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The cover image is of Pike Island at Fort Snelling State Park in Minnesota, looking west, showing the Mississippi River. Photographer Brett Whaley. (CC BY-NC 2.0)

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Editors

Contact Us

Open Rivers
Institute for Advanced Study
University of Minnesota
Northrop
84 Church Street SE
Minneapolis, MN 55455

Telephone: (612) 626-5054
Fax: (612) 625-8583
E-mail: openrvrs@umn.edu
Web Site: http://openrivers.umn.edu

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FEATURE

ANTHRACITE HERITAGE: LANDSCAPE, MEMORY AND THE ENVIRONMENT

By Paul A. Shackel

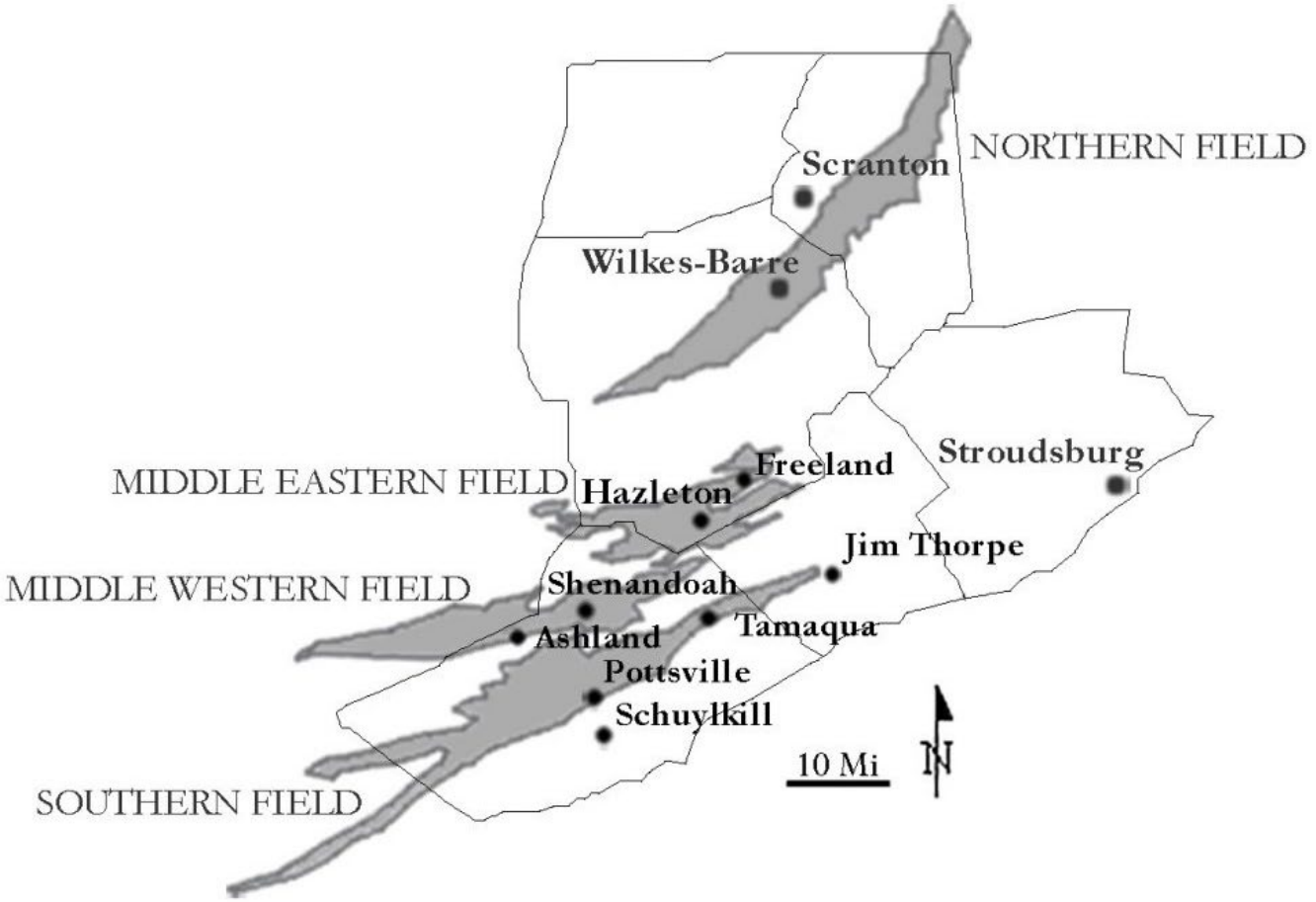
Introduction

Place always exists in a particular time, and for Northeastern Pennsylvania that time is anthracite coal time. Because coal mining has decreased significantly over the past 50 years, the result has been a major outmigration of the area's traditional population. The poverty and unemployment rates are among the highest in the country. However, the legacy of coal still runs

