

COAL MINING AND LANDSCAPE CHANGE: THE CASE OF HARRISON COUNTY, OHIO¹

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Abstract The evolving landscape of Harrison County, Ohio illustrates the interaction between increasing coal demand and modern mining technology upon the available resource base, as modified by changing reclamation policies and practices. A subsistence production period (before 1915) and an early commercial period (1916-1940) were followed by the high, but fluctuating, coal demands of the current commercial period (1941 to present). Post-war technology has enabled less accessible and/or commercial reserves to be mined over larger areas. Mined landscapes created prior to the Reclamation Act of 1949 are generally composed of low conical hills or parallel ridges, revegetated by natural invasion or voluntary afforestation programs. Post-law landscapes are largely graded, often benched or gently contoured, and more recently have been replanted in forage species. The concentration of extensive mining in the southeastern portion of this once productive pastoral Appalachian county has been concomitant with a 50% reduction of land in agriculture, a 70% reduction in number of farms and a shift to larger farms north and west of the mined area.

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Harrison County has traditionally been a major coal producing county of the eastern Ohio coal fields. Over the past century and a half, subsistence and commercial coal mining have profoundly affected both the physical and cultural components of the county's landscape. Studies of such an evolving landscape may enable the morphology of future mined landscapes within the region to be properly planned and managed so that the affected lands can be returned more quickly to acceptable states of productivity. The objectives of this paper are to trace the history of mining in Harrison County, to describe the impact of this activity on the evolving landscape and to discuss the implications of this upon local land use patterns.

STUDY AREA

Harrison County lies in the Appalachian Plateau near the center of the productive eastern Ohio coal fields. The area consists primarily of undisturbed sandstones, shales, limestones, and associated coal beds of Pennsylvanian and

Permian age which dip gently to the southeast. The Flushing Escarpment crosses the eastern portion of the county trending slightly northeast to southwest. The section to the east contains generally open valleys and broad interfluves flanked by gentle slopes. The western section is steeper and more dissected and the larger streams have well developed floodplains.

Approximately 800 feet of strata are exposed in the county (Brant and DeLong 1960). The upper portion of the Allegheny Formation crops out only in the lower reaches of the major western drainages (fig. 1). It contains both the Lower and Upper Freeport coal beds. Although the latter bed is commercially inferior, a major commercial reserve of Lower Freeport coal lies at depth beneath several eastern townships. Two minor coal beds are found in the Conemaugh Formation that dominates the western and northern townships and underlies the larger valleys east of the escarpment. Scattered remnants of the Monongahela Formation are found in the hills and broad interfluves of the eastern and southern townships. The Pitts-

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burgh coal forms the base of this formation, the Meigs Creek bed lies roughly midway, while the Waynesburg coal caps the formation. No coal is contained in the lower Washington Formation found on isolated hilltops in the southeastern corner of the country. The original coal reserves generally increased in a southeasterly direction owing to the greater volume of Monongahela Formation present. Over half of these estimated reserves were concentrated in the four southeastern townships of the county (Brant and DeLong 1960).

east of Cadiz, where the open valleys and broad interflaves simplified mining operations. Commercial strip mining began in 1916 and by 1920, steam shovels were actively mining Pittsburgh coal (Eckley and Perry 1921). Underground production from the extensive Lower Freeport reserve beneath the eastern townships began in 1927.

