

hour and operates a car pool to transport his crew to and from work.

In Arkansas, the first State to get into operation, Green Thumbers planted trees every 20 feet along the right-of-way of a 40-mile stretch of road. In all, they planted 150,000 trees.

In Minnesota, Green Thumb crews planted 105,000 trees, cut several miles of brush that obscured views of two lakes, and cleared and cleaned up along the 40-mile Crow Wing Saddle and Canoe Trail.

In New Jersey, the crews concentrated upon planting and caring for shrubbery in medial strips of highways to reduce headlight glare for safer night driving.

Those are just a few of the tangible accomplishments reported in the third quarter of the first year.

What about the future of Project Green Thumb?

"Naturally, we hope to continue and

to expand the work," Carstenson said.

"More than 1 million older and retired farmers over 65 badly need additional income. We have proved they can and want to work; that they can carry out projects of value to the public."

Director Carstenson said an important byproduct of the project is developing new skills among the oldsters so that, once the age-prejudice barrier is overcome, they can obtain useful part-time employment as gardeners, nurserymen, landscapers, and similar work. Another is rural opportunity loans to help them set up nurseries to grow plants for future beautification work.

It can safely be said of Project Green Thumb that it is helping to alleviate poverty among our rural senior citizens, stimulating the self-pride and economy of small towns, beautifying the highways, retraining oldsters to a useful trade, and providing motorists with travel pleasure.

## Healing Strip Mining Scars

MAURICE K. GODDARD



ALTHOUGH the extraction of minerals is important to our material well-being, it is the duty of government, industry, and the people to protect the land from surface mining damage in order to maintain a livable and pleasant environment.

This case study illustrates how planning procedures, developed and carried forward to fruition by government, industry, and local communities, can erase the scars of strip mining operations and restore a pleasing appearance to a thoroughly blighted area.

In the beginning, the anthracite region of northeastern Pennsylvania was a rich, mountainous land. It was spectacularly

beautiful with deep forests and countless clear, sparkling streams.

Deep underground mining was conducted in this region for over 100 years. Great masses of debris, consisting of the material removed in driving passages to reach coal seams and refuse from the breakers, accumulated around the collieries. This material encroached upon the surrounding communities.

After the transition to the open pit mining of coal deposits which began in the early 1930's, the appearance of the



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landscape began to change very rapidly.

A vast amount of the surface material which was stripped away to expose and extract the underlying coal was spread over wide areas. Today a visitor to the region sees that large portions of this once bounteous and beautiful land have been severely damaged by years of mining operations which have despoiled about 24 percent of the total land area. Open pit mining has accounted for 76 percent of the 112,928 acres of the land surface which have been affected by coal mining activities.

Although landscape beauty and prosperity should go hand in hand, visitors and industry encouraged to locate in the anthracite region were repelled by the scarred landscape, eroded spoil banks, waste dumps, burning culm piles, and polluted streams. The detrimental effects of surface mining offset the many favorable factors which could bring about an industrial development and economic growth and thus contribute to the prosperity of the region and the happiness of those working and living there.

Since steps have been taken to deal effectively with the scars of mining operations, the economic growth of the region has been stimulated. Industry and people have been attracted to the area in ever increasing numbers. A total of 750 new industries have located here since 1946. Job opportunities have been

created for 56,326 people with a payroll of over \$214 million.

Trees have always been the objective in the reclamation and improvement of surface mined areas. Their propagation still stands as one of the best methods of attaining an improved economic benefit by restoring the natural beauty of an area which has been very extensively disturbed by strip mining.

A need to enhance and restore the esthetic beauty of the anthracite region, in order to further its economy and to provide an attractive, wholesome, and satisfactory environment, was recognized early in 1961 by the Pennsylvania Power & Light Co. Financed by funds provided by the company, "Operation Trees" was developed in cooperation with the North-eastern Forest Experiment Station.

The Forest Service technical personnel started a three-phase research study of the problem. They located, classified, and mapped all areas disturbed by surface mining in the anthracite region extending from Carbondale, near the northeast corner of Lackawanna County, to Lykens in Dauphin County. Disturbed areas were classified and shown on 41 detailed maps as strip mine bank or spoil piles from deep mining operations. Towns of over 5,000 population formed the basic unit where possible. County and regional maps were also prepared. The areas were further classified on the basis of the



*Strip mined area near Trevorton, Pa.*

amount of natural vegetation present, as well as their suitability for screening. Roadside plantings would not only beautify the highways, but would also screen bleak spoil piles from view.

Areas visible from the main highways were outlined on the maps and then were classified as to whether roadside screens would be effective. If not, cover plantings on the spoils were designated.

Revegetation research was undertaken under controlled conditions upon mine spoils to determine growth, survival rate, and suitability for cover and screening.

Results of the three-phase study have provided information and principles for tree planting upon spoil banks in the anthracite region and also have indicated where additional studies are required.

