

STRIPMINE RECLAMATION RESEARCH IN OHIO¹

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Many problems have arisen in conjunction with the accelerated coal-stripping industry of Ohio. They concern widely-varying phases, from revegetation of the spoils to economic effects of stripping on community organization. Because of the rough terrain left by stripping shovels and the natural vegetation surrounding the stripped area, most early concepts of reclamation centered around the establishment of forest trees. The Central States Forest Experiment Station began making tree plantings on coal spoils in central Ohio in 1937, and has carried on a forestry research program since that time. Recent experience has shown that agricultural crops, such as pastures, berries, and orchards may have a place in the reclamation program. Also, the extreme variability of results of all types of plantings, caused by chemical and physical relationships of spoil material, pointed to the need for basic information. In order to supplement earlier work which was done with trees, and to begin investigations aimed at finding out how to establish plants successfully on as many spoil types as possible, the Ohio Agricultural Experiment Station undertook stripmine reclamation research in 1950.

There has been considerable progress in the reclamation of Ohio's spoil banks since the days of the first reported stripping in Jefferson County in 1913. Early reclamation attempts were sincere efforts by the coal operators to revegetate the spoils. Dean (1925) reported that the Wayne Coal Company had devoted 45 acres to forestry work in Jefferson and Harrison Counties. Black locust was planted almost exclusively at that time. By 1937, about 200 acres had been planted in Ohio to black locust, white ash, red oak, black walnut, and several species of pine. Recent examinations of some of these areas show that the locust has been damaged extensively by the locust borer. Volunteer black cherry, elm, and other hardwoods are gradually invading the areas. The locust has generally failed to produce good commercial fence posts as intended, but has served as a nurse crop to speed succession along. In 1940, the formation of the Ohio Reclamation Committee, later known as the Ohio Reclamation Association, marked the first attempt by the operators to solve their reclamation problems by cooperative action.

Increasing pressure of public opinion caused the passage in 1947 of the first Ohio stripmine reclamation law, and in 1949 the now effective coal stripmine land reclamation act. This act provides that a bond of \$190 per acre will be forfeited by the operator if grading and planting are not completed within two years after stripping; spoils are to be graded to gently rolling topography and planted according to a previously approved plan. To administer the law, the 1949 act established the Division of Reclamation under the Ohio Department of Agriculture. This Division licenses coal operators, helps them plan reclamation work, holds their bond until the work is completed, and makes a final inspection to see if reclamation meets the provisions of the law. Administration of the law is the function of the Division of Reclamation; the Ohio Agricultural Experiment Station is at present responsible for solving the technical difficulties of revegetation of spoils.

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The reclamation research program of the Ohio Agricultural Experiment Station includes the following phases of the stripmine problem: a survey is being made to determine the amount and distribution of the land directly affected by coal stripping in the state; observations of plantings made by coal operators are continually carried on; experimental plantings of trees, pasture plants, and berries are being made; basic laboratory research concerning the spoil materials is supplementing the field observations; and greenhouse studies are being conducted.

Before a comprehensive plan for carrying on stripmine research could be completed, knowledge about the areas requiring reclamation was essential. During 1951 new aerial photographs of the state became available. They were made during 1950 and early 1951 by the Production and Marketing Administration, U. S. Department of Agriculture. After preliminary examinations of sample areas, it was decided that valid estimates of stripped areas could be made directly from the photos with a minimum of effort.



FIGURE 1. Grading stripmine banks, Harrison County, Ohio, January, 1950.

Two results were sought from the photo survey; an outline map of each county showing the approximate extent and location of all stripped land, and an estimate of the stripped area in each county using a method similar to that described by Moessner and Jensen (1951). The two operations were carried out with one examination of the photos. The photos of each county containing stripping were arranged in order; a templet of dots was placed over the net area of each photo. The number of dots to be counted in a given county was based upon the percentage distribution of the two attributes to be tallied, in this case stripped land and non-stripped land. A rough estimate of the percentage of stripped land provided the number of dots required for a precision of ten percent maximum error at the .05 level of significance, used as a goal in each county. Both the dots falling within land affected by stripping and the total dots were tallied; their ratio is equivalent to the ratio of the acres of stripping to the total acres in the county. The area of stripping was computed from this proportion.

The stripped area appearing on each photo was outlined with grease pencil, avoiding duplication, after the dot-tally was completed. Each photo was projected on a county highway map, with photo scale reduced and oriented to that of the map by means of a reflecting projector, and the stripped areas outlined on the county map. Each completed map was traced to show only county outline, county seat, and stripped area. All 27 counties containing stripping were handled in this manner, photographed, and assembled for a state photograph (fig. 3).