World War II greatly increased the national demand for coal. The county's largest producer, Hanna Coal Company, concentrated on the surface mining of Pittsburgh coal south and east of Cadiz,

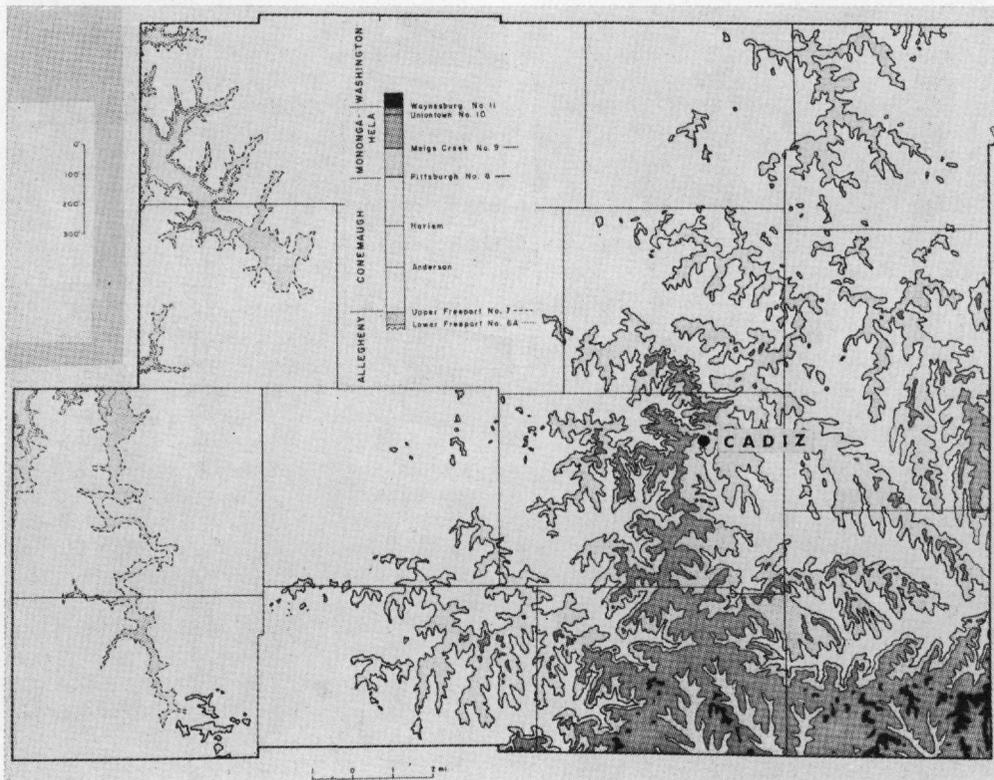


FIGURE 1. Distribution of geologic formations and coal seam outcrops (Ohio Div. Geol. Surv. 1954; White 1947) and generalized stratigraphic column (Brant and DeLong 1960) for Harrison County, Ohio.

MINING HISTORY

Local villagers and farmers used all coal beds in the county during the last century for fuel (Stevensen 1878). Three commercial mines were opened by 1907 and coal was shipped by rail from the county (Brownocker *et al* 1908). Most early commercial production was concentrated in the area lying east and south-

while additional wartime activity was centered north and northeast of Cadiz. Here, less capable pre-war equipment often removed the deep overburden in two layers in order to reach some scattered reserves in this hilly terrain. The Meigs Creek bed was brought into surface mine production by the end of the war (Ohio Division of Mines 1946).

Post-war mining was characterized by both the introduction of large-scale excavation equipment and by a diffusion of activity from the traditional mining area. The MOUNTAINEER, the first of this country's gigantic shovels, was purchased in 1956 to rework older mine sites east and southeast of Cadiz where overburden depths had been prohibitive. The SILVER SPADE began operating in 1965, reworking formerly mined areas adjacent to the Flushing Escarpment south of Cadiz (Bovenizer and Ault 1967). In some locations, the Meigs Creek bed was mined in conjunction with the Pittsburgh bed. As the locally accessible near-surface deposits became depleted, more attention shifted to the deeper Pittsburgh reserves (Ohio Division of Mines 1960) and the Lower Freeport bed (Ohio Division of Mines 1968). Concurrently, the scattered near-surface deposits of Pittsburgh coal throughout the hills and ridgetops southwest of Cadiz (Ohio Division of Mines 1963), and the very limited Waynesburg deposits (Ohio Division of Mines 1970) were brought into production.

