

AVAILABILITY OF COAL RESOURCES FOR FUTURE DEVELOPMENT IN ILLINOIS

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INTRODUCTION

The Illinois State Geological Survey (ISGS) in co-operation with the U.S. Geological Survey (USGS) is conducting a series of studies of the availability and recoverability of coal resources in Illinois. The goals of these studies are 1) to determine the quantity, characteristics, location, cost of mining, and recoverability of resources available for future mining in Illinois and 2) to identify the significant geotechnical and land use factors that limit the availability of coal for development.

Traditional estimates of coal quantities reported by the ISGS, USGS, and U.S. Department of Energy, such as identified resources or demonstrated reserve base, report the total amount of coal in the ground that meets very broad criteria of thickness and drill hole spacing. While these figures are necessary for very long-range energy planning, they provide a misleading picture of resources attractive for mining over the next twenty years. Resources are deposits of coal "in such forms and amounts that economic extraction is currently or potentially feasible" (Wood et al. 1983). The demonstrated reserve base is that portion of the resources "that meets specified minimum physical and chemical criteria related to current mining and production practices" (Energy Information Administration 1996). In actuality, much of the resources and reserve base cannot be mined or cannot be mined profitably due to environmental and regulatory restrictions, the presence of towns and other cultural features, current mining technology, and geologic conditions.

The ISGS attempted to provide some perspective on minability of resources by subdividing resources into categories of "high," "moderate," and "low" development potential (Treworgy and Bargh 1982). Due to lack of detailed knowledge about specific restrictions on mining and the then limited capability to integrate information on restrictions with resources, the classification of resources by their development potential was very general and did not consider many significant geotechnical restrictions to mining.

To address these problems, the USGS is sponsoring a program to determine the quantity of coal that is "available for mining under current and foreseeable conditions" (Eggleston et al. 1990). The concept of the USGS coal availability studies is to use detailed studies of sample areas, generally 7.5-minute quadrangles (an area of about 56 square miles), to identify restrictions to mining. The sample areas selected are representative of

conditions for a broader mining district. The restrictions identified in the sample areas are then extrapolated to larger regions to estimate the total amount of available coal.

This paper describes the study of available coal resources in Illinois, provides an example from the study of the Galatia Quadrangle, presents cumulative results for the quadrangles completed to date, and makes a preliminary extrapolation of some of the findings. Six published reports on this project, including the results from individual quadrangle studies, are available from the ISGS (Treworgy et al. 1994, Treworgy et al. 1995a, Treworgy et al. 1995b, Jacobson et al. 1996, Treworgy et al. 1996a, and Treworgy et al. 1996b).

To provide a framework for these investigations, the state was divided into seven regions, each with differing geologic and physiographic conditions (fig. 1). The available resources of coal are being assessed for two to six quadrangles in each region. Findings from the individual quadrangle studies will then be extrapolated to produce an estimate of available coal resources for each region and, ultimately, the entire state.

The methodology for each quadrangle study area is to map the resources and related geology of all coals present within the quadrangle. Mining engineers and geologists from three or four companies familiar with mining in the conditions found on the quadrangle then are interviewed. In the interviews, the company representatives examine the maps of the quadrangle, delineate the areas they do and do not consider to be suitable for mining, and explain the factors they considered in reaching their decisions.

The information obtained from the interviews is combined to produce a set of criteria defining available coal resources in that quadrangle. Although mining experts seldom agree on all details of the criteria defining available coal, this process helps us to identify land use patterns, geologic conditions, and other technical factors that impose significant restrictions on the availability of coal.

As of the fall of 1996, assessments of available coal have been completed for eight quadrangles and studies are underway in five additional quadrangles. We plan to complete studies of about 26 quadrangles in order to have sufficient information to extrapolate the results to the statewide level.

To date, twelve mining companies and consulting firms, plus the Illinois Office of Mines and Minerals, have participated. The expert advice and data we have received from these organizations have been invaluable to the success of the project. By the time the project is completed we hope to have worked with all the companies actively involved in the coal mining industry in the state.

