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LAND DISTURBANCES FROM STRIP-MINING IN EASTERN KENTUCKY. 3. LICKING RIVER COAL RESERVE DISTRICT.

Abstract. Results of an airphoto survey to determine the extent of land disturbance by coal mining and by coal-haul roads in one of the six coal-reserve districts of eastern Kentucky. Describes the district, forest cover, physiography and geology, and distribution and physical characteristics of the 1,456 acres disturbed in this 1.1 million-acre district.

Open-pit or strip-mining—primarily for coal—has expanded rapidly in eastern Kentucky during the past 15 years. Information about the amount, location, and general characteristics of the disturbed areas is necessary for appraising the economic impacts and overall effects of strip-mining in that section of the State, for planning reclamation programs, and for determining research needs and priorities.

To obtain reliable estimates of the acreage disturbed both by the mining itself and by the associated coal-haul roads, and to provide relevant information about the disturbed areas, a survey was made. The survey was based on aerial photographs of all stripped areas as of October 1964.

The survey was broken down in accordance with the six subdivisions or coal-reserve districts delineated by the U.S. Geological Survey,¹ and a separate report on each district is planned. The first two reports^{2, 3} have been published. This is the third in the series.

¹Huddle, J. W., F. J. Lyons, H. L. Smith, and J. C. Ferm. COAL RESERVES OF EASTERN KENTUCKY. U. S. Geol. Survey Bull. 1120, 147 pp, 1963.

²Plass, William T. LAND DISTURBANCES FROM STRIP-MINING IN EASTERN KENTUCKY. 1. UPPER CUMBERLAND COAL RESERVE DISTRICT. U. S. Forest Serv. Res. Note NE-52. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa. 1966.

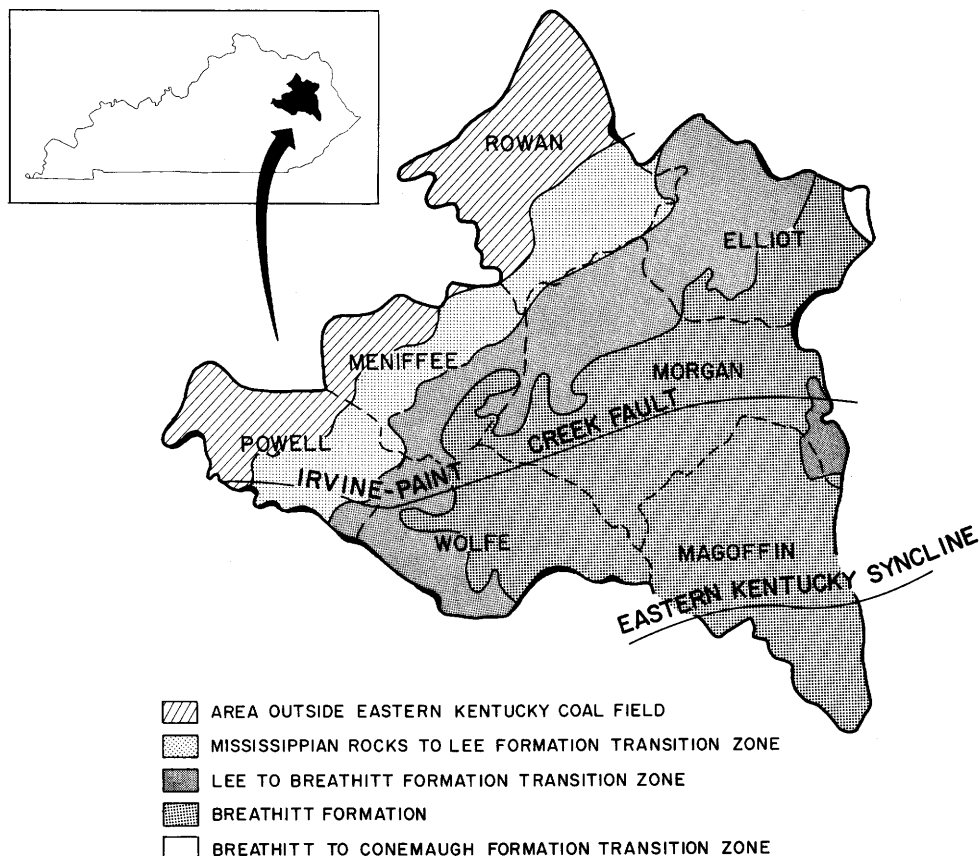
³Plass, William T. LAND DISTURBANCES FROM STRIP-MINING IN EASTERN KENTUCKY. 2. PRINCESS COAL RESERVE DISTRICT. U. S. Forest Serv. Res. Note NE-55. 8 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa. 1966.