More recently, mining began northeast of Cadiz in the formerly noncommercial Harlem bed (Ohio Division of Mines 1975).

Mining activity in Harrison County may be divided into three relatively distinct coal production periods (fig. 2); a primarily subsistence period up to 1915; an early commercial period from 1916 to 1940; and the current commercial period from the beginning of World War II to the present. The relative importance of each bed has changed over time (table 1). While the Pittsburgh bed was traditionally the major producer, recent production has shifted to the more accessible Meigs Creek coal and underground to the Lower Freeport reserve.

LANDSCAPE MODIFICATION

Sixty years of commercial coal mining has directly modified significant portions of the county's landscape. These mined landscapes can be divided into two major types—those mined prior to the Ohio Coal Strip Mine Land Reclamation Act of 1949 and those mined since the Act.

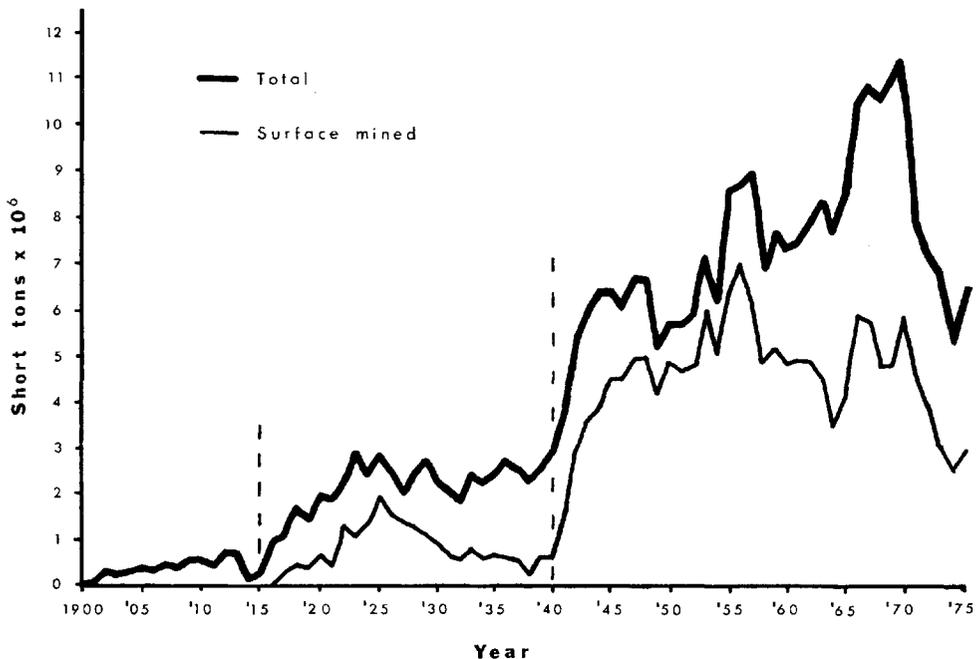


FIGURE 2. Coal production for Harrison County, Ohio for the subsistence period to 1915, the early commercial period of 1916-1940, and the current commercial period since 1940. Production peaks in the latest period represent war demands and the purchase of large-scale extraction equipment. Sources: Ohio Div. Mines (1956b, 1957-1976).

TABLE 1
Coal reserves and coal production for Harrison County, Ohio

Bed	Estimated total reserves* (%)	Total production period 1830-1975** (%)	Current production period 1941-1975** (%)	Recent production 1970-1975*** (%)
Waynesburg	<1	<1	<1	4
Meigs Creek	8	15	18	33
Pittsburgh	31	63	56	22
Upper Freeport	24	<1	2	3
Lower Freeport	36	21	22	38
Total amount (short tons x 10 ⁶)	1,583	321	259	46

*Source: Brant and DeLong (1960).