EXAMPLE OF QUADRANGLE STUDY

The study of the Springfield Coal in the Galatia Quadrangle provides a typical example of our quadrangle assessments. The Galatia Quadrangle is located in Saline County, just north of the city of Harrisburg.

The coal seam ranges from less than one to more than eight feet thick (fig. 2). About 90 million tons of the resources in the quadrangle have been mined or left as pillars. The Galatia channel, an ancient river that flowed through the Springfield peat swamp, crosses the northern and western edges of the quadrangle. The coal is missing in the channel and may be split into multiple benches adjacent to the channel. Numerous faults, part of the Cottage Grove Fault System, disrupt the coal across the southern part of the quadrangle.

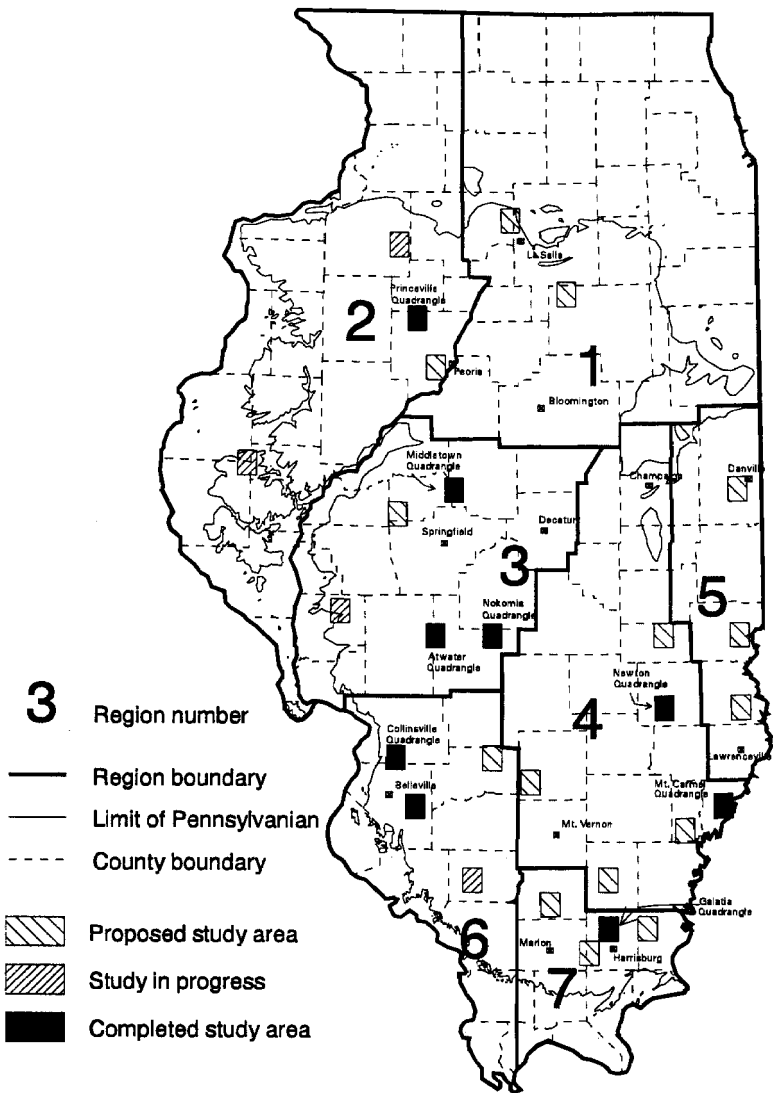


Figure 1. Quadrangles selected for coal availability studies.



Figure 2. Thickness of the Springfield Coal in the Galatia Quadrangle (from Treworgy et al. 1995a).