The method used in our survey was a modification of forest-survey procedure. A 3-by-6-inch transparent template with 25 dots per square inch was positioned over the center of each photograph. Areas on the photographs that appeared to be stripped land or coal-haul roads were examined stereoscopically to determine important characteristics, and the amount of area in various categories was estimated by dot counts.

The Licking River District

The Licking River Coal Reserve District is located along the western edge of the eastern Kentucky coal field. It includes all of Morgan, Elliot, Magoffin, and Wolfe Counties and portions of Rowan, Powell, and Meniffee Counties (fig. 1). The District has produced less coal than any of the

Figure 1.—Geographic and geologic features of the Licking River Coal Reserve District.



other six districts because of limited reserves and generally thin beds. However, refractory clay is an important mineral in Rowan County.

The first coal mining occurred in Morgan County about 1850. Since that date about 10 million tons have been mined in the district. Strip-mining, which probably began in the 1950's, has expanded very slowly and only in a few localities. The Kentucky Department of Mines and Minerals⁴ reported 1962 production from all mining to be 178 thousand tons. Seventeen percent of this total came from strip mines.

District coal reserves (measured, indicated, and inferred) are estimated to be 2.2 billion tons. However, less than 1 billion tons are in beds more than 28 inches thick. Magoffin County has more than half of the estimated reserves and has 75 percent of the beds that are more than 42 inches thick.

In Rowan County, clay mining has been active for many years. The mines are small and individually result in small areas of disturbance. It is estimated that there are extensive reserves of refractory clay, but the supplies of specific grades may be diminishing.

Forest Cover

About 75 percent of the district land area is covered with forests.⁵ In the clay- and coal-producing areas forests generally cover the slopes and ridges. Eighty percent of the disturbance from surface mining for clay and coal is located on the upper slopes and ridges. Ninety percent of the disturbed areas have forests immediately below and adjoining the disturbance.

About one-half of the commercial forest stands are of sawtimber size. These are generally mixtures of hardwood species but varying percentages of southern pine are found in some stands. In Elliot, Menifee, and Wolfe Counties 20 percent or more of the forest land is in southern pine and southern pine-hardwood types.

Physiography and Geology

The topography of the district is varied. On the western edge, the major streams have cut steep-walled canyons into the Pottsville escarpment. Above the escarpment the topography is gentler and the valleys broaden. Finally, near the headwaters of the major streams, the valleys narrow as they wind into the more rugged uplands.

⁴Mandt, A. H. ANNUAL REPORT. Kentucky Dep. Mines and Minerals. 166 pp. 1963.

⁵Unpublished preliminary report, BASIC FOREST RESOURCE STATISTICS, NORTHERN CUMBERLAND UNIT, KENTUCKY, 1963. U. S. Forest Serv. and Kentucky Dep. Natural Resources, 1965.

Tributaries to three major river basins are located within the district boundaries: the Licking River drains a major part of the district; the Little Sandy River, in the northeast, drains most of Elliot County; in the south and west the Red River, a tributary to the Kentucky River, drains Wolfe and Powell Counties.

There are only a few geologic features that substantially modify the structural geology of the district. Chief among these are the Eastern Kentucky Syncline, which controls a gentle southeastwardly dip of the strata, and the Irvine-Paint Creek fault, which accounts for some discontinuity in coal bed correlation.

On the basis of the surface geology we recognized four zones from west to east: the Mississippian rocks to Lee formation transition zone; the Lee to Breathitt formation transition zone; the Breathitt formation; and the Breathitt to Conemaugh formation transition zone. The Lee formation is a clay producer and the Breathitt formation a coal producer. The Breathitt formation underlies about two-thirds of the land area in the District.

The coal reserves in the Breathitt formation are based on 18 seams. Of these, only four have been mined by open-pit methods.

Distribution of Stripped Areas

As of 1964, 1,456 acres in this 1.1-million-acre district had been disturbed by strip- and auger-mining. Of this total, 926 acres were attributed to coal stripping and 530 acres to open-pit clay mining.

