U. S. FOREST SERVICE RESEARCH NOTE NE-69

1967

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FOREST SERVICE, U. S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA.

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LAND DISTURBANCES FROM STRIP-MINING IN EASTERN KENTUCKY. 4. BIG SANDY 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 acres disturbed in this 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] Thus there will be a series of six reports, of which this is the fourth.

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

[1]Huddle, 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.

photographs that appeared to be stripped land or coal-haul roads were examined stereoscopically to determine important characteristics, and the amount of areas in various categories was estimated by dot counts.

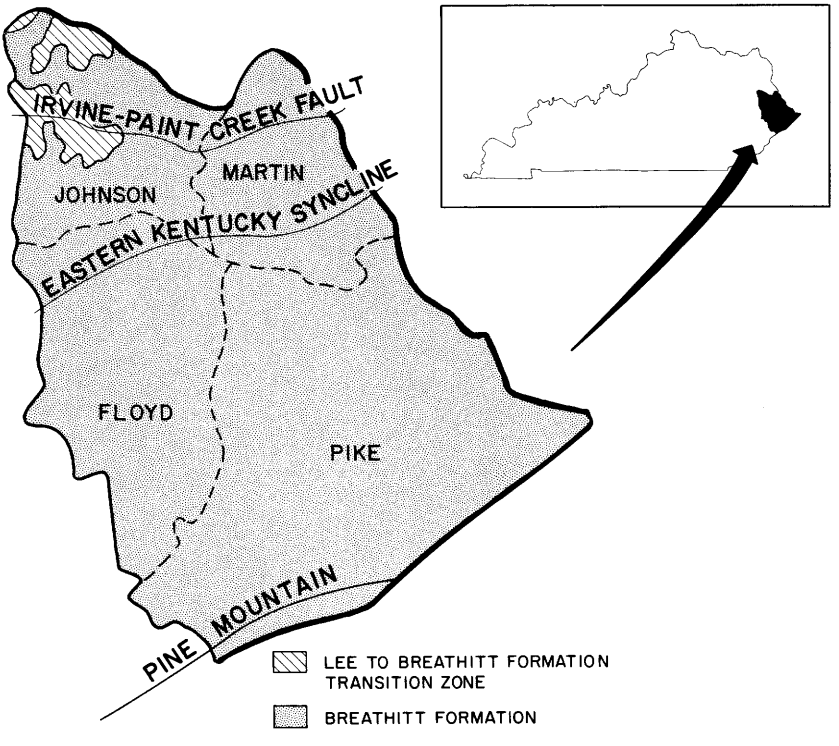
The Big Sandy Coal Reserve District

The Big Sandy Coal Reserve District, one of the major coal producing centers of eastern Kentucky, includes all of Johnson, Martin, Floyd, and Pike Counties (fig. 1). Most of the disturbance due to strip-mining occurs in Pike County.

The first coal mining in the District began in Johnson County in 1879. Production in the other counties began after 1900. The total production up to 1955 was 510 million tons. In 1962, 17 million tons were produced by underground-mining and by strip- or auger-mining.[2] Of this, about 2 percent came from strip mines, and 7 percent came from auger-mining.

[2]Mandt, A. H. ANNUAL REPORT. Ky. Dep. Mines and Minerals. 166 pp., 1963.

Figure 1.—Geographic and geologic features of the Big Sandy Coal Reserve District.



In 1947 Merz found 171 acres of strip-mine disturbance in the District.[3] All of this was in Pike County, and all of the spoils were less than 5 years of age.

District coal reserves, (measured, indicated, and inferred) are estimated to be about 10 billion tons.[1] Three billion tons are in beds more than 42 inches thick, and 4 billion tons are in beds 28 to 42 inches thick. About 60 percent of these reserves are in Pike County, and 30 percent in Floyd County.

Forest Cover

Forests cover about 83 percent of the District's land areas, and nearly all of the non-forest land is located in the valleys.[4] About 60 percent of the strip and auger mines are located on the upper slopes and ridges. Ninety-seven percent of these mines have forest immediately below and adjoining the disturbed area.

Sixty percent of the commercial forest stands are of sawtimber size, with oak-hickory and central mixed hardwood types dominating. Pine and oak-pine types occur on 5 percent of the forest land.

