

Revegetation of Strip-Mined Areas in Oklahoma

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Not long after the War Between the States, there developed a new system of coal mining in our country. This system was the mining of coal by removal of the overburden. The terms "spoil" and "overburden" refer to soil and other matter overlying coal veins.

Although it was estimated to be two and one-half times cheaper to mine coal this way, the development of the method was impeded until the World War I. This was due to the lack of power equipment and a demand for coal. From then on, the removal of overburden became the mining method which has rearranged the topography of thousands of acres in twelve states.

In order to combat the mass removal of the topsoil, some states such as Ohio and Pennsylvania, have passed laws requiring the posting of a bond as indication that the companies will re-level the spoil area. In Oklahoma, however, no such law exists. Thus, the counties of Coal, Craig, Haskell, Latimer, LeFlore, Muskogee, Okmulgee, Pittsburg, Rogers, Tulsa, and Wagoner are confronted with the problem of revegetating these areas.

To better understand the problem, it becomes necessary to examine the types of removal and their effects upon the spoils.

The first of the three types of operations to be considered will be draglining. The dragline, in removing the overburden, places the spoil in a conical pile. By removal of the top-soil and the sub-soil first and the placing of rocky material on top the task of revegetation is difficult. If, by this type of operation, the rock strata is low in soil content, then the percentage of plants to survive will be small. The conical shape spoils also erode easily.

The power-shovel is the usual type of machine used in strip-mining operations. Although the spoils contents are of similar composition, there is a general preponderance of calcareous and fine textured materials. The two great limiting factors are acidity and low soil content.

The tandem operation is the last to be considered. This type of operation requires two steps. The upper overburden is removed from a succeeding cut and then placed on a former cut. By using this system, the soil is more homogenous and therefore easier to plant.

In order to work out a solution to the problem, the Forestry Department, State Universities, and the Soil Conservation Service got together to try some experiments. The first problem was how and when to plant. In order to arrive at a conclusion, it is necessary to know something about the erosion and the type of material involved. It was found that erosion was very intense, unless the spoils were protected by rocks or shale. Erosion rounds off the tops of the ridges and takes away sheets of soil material along the side, but does not actually reduce the slope of the ridges. In the spoil area there is a tendency toward leveling of the colluvium. Upon examination, it was found that very shaly spoil may stay as steep as eighty per cent after 25 years. The more stones on the overburden, the less likely it would be to erode.

The most opportune time for planting depends upon the state of erosion of the spoil. It is generally considered best to wait for a period of one to two years. When volunteer plants first appear in the recess, it is then time to start the revegetation process.

The second phase before replanting is the determination of the potential soil material and its quality. It was found that the spoil has ample

moisture, but was deficient in nutrients. Many coal deposits contain large amounts of pyrite of iron and other forms of iron sulfide and very gentle oxidation easily results in sulfuric acid. Many spoil banks contained local areas of calcareous materials adjacent to strongly acid material.

In considering the vegetation for the spoils, it has been found that they can be used for pasture or forest. The determining factor is, if the soil is calcareous, it must be pasture; if not, it must be planted in forest. When the slope is less than ten per cent, acid soils are suitable for orchard planting. This has been tried successfully in Illinois.

By leveling and using large amounts of lime and other fertilizers, many spoil areas have been known to produce thirty bushels of wheat and eighty bushels of corn per acre. However, it must be pointed out that it would cost more than \$300 per acre for leveling, plus tons of fertilizer to put the soil in condition for crops.

Most of the strip-mined lands of Oklahoma are suited for forestry. In experiments in Tulsa, Wagoner, and Rogers counties it was found that black locust and evergreen trees grow much better than some other varieties of trees. Due to acid spots on the spoils in some areas, re-vegetation is not practical. Evergreen trees, with about five years growth, were cut and sold in Tulsa for Christmas trees. This method is perhaps the most immediate in bringing financial return. In addition to Christmas trees, the forest on overburden areas adds to production of wood, helps control erosion, and provides a wildlife refuge. Most of these lands are particularly adapted to the growing of fence posts, mine props, pulpwood, and timber. Although definite data is lacking, it is estimated that the overburden area will take from fifteen to twenty years to grow fence posts, mine props, and pulpwood. The production of sawlogs will require a much longer period of time. By the use of selective planting and thinning, trees of the highest quality may be raised.

When the soil is calcareous, pasture planting will be about the only solution. It has been found that grass and legume crops will grow readily in these areas. Here, too, the soil with mild forms of acidity may also be planted in alsike clover or lespedeza. In preparing the pastures for planting, it has been found that the best method is to grade off the peaks of the overburden, thus making a rolling terrain.

Calcareous spoils have been and are being developed into highly successful grazing areas. By the use of grass and legumes, they will support beef cattle and sheep herds easily. Seeding by airplanes is the cheapest method and gives the farmer a better pasture. Recently the use of helicopters for seeding and spraying have proved feasible.

By revegetation of strip-mined areas, we are turning a wasted, deformed eyesore into a productive and useful area. These areas may be used as pasture, forest, or recreational areas to beautify our state.

Perhaps the greatest value per acre for the overburden areas is for industrial uses. In many places near cities where population pressure is great and land values high, it is profitable to level the strip-mined areas. This is in evidence on Tulsa's northeast side. It can thus be assumed that all strip-mined areas can be satisfactorily rehabilitated.