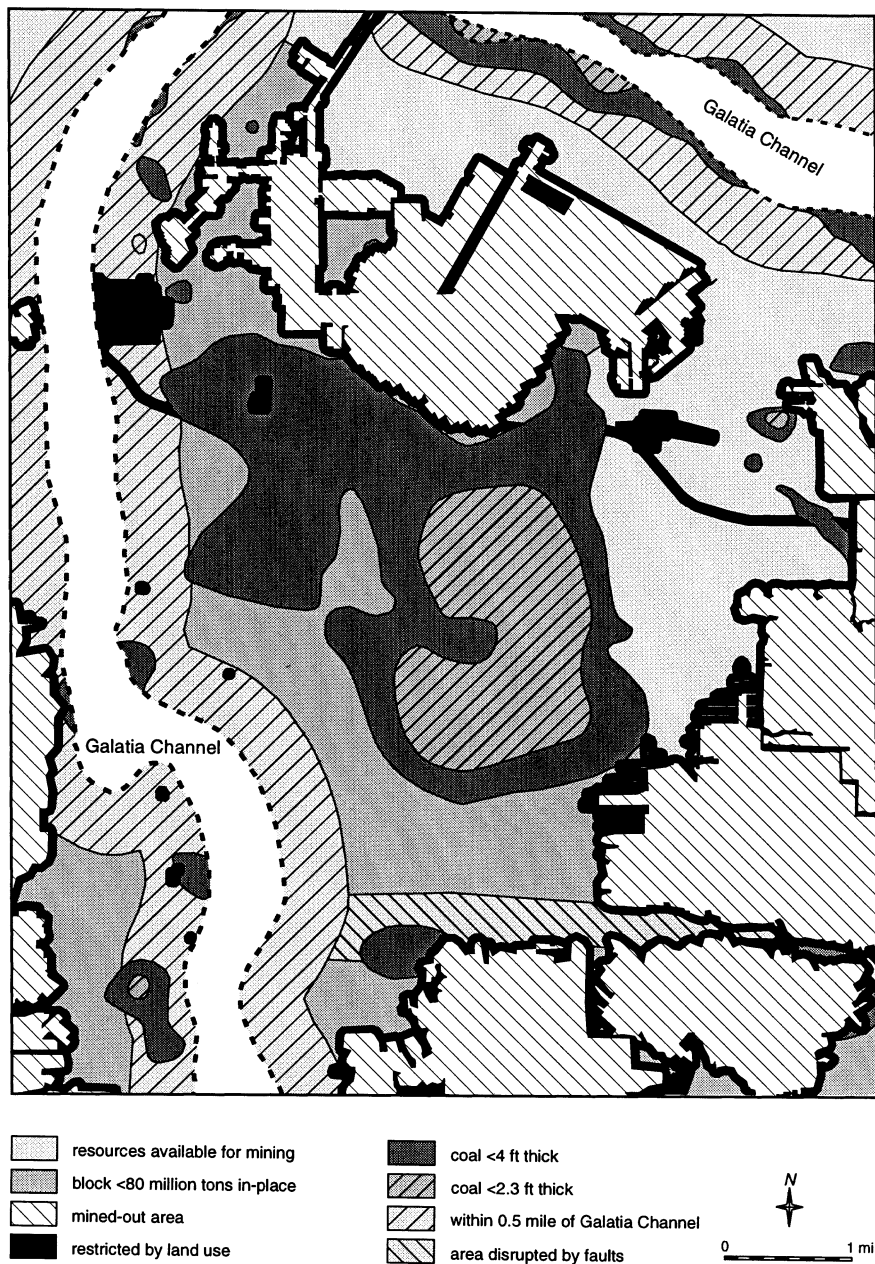


Figure 3. Availability of Springfield Coal resources for underground mining in the Galatia Quadrangle (from Treworgy et al. 1995a).

Through interviews with mining experts, several restrictions to future mining were identified (table 1; see Treworgy et al. 1995a for a complete description). Based on these restrictions, only 15 percent of the Springfield Coal resources originally present in the Galatia Quadrangle remain available for mining (figs. 3 and 4). Mining has already removed or otherwise eliminated 30 percent of the original resource; another 20 percent is eliminated by poor mining conditions associated with the Galatia channel, 13 percent reside in blocks that are too small or convoluted to mine, 10 percent are in seams that are too thin, ten percent are restricted by land use (e.g. they underlie surface features which preclude mining or are within 300 feet of abandoned mines), and two percent are restricted by faults.