**Sources: Ohio Division of Mines (1956b, 1957-1976).

***Sources: Ohio Division of Mines (1971-1976).

Landscape differences are primarily related to the mandatory reclamation requirements for grading and planting and to changing mining technology—especially the increased capabilities of the mining equipment. The pre-law landscape is composed of low conical hills or parallel ridges of modest relief. The post-law landscape is usually more extensive and may possess greater local relief, even though it has been graded sometimes benched to eliminate the irregular topography. Many mined sites are bordered on the upslope side by a terminal pit and an adjacent highwall that may reach 120 feet in height and run for several miles. The terminal pit, as well as other depressions created by mining activities, often impound drainage waters by modifying local runoff and groundwater patterns. Riley (1960) estimated that strip-mine lakes constitute approximately 5% of the mined landscape in eastern Ohio.

The local overburden is composed of a heterogeneous mixture of fragmented and unweathered parent material, subsoil, topsoil, and coal debris. Mills (1964) indicated that this material was generally above pH 6.5, high in basic nutrients, and low in organic matter and nitrogen. Exceptions are found in a predominately sandstone area in the southcentral portion of the county or at local sites where coal debris or pyrite

deposits have been exposed at the surface. The county does not have the acid-mine drainage problems affecting many other areas owing to the buffering effect of local limestones on the acid forming minerals.

Revegetating the overburden banks hides and stabilizes the material; regulates water, nutrient, and sediment yields and may provide an economic base for forestry, grazing and recreation. Many of the pre-law banks support shrub and hardwood communities that have developed through natural invasion and succession. Some operators did voluntarily replant their mined lands prior to the Reclamation Act of 1949. Early mandatory afforestation programs achieved varying degrees of success with such species as black locust (*Robinia pseudo-acacia*), silver maple (*Acer saccharinum*), green and white ash (*Fraxinus pennsylvanica* and *F. americana*), European alder (*Alnus glutinosa*), Norway spruce (*Picea abies*), red and white pine (*Pinus resinosa* and *P. strobus*), cottonwood (*Populus deltoides*), tulip poplar (*Liriodendron tulipifera*), and sycamore (*Platanus occidentalis*) (Reilly *et al* 1965). In addition, some revegetation programs of the mid-1960's strongly emphasized the use of crownvetch (*Coronilla varia*) and other forage species, such as alfalfa (*Medicago sativa*), birdsfoot trefoil (*Lotus corniculatus*), sweet clover (*Melilotus*

alba), brome grass (*Bromus inermis*), and orchard grass (*Dactylis glomerata*).

LAND USE

Historically, Harrison County was one of the more productive agricultural counties of the Appalachian Plateau, leading the state and ranking third nationally in sheep production in the 1880's (Eckley and Perry 1921). Between 1890 and 1969, the amount of land in agricultural use was reduced by 50%, while the number of farms declined by over 70% (fig. 3). These conditions resulted in a nearly twofold increase in average farm size. Sitterley (1964) described a similar but generally less dramatic change in agricultural land use for the unglaciated portion of southeastern Ohio.

and abandonment of cleared farm land in Harrison County primarily to strip-mining.

Coal mining has affected over 17% of the surface area of Harrison County (Ohio Division of Forestry and Reclamation 1969). The distribution of this mined landscape approximates that of the original Monongahela Formation, although a few small mined areas do occur in several western townships. The southeastern half of the county, however, is a mosaic of mined areas of various sizes, shapes, and ages, with attendant high-walls, lakes, and haulroads, several small settlements, and the remnants of a few active or relict farms. Large portions of formerly agricultural land were either leased or sold to the coal companies.