Physiography and Geology

Narrow V-shaped valleys and ridges with moderately steep slopes characterize the topography of the District. The average relief increases from north to south.

The Big Sandy River drains the entire District by two secondary drainage systems. Tug Fork on the east, which is the boundary between West Virginia and Kentucky; and Levisa Fork, which meanders through the heart of the District to headwater in Virginia.

Structural geology in the District is controlled by the eastern Kentucky syncline in northern Floyd County and in central Martin County.[1] To the south the syncline causes a regional dip of about 1 degree to the northwest. North of the syncline, the dip is to the southeast, but it is broken by the Irvine-Paint Creek fault. Along the southern boundary, the Pine Mountain overthrust block influences a very small portion of the District.

The rocks outcropping in the District are confined to the Lee and Breathitt formations of the Pennsylvania Age. The Lee formation out-

[3]Merz, Robert W. CHARACTER AND EXTENT OF LAND STRIPPED FOR COAL IN KENTUCKY. Ky. Agr. Exp. Sta., Circ. 66, 27 pp., 1949.

[4]U. S. Forest Service and Kentucky Department of Natural Resources. BASIC FOREST RESOURCE STATISTICS, EASTERN UNIT, KENTUCKY, 1963. 1965. (Unpublished preliminary report on file at the Kentucky Division of Forestry and the Northeastern Forest Experiment Station, Upper Darby, Pa.).

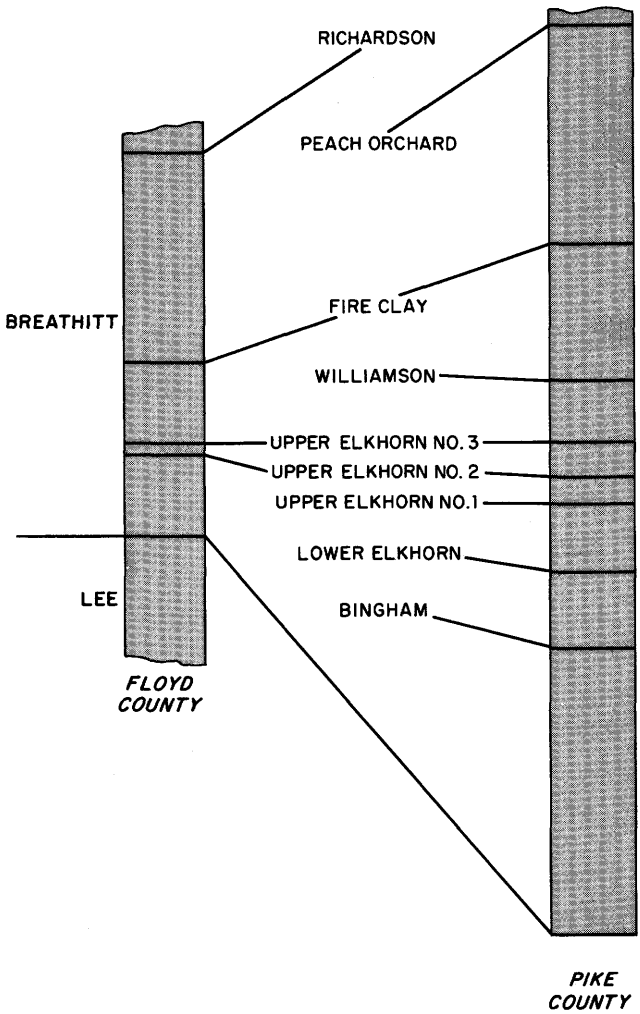


Figure 2.—Relative position of the coal beds mined by the open-pit method in the Big Sandy Coal Reserve District.

crops in a small area in northwestern Johnson County and along Pine Mountain. The remainder of the District is underlain by the coal-bearing Breathitt formation. The thickening of this formation from south to north causes problems in coal-bed correlation. The magnitude of this problem can be measured by the interval between the top of the Lee formation and the Peach Orchard coal seam. In the north these are 900 feet apart, but in southern Pike County the interval increases to 3,000 feet.

In the Breathitt formation the U. S. Geologic Survey recognizes 21 coal beds of commercial importance.[1] Of these, nine have been strip- or auger-mined (fig. 2).