Rowan County had the greatest amount of disturbance, even though only one-third of the County is considered to be in the eastern Kentucky coal field. The disturbance in this portion of the County totalled 520 acres or 0.79 percent of the land area (table 1). All of this was from clay mining.

Morgan and Magoffin County each had about 450 acres of disturbance from strip- and auger-mining for coal. Very small acreages have been disturbed in Wolfe and Elliot Counties and no disturbance from strip-mining was observed in Menifee and Powell Counties.

Of the area underlain by the Breathitt formation, 895 acres or 0.12 percent had been disturbed. Next among the geologic zones in area disturbed was the Mississippian rocks to Lee formation transition zone, with 497 acres. However, the disturbance in this zone was proportionally greater, amounting to 0.33 percent of the land area.

The four coal seams strip-mined were the Zachariah, Fire Clay, Fugate, and Hindman. Sixty percent of the disturbance in the District resulted

Table 1.—*Acreage disturbed by open-pit mining in the Licking Coal Reserve District*

County	Lee to Mississippian transition zone	Lee to Breathitt transition zone	Breathitt formation	Breathitt to Conemaugh transition zone	Total disturbed acreage	Percent of total land area
Elliot	—	10	—	—	10	0.01
Magoffin	—	—	454	—	454	.23
Morgan	—	—	433	—	433	.16
Menifee	—	—	—	—	0	0
Powell	—	—	—	—	0	0
Rowan	497	23	—	—	520	.79
Wolfe	—	31	8	—	39	.03
Total disturbed acreage	497	64	895	0	1,456	0.10
Percent of total land area	0.33	0.02	0.12	0	0.01	—

from mining the Hindman coal seam in Magoffin County. Next in importance was the Fugate or Sebastian coal bed mined in Morgan and Magoffin Counties.

The Olive Hill clay bed is the clay producer in the District, and it outcrops extensively in Rowan County. It occurs near the base of the Lee formation.

Physical Characteristics of Disturbed Areas

There are two basic types of strip-mining in the eastern Kentucky coal field: contour- or rim-stripping, and area-stripping. Auger-mining is usually employed as a supplement to contour-stripping. About 60 percent of the 1,456 acres disturbed in the District results from contour-stripping for clay or coal.

In the contour-stripping, 9 percent of the disturbed area was on or above the highwall; 53 percent was in pits, inslopes, and leveled or unleveled benches; and 38 percent was in the out slopes. Of the 335 acres in out slopes, 67 acres, or 20 percent, were in slides or slumps.

Area-stripping, which made up 40 percent of the total disturbed acreage, was done in most cases on ridge tops where the overburden was relatively shallow. The area-stripping was about equally divided between coal and clay operations. The proportional distribution of the disturbed area by bank position was as follows: on or above the highwalls—2 percent; pits, inslopes, leveled or unleveled benches above the out slopes—54 percent; out slopes—44 percent. Slides and slumps occurred on 49 percent of the 254 acres of out slope area.

Table 2.—*Disturbance by coal haul-roads*

County	Clay mining		Coal mining		Total	
	<i>Acres</i>	<i>Miles</i>	<i>Acres</i>	<i>Miles</i>	<i>Acres</i>	<i>Miles</i>
Elliot	—	—	2.5	0.7	2.5	0.7
Magoffin	—	—	45.9	12.1	45.9	12.1
Morgan	—	—	23.0	6.1	23.0	6.1
Menifee	—	—	—	—	—	—
Powell	—	—	—	—	—	—
Rowan	40.8	10.7	—	—	40.8	10.7
Wolfe	—	—	5.1	1.3	5.1	1.3
Total	40.8	10.7	76.5	20.2	117.3	30.9

Leveling of the disturbed areas has been required by state law since 1954. In this District, 78 percent of the area disturbed by clay mining had been leveled and 10 percent had been partially leveled. Less leveling had been done on the areas disturbed by coal mining—30 percent completed and 1 percent partially leveled.

According to estimates derived from dot counts on the aerial photos, coal and clay haul-roads built by the mining operators had disturbed 117 acres in the district. The average width of disturbance along these roads was 31 feet, which means that each mile of road disturbed about 3.8 acres. Thus the 117 acres converts to about 31 miles of road (table 2). On the average, there were 47 acres of mining disturbance for each mile of road.

About 80 percent are primary haul-roads built from county, state, or federal highways to the mining site. The remainder are secondary haul-roads, joining two mining sites or serving as spurs for primary haul-roads.

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