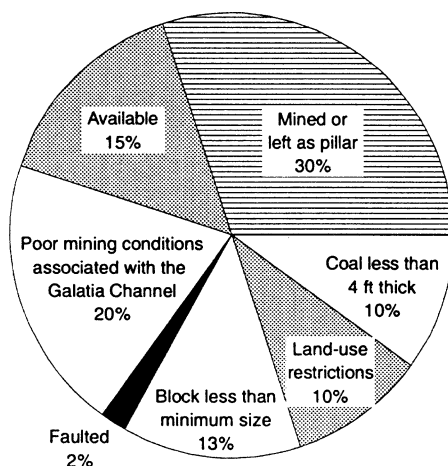


Figure 4. Factors restricting the availability of underground-minable Springfield Coal in the Galatia Quadrangle (from Treworgy et al. 1995b).

RESULTS OF QUADRANGLE STUDIES

The amount of available coal resources in the eight quadrangles completed to date has ranged from as little as 18 to as much as 76 percent of the original resources (fig. 5). Geotechnical factors such as thickness of the coal and overlying bedrock, roof and floor conditions, faults, and size of the mining block account for most of the restrictions on coal availability. Land use features such as towns, cemeteries, and interstate highways restrict from about one percent to almost 22 percent of the resources in the eight quadrangles. Cumulative availability of coal resources in the eight quadrangles is 45 percent of the original resources. Technical factors restrict 40 percent and land use six percent; three percent of the original resources have been mined or left as pillars.

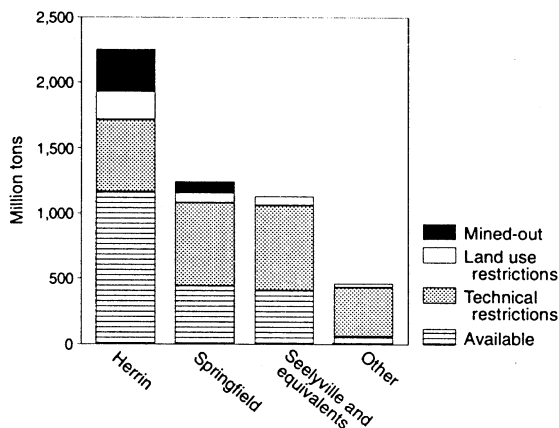


Figure 5. Availability of coal resources in eight quadrangles in Illinois (from Treworgy et al. 1996b).

Slightly more than four billion tons of resources representing 16 seams have been assessed so far. On a seam basis, the Herrin Coal has the highest availability, more than 50 percent of original resources, compared to 36 percent of the Springfield and Seelyville Coals and less than 13 percent of the other coals (fig. 6). The high availability of the Herrin Coal reflects the relatively thick, uniform character of this seam and the excellent mining conditions associated with it.

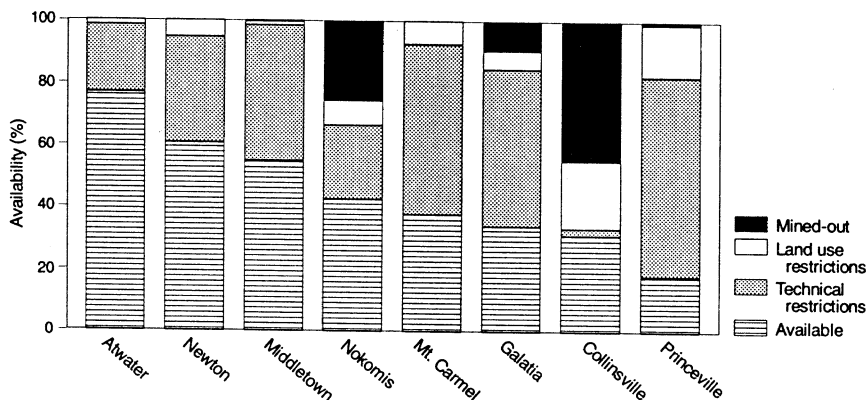


Figure 6. Tonnage of available resources by seam in eight quadrangles in Illinois (from Treworgy et al. 1996b).