Dean (1925) reported that 16,000 acres of Ohio's lands were subject to stripping in Jefferson, Harrison, Tuscarawas, Perry, and Muskingum Counties. Limstrom and Merz (1949) reported about 36,000 acres stripped by 1946, based on an extensive survey of the extent, distribution, and makeup of the spoils of Ohio conducted by the Central States Forest Experiment Station. The Ohio Agricultural Experiment Station survey produced an estimate of 76,000 acres stripped in the state by 1951, with the areas varying from 3 acres in Monroe County to 16,000 acres in Harrison County. Field reconnaissance work to determine distribution of the spoil types will complete the information desired from this survey.

Many coal operators and their representatives very conscientiously spend a great deal of time and money trying to revegetate their spoils. It is only by locating and examining some of the older plantings made long before the compulsion of the reclamation law, that the long-range effects of planting on spoils can be observed. Valuable information has been obtained from study of planting successes and failures of coal operators.

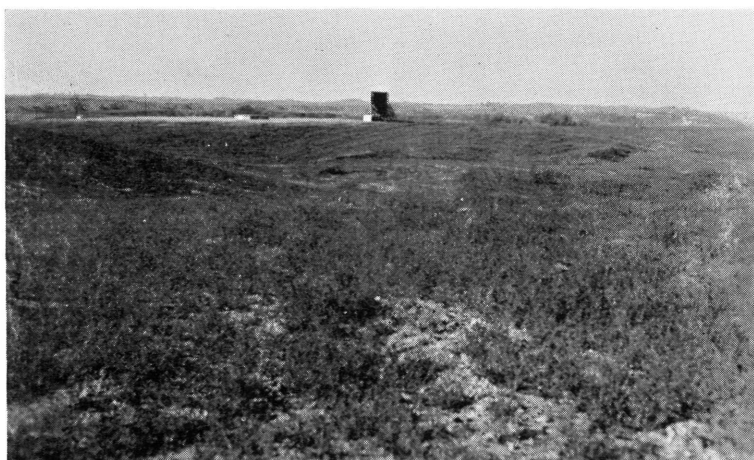


FIGURE 2. Established pasture on same area, October, 1950.

Experimental plantings being made now will furnish information about the treatment necessary for establishment of trees, pastures, and berries, especially on the more acid spoils of the state. Trees being tried include red elm, red maple, hybrid poplar, walnut, and chestnut. Forage crops such as alfalfa, birdsfoot trefoil, bromegrass, timothy, and bluegrass can be successful in the limestone spoil region of eastern Ohio. Experimental plots of these and other forage crops, using different lime and fertilizer applications, have been recently established on acid spoils. Small plantings of blueberries, raspberries, and grapes also are being made with the advice of horticulturists.

Basic research concerning spoil materials has been initiated at the Ohio Agricultural Experiment Station to supplement field plantings and observations. The purpose of this study is to obtain much-needed information regarding the chemical and physical nature of the different spoil types in order to achieve rapid and successful reclamation. Within the state, spoil materials range in pH from about two to nearly eight, and in texture from sands to heavy clays. Plant growth sometimes occurs on quite acid spoils in one area but not on less acid spoils in another; apparently there are toxicities or nutrient deficiencies involved which require chemical determination. The surface of stripped and graded land is

