 years. Most were active long enough to have a significant economic impact on the community, and usually other surface-mining operations began later within the same watershed or drainage area.

CHARACTERISTICS AND PHYSICAL CONDITION

Of the 3.2 million acres disturbed by surface mining, about a third needs no further treatment to prevent sediment or other damage to adjacent land and water. About 46 percent of these 1.1 million acres that need no treatment was stabilized by nature over a period of years; 51 percent was treated through efforts of the mining industry and individual landowners; and the rest was treated by government at some level.

On the other two-thirds, newness of the disturbed area, distance from natural seed sources, or other problems make establishment of protective plants slow or difficult. Steep or unstable slopes, acidity, or stoniness are problems in some areas. These are susceptible—in varying degrees—to erosion and may contribute sediment and other pollutants to streams that drain them.

Spoil banks

In surface-mining operations the layers of soil and rock above the mineral deposit are shoveled out and piled up in "spoil" banks. These banks are a mixture of soil, subsoil, and unweathered rock that is far from resembling a soil formed in nature. Their characteristics vary greatly among mines, and even within the same mine. Prediction of site suitability thus is best done with the help of professional soil scientists, agronomists, foresters, and other specialists.

Texture.—Spoil texture influences the amount of moisture available for plant growth. In general, spoil composed largely of sand has good aeration but is apt to be droughty. Clay banks compact easily and crust over during dry periods. Loams and silty shales usually have enough fine material to hold moisture. On about 80 percent of the surface-mined land, spoil texture is adequate for growing adapted grasses and legumes for quick erosion control and to supplement tree or shrub plantings. Rock content on about three-fourths of the banks, however, restricts the type of equipment that can be used in revegetation. On about one-fourth of the banks the spoil is suitable for farm crops.

Acidity.—Acid problems are associated largely with coal mining. They are caused when minerals left exposed to air and water react to form toxic or corrosive substances.

By itself, acidity does not directly influence plant growth. But it affects the availability of soil nutrients—dissolved minerals—and the number of soil microorganisms. Strongly acid soils may, however, dissolve enough elements to injure or destroy plants that absorb them. More than half of the sites have acid soils; 20 percent are acid enough to be a limiting factor in establishing plant cover; only 1 percent is so acid that plants will not grow. Acidity usually is reduced through weathering and leaching of the acid-forming materials.

Slopes.—More than 2 million acres (about 75 percent) have been mined on areas with original slopes of less than 20 percent—in the small watershed projects with which USDA has been working most of the mined areas have slopes of less than 10 percent. Only about 8 percent of the mined areas were on hill-sides with slopes of more than 40 percent.

Four-fifths of the affected areas were on side slopes, ridgetops, or isolated knobs from which storm-water flows need to be guided into defined stream channels—with grass waterways or chutes, for example. The other one-fifth were on valley floors close to rivers and subject to local flooding.