EXTRAPOLATION OF FINDINGS

In the final stage of this project, findings from the individual quadrangle studies will be extrapolated to the entire state and, with the assistance of the USGS, the recoverability and cost of mining will be assessed. To offer an example of what the extrapolation will look like, the Herrin Coal resources were screened to identify areas of the state free from

some of the major restrictions identified in the quadrangles completed to date (thickness of bedrock, roof stability and mining conditions, block size, towns, and interstate highways). This is just a preliminary extrapolation; the remaining quadrangle studies will identify additional factors that will be used to refine the extrapolation.

Figure 7 shows the areas of the state where the Herrin Coal is free from major restrictions and more than 5.5 feet thick. The approximately 25 billion tons of resources can be considered to have mining costs roughly

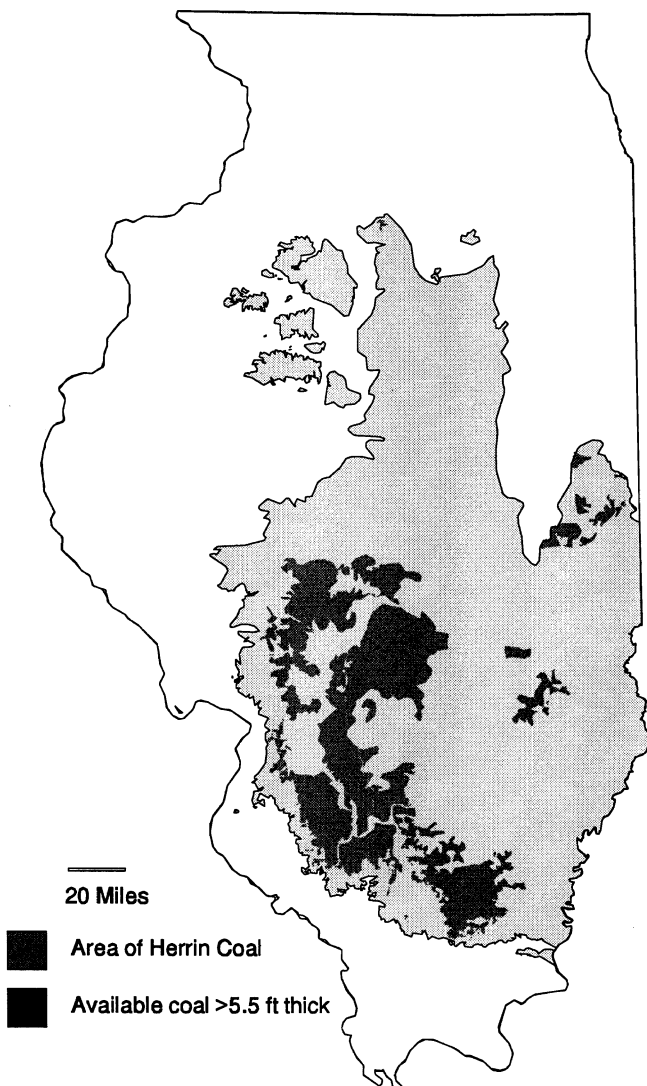


Figure 7. Available Herrin Coal resources greater than 5.5 feet thick.

comparable to those at currently active mines. They are, for the most part, at shallow to moderate depths. These resources are suitable for longwall mining because they are in large contiguous blocks and are relatively free from surface development and geologic anomalies, such as faults. For the most part, these are high-sulfur resources, but there are some low- and moderate-sulfur deposits as well.

CONCLUSIONS

This preliminary extrapolation suggests two conclusions. First, ample resources of Herrin Coal are available with characteristics comparable to those in currently active mines. Secondly, because of these ample resources, the cost of mining in Illinois will not be driven up by lack of available resources with favorable geologic conditions. While these findings will not help companies weather the current competitive market conditions, they do suggest that, over the long term, Illinois can continue to be a significant contributor to the nation's coal production.

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