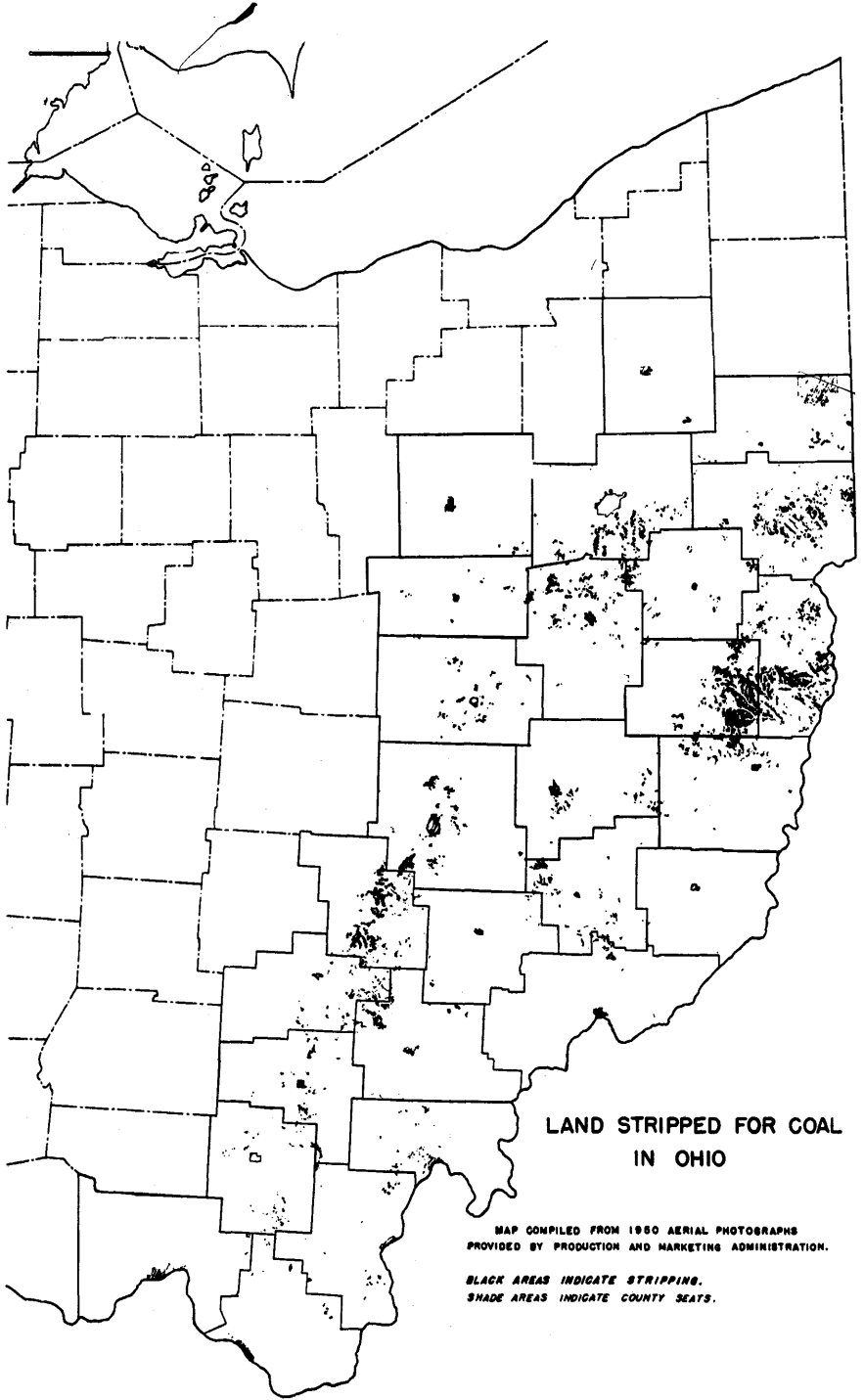


FIGURE 3.

extremely variable as a result of different stripping methods, rock strata, and depths of cut.

Surface sampling for laboratory study must be done carefully to insure significant results; it has been found that composite samples consisting of at least eight subsamples from each area visibly different in color, texture, and mineral content will provide satisfactory material for further study in the laboratory and greenhouse.

In order to obtain the basic information desired, research is being directed along several lines: chemical studies of the mineral elements in the spoil material; chemical analysis of the plants grown on spoils; trial of new plant species for use on the various spoil types; treatment of spoil materials with limestone and fertilizers to promote plant establishment and growth; and observations of the rock strata exposed in the highwall of the final cut.

Spectrographic techniques are being perfected to facilitate the chemical studies of spoils and plant materials. Preliminary investigation has shown that high acidity of many spoil types is accompanied by relatively high solubility of elements such as iron, aluminum, manganese, copper, cobalt, zinc, lead, and nickel. Some of these are essential in trace amounts for plant growth but toxic at higher concentrations. When acid spoils are permitted to remain exposed until the acidity has been reduced by natural weathering and leaching, these desirable elements are lost. On the other hand, application of limestone both reduces the acidity and precipitates the trace elements, thus conserving them for future use by plants.

Greenhouse studies are being conducted to complement the direct chemical investigations of spoil materials. New species of forage plants can be more economically tried in small scale greenhouse plantings than in the field; successful growth there will be followed by more extensive field trials. Chemical analysis of plants grown under controlled greenhouse conditions will reveal the natural availability of nutrient elements and show the results of soil treatments with limestone and fertilizers.

In order to obtain basic criteria for classifying spoil types, observations are being made on the rock strata disturbed in stripping. These observations are supplemental to those made and reported by the Central States Forest Experiment Station. The newly stripped spoil material alone cannot be used readily for complete identification since its properties such as texture, reaction, and chemical and physical composition undergo rapid changes upon exposure to weathering. Observations of thickness and type of rock strata such as sandstones, shales, and limestone together with records of the ultimate spoil properties will eventually be used to guide reclamation of new spoils.

Stripping in the State of Ohio is proceeding at a rate of about 6,000 acres per year, with a total of about 76,000 acres affected at the start of 1951. Approximately three-quarters of that area was stripped before the first reclamation law and will remain untouched except for the land voluntarily reclaimed by the coal operators. All land affected by stripping subsequent to 1947 will be reclaimed under provisions of Ohio law. The Ohio Agricultural Experiment Station is carrying out research to help the stripmine industry fulfill its reclamation obligations to the people of Ohio.

LITERATURE CITED

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