Distribution of Stripped Areas

By 1964 strip- and auger-mining had disturbed (excluding coal-haul roads) a total of 8,343 acres or 0.8 percent of the total land area within the district (table 1). Pike County had the largest acreage (7,719 acres) and the highest percentage of area disturbed (1.5 percent). In Floyd County, 581 acres, or 0.2 percent of the total land area, had been disturbed. Only 43 acres had been disturbed in Martin County, and there was no disturbance in Johnson County.

Of the nine coal seams mined, Upper Elkhorn No. 3 was the most extensively mined. Forty-six percent of all mining disturbance in the District resulted from mining this coal seam. Other seams with large acreages of disturbance were Fireclay, Williamson, and Upper Elkhorn No. 2.

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 usually is employed as a supplement to contour-mining; it is a means for working a seam beyond the point where removal of the overburden by stripping is economically feasible. In this district 97 percent of the disturbance has resulted from contour-stripping. All the area-stripping occurred on the ridge tops.

In the contour-stripping, 11 percent of the disturbed area was on or above the highwall; 43 per cent was in pits, inslopes, and leveled or

Table 1.—*Disturbed area by counties and coal seams in the Big Sandy Coal Reserve District, in acres*

Coal Seam	Floyd County	Johnson County	Martin County	Pike County	Total
Bingham	—	—	—	463	463
Lower Elkhorn	—	—	—	309	309
Upper Elkhorn No. 1	—	—	—	154	154
Upper Elkhorn No. 2	58	—	—	849	907
Upper Elkhorn No. 3	227	—	—	3,613	3,840
Williamson	—	—	43	1,158	1,201
Fireclay	267	—	—	1,158	1,425
Peach Orchard	—	—	—	15	15
Richardson	29	—	—	—	29
Total	581	0	43	7,719	8,343
Percent of land area disturbed	0.2	0	+	1.5	0.8

Table 2.—*Mileage of coal-haul roads in the Big Sandy Coal Reserve District*

Road Class	Johnson County		Martin County		Floyd County		Pike County		Total	
	Acres	*Miles*	*Acres*	*Miles*	*Acres*	*Miles*	*Acres*	*Miles*	*Acres*	*Miles*
Primary	—	—	3	.3	31	3.5	359	40.9	393	44.7
Secondary	—	—	—	—	18	2.0	183	20.9	201	22.9
Third-class	—	—	—	—	—	—	13	1.5	13	1.5
Total: Acres	—	—	3	—	49	—	555	—	607	—
Miles	—	—	—	.3	—	5.5	—	63.3	—	69.1

unleveled benches above the outslope; and 46 percent was in outslopes. Of the 3,723 acres in outslopes, 9 percent or 335 acres was in slides or slumps.

On 77 percent of the contour-stripping operations, there had been some grading of the spoil between outslope and highwall or pit. About 10

percent was graded to nearly level benches. Probably most of this leveling has been done since the enactment in 1954 of state legislation requiring reclamation of areas disturbed by strip- and auger-mining.

All the area-stripping—250 acres—was done on the ridge tops where the overburden was relatively shallow. The proportional distribution of the disturbed area by bank position was as follows: on or above the highwall, 2 percent; pits, inslopes, leveled or unleveled benches above the outslope, 53 percent; and outslopes, 45 percent. Slides and slumps occurred on 18 percent or on 20 of the 112 acres in outslopes.

Some leveling had been done on 77 percent of the area-stripping. Fifteen percent had been graded to a nearly level bench.

In all stripping operations, the operator must build and maintain a network of roads for hauling coal from the mines. In this survey we classified haul roads as: primary (running from a public road to the mine); secondary (joining two pits or serving as spurs for primary roads); or third class (service roads and temporary haul roads).

We estimate that 607 acres had been disturbed by coal-haul roads in this district. This figure was computed directly from dot counts on the aerial photographs. After determining the average width of the road disturbance to be 73 feet by field measurement, we converted acres to miles of road. By this calculation there were 69 miles of road in the District. This mileage was distributed among the three classes of roads as follows: primary, 45 miles; secondary, 23 miles; and third-class, 1 mile (table 2). On the average there are 121 acres of strip-mining disturbance for each mile of coal-haul road.

About 90 percent of these roads ran through forested country. Forty percent of the first-class roads were built in the valley bottoms; the remainder were built along the hillsides. The distribution for secondary roads was as follows: valley, 13 percent; slopes, 64 percent; and ridges, 23 percent. All of the third-class roads were located on the ridges.

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