The spoil banks are now classified into four types, according to the characteristics of the material and acidity. A survey which included height measurements, vigor, and survival counts was made of the species established on graded spoils and related to individual coal seams. Investigation of the oldest tree plantation has disclosed that some spoils will produce timber products, and that the tree survival is generally better with spring planting. It also was found that certain species are suited to certain spoil types, as European white birch for extremely acid sites. Species selection is important on good sites to produce commercial timber, and is essential on poor spoils for obtaining the best cover.

These studies have demonstrated that one solution to the problem of recapturing the beauty of the anthracite area is the planting of trees which will shield unattractive spoil areas, giving the impression of great wooded areas. Evergreens, which provide year-round cover, are the most suitable for this purpose.

Screening and the small amounts of cover planting will later have to be followed by extensive cover planting and by a physical reworking of the land—grading and leveling.

Up to September 1966, the Pennsylvania Power & Light Co. has spent about \$100,000 on "Operation Trees" and has furnished nearly 625,000 seedlings for this ambitious project.

It is estimated that 100 million seedlings will be needed in the anthracite area to plant all the disturbed areas to recommended standards. The company has supported studies in 41 demonstration areas utilizing 14 tree species which include 10 types of conifers, 3 hardwoods, and hybrid poplar clones to determine the performance of these forest tree species on strip mine spoils.

The Pennsylvania Department of Forests and Waters supplied all the hybrid poplar cuttings which were used in these experiments.

### Community Support

Planting of seedlings which began in 1962 has received the cooperation and endorsement of entire communities, as well as government agencies. Participants in plantings include civic, business, and social groups, coal operators, landowners, merchants, unions, and youth groups like school classes, Girl Scouts, Boy Scouts, 4-H Clubs, Future Farmers of America, and Future Homemakers.

After 3 years, enthusiastic interest in the tree planting project has been sustained, and the screening phase of the program is about completed. The project promises to bring about a remarkable improvement in the area's appearance during the early 1970's.

The company is embarking on a research program for the use of a mechanical process that will seed mixtures of grasses, legumes, and trees.

Studies will also be continued on the adaptability of several types of grasses and trees on spoil piles.

The first tree plantings on anthracite spoils were made during 1938 by Stanley Mesavage, a forester, for the Susquehanna Collieries Co. A preliminary survey of the problem was also undertaken in 1940 by C. E. Ostrom of the Allegheny Forest Experiment Station, followed by the experimental greenhouse studies on spoil acidity and fertility conducted by William E. McQuilkin in 1943 at the Northeastern Forest Experiment Station.

These latter studies were concurrent with studies made by Joseph Paddock,

forester, with the Wilkes-Barre Chamber of Commerce during the early 1940's.

In 1944, the Pennsylvania Department of Forests and Waters initiated experimental plantings. After the passage of the first Anthracite Strip Mining and Conservation Act for the Commonwealth of Pennsylvania in 1947, the department administered the tree planting required under the law.

A total of 200,000 trees were planted by the department of forests and waters between 1944 and 1950. Results of planting could not always be evaluated due to failures and losses occurred in restripping. Some 25 to 30 percent of the volunteer plantings, during the 1964-65 seasons, have been affected by restripping and the relocation of highways and industrial sites in revegetated areas.

### Research Unit Set Up

About 1955, the Pennsylvania Department of Mines and Mineral Industries began to administer the planting of trees on anthracite spoils. During the 1963-66 period, the department supervised the planting of about 3 million trees. Over 1 million were planted in spring of 1966.

In 1957, the Pennsylvania Department of Forests and Waters, in cooperation with the Northeastern Forest Experiment Station and the School of Forest Resources of Pennsylvania State University, formed a research committee to solve the problems of tree planting on coal mine spoils. This committee now includes the Pennsylvania Department of Mines and Mineral Industries, Pennsylvania Game Commission, Pennsylvania Conservation Association, Izaak Walton League, West Virginia Pulp & Paper Co., and Pennsylvania Coal Mining Association.

It has made important contributions concerning the knowledge and methods of strip mine revegetation. Although this committee's research has been primarily directed toward bituminous revegetation programs, the work has been very closely coordinated with the anthracite area's revegetation program and has aided it.

A total of 6,625,000 trees are estimated to have been planted on anthracite spoil

piles since 1938 by the U.S. Forest Service, the State department of mines and mineral industries, the State department of forests and waters, by industry, and by community groups.

About 20 percent or 22,400 acres of the disturbed areas in the anthracite region of Pennsylvania has been revegetated by natural processes. Screen plantings of 1,000 trees per acre have reclaimed another 600 acres in other areas.

I feel that our knowledge and progress in the reclamation and revegetation of mined areas has greatly improved. However, much research in these fields needs to be done before the problem of revegetating mine spoils is solved.

We need a greater knowledge of the physical and chemical characteristics of spoil materials. Our knowledge of the species of trees, shrubs, herbs, grasses, and methods for their establishment on highly acid spoils must be enlarged. Active research in this direction is being continued by personnel of the Northeastern Forest Experiment Station at Kingston, Pa., assisted by industry, State agencies, and private groups.

For further reading:

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