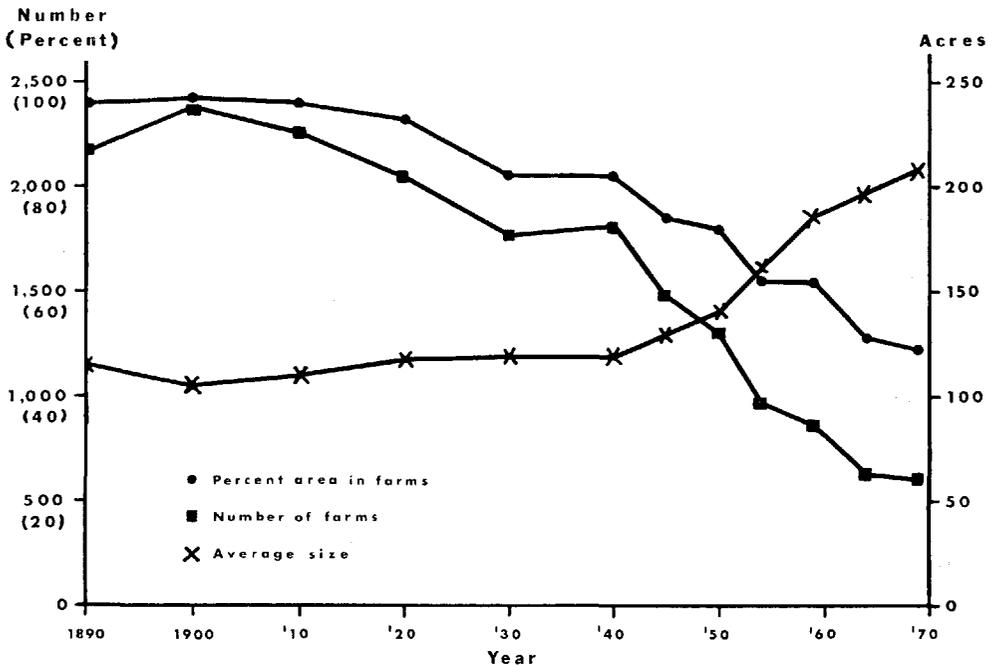


FIGURE 3. Number, average size, and % area in farms, Harrison County, Ohio—1890-1969. Sources: U.S. Dept. Comm. (1900, 1910, 1920, 1930, 1945, 1954, 1959, 1964, 1969).

Although the 19th century westward migration of the sheep industry and the 20th century rural-urban outmigration contributed to changing landuse patterns within Harrison County, the dramatic changes were concomitant with the advent of large scale mining in the early 1940's. Hart (1968) attributed the loss

Land in the northeastern townships was generally leased and mined during the 1940's, while the continuous mining of the southeastern townships has been on lands generally purchased outright by the coal companies.

Much of the mined land apparently has been perceived to be "other land" and

generally was not included in cropland, pastureland, or forest and woodland land-use categories (Harrison County Conservation Needs Committee 1963). Most of the mined land has not been returned to agriculture, although some of the few remaining farms in mined areas have integrated some affected land into the farm unit, and one coal company has leased portions of its holdings for cattle grazing. The majority of the county's current agricultural production, however, comes from dairying and livestock concentrated on the larger farms in the northern and western townships outside the mined area. During the last decade, approximately 75% of the farmers worked more than 100 days off the farm, many in the local mines (Winnery and Hill 1965).

Over the past decade, recreational land use has become more important. A state park in the Harrison County Reclamation Area was opened on partially mined land north of Cadiz. This park provides facilities for camping, picnicking, hiking, fishing, riding, and hunting. A smaller, but intensively used, local park provides camping, picnicking, and fishing facilities immediately south of Cadiz. Several local organizations also have club facilities on mined land and local residents have fished for bass (*Micropterus* sp.) and bluegill (*Lepomis macrochirus*) in the surface-mine lakes for decades.

The evolving landscape of Harrison County illustrates a succession of inter-related activities. By understanding the evolution of such mined landscapes, some of the environmental impacts to be caused by increased future mining may be evaluated. By planning for their eventuality, the affected areas may be integrated into local land management programs designed to achieve predetermined states of biotic and economic productivity.

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