These mine pools have orange oxygenated water with high levels of iron hydroxide. Image by Gabby Zawacki, 2016.

deep as reminders of coal heritage are scattered throughout the 484 square miles that make up the anthracite coal region. About 15 percent of these lands have been severely impacted in some way by almost two centuries of mining, and yet much more has been indirectly affected. Scattered rubble and waste are strewn throughout patches of land, reminiscent of a barren, uninhabited moonscape. There are black mounds and hills of coal waste, known as culm banks, some reaching 125 feet high. Water running through abandoned mines are emptying into streams and rivers with very low pH and some water is orange in color, a product of acid mine drainage. While people and institutions remember the masculine history of the machine and human power needed for mining extraction, this memory occurs at the expense of overlooking the exploitation of humans and environment. The anthracite region is in need of the reclamation of memory, landscape, and the environment.

How people remember the past and what they see as important representations of their heritage is telling about how they see themselves as a community. Since 2010, the Anthracite Heritage Project has been working in Northeastern Pennsylvania with the goal of promoting anthracite heritage, as well as focusing on the application of heritage to contemporary issues, such as work, labor and migration. While working in the region, researchers soon realized that the area's heritage is also closely linked to long-term environmental degradation. While devastation tourism serves as a curiosity to outsiders, the



Map of Northeastern Pennsylvania showing the three anthracite fields and some of the cities and towns in the region. Image drawn by V. Camille Westmont, courtesy of the author.

impact of mining has had tremendous negative effects on the region.

Coal is formed from decomposed organic material that has been buried for millions of years. Heat and pressure transform this organic matter into various forms of coal: lignite, sub-bituminous, bituminous, and anthracite, which is the purest form of coal. In the anthracite region of Pennsylvania coal is found in alternating layers of rock that have been folded into mountains. The creation of anthracite is the final product of the geological process known as coalification. Anthracite contains 90-95 percent carbon. While difficult to ignite, it burns longer and cleaner than any other type of coal (Wallace 1987). The anthracite coal region in Northeastern Pennsylvania contains most of the world's supply of anthracite. The coal is located in several narrow bands that are divided into three fields—southern, middle, and northern—and run in a northeasterly direction. Most of the coal is found in seams, or "veins," that can be a few inches thick to as much as 40 to 60 feet thick and can be mined several hundred feet below the ground surface (Wallace 1987, 5).

Anthracite Coal on the Landscape

While anthracite coal was first mined in the Wilkes-Barre region in northeastern Pennsylvania in 1775, it was not until the 1820s and 1830s that east coast industries began to replace water power with coal, creating a demand for anthracite. The growing iron industry east of the Alleghenies was fed by the increased extraction of coal, and as a result, iron became cheaper and more accessible to east coast industries (Keil and Keil 2015, 7; MacGaffy 2013, 4). The demand for anthracite coal in industry and home use led to the long-term and large-scale growth of mining. Northeastern Pennsylvania's population grew dramatically as entrepreneurs and speculators invested significant capital to build an infrastructure for the mining and delivery of coal. Because of this industrial expansion there was a need for greater human labor. From 1870 to about 1920, the anthracite region became the third largest population center in Pennsylvania, after Philadelphia and Pittsburgh. At its peak during the WWI era, the coal industry employed 180,000 men. The region had 12 mining towns that contained a population between 5,000 and 10,000 residents, and 16 towns that exceeded 10,000 people. The largest cities included Wilkes-Barre (73,000) and Scranton (137,000) (Powell 1980, 18). Because of the high profit realized by the few coal operators (at the expense of hundreds of thousands workers) the mined anthracite became known as black diamonds.

Originally, the mining, breaking, cleaning, and sizing of coal was performed manually. As coal increasingly replaced water power for industry and supplanted wood to heat houses, the new consumers demanded higher quality coal without inclusions of soil and slate. The development of the breaker helped to meet this demand. The first breakers appeared in the anthracite region in the mid-1840s; they became a dominant feature on the landscape by the 1860s. Coal would be hauled to the top of the breaker and dumped into a hopper. The hopper released the coal onto a set of screens that separated the coal by size. Conveyed by gravity, the coal fell through a rotating cylindrical mud screen that separated the coal dust and soil from the rest of the coal. Then the coal passed through the breaker rolls, which were cylinders studded with teeth to break the coal into smaller pieces. These pieces fell onto screens and finally into storage bins. The coal then passed down chutes where slate pickers manually removed any bits of slate or other impurities that remained (Wallace 1987, 15–16). The waste materials that were not sold were deposited in

culm banks next to the breaker. These black mounds developed into small hills, in many cases reaching several stories high, and a few reached over 100 feet high.

Initially, the breakers were constructed of wood. People who witnessed these breakers in progress often spoke about hearing thunder in the background as the coal was broken and traveled down chutes to the slate pickers. In 1915, *The Coal Trade* noted that 300 breakers standing 100-150 feet tall could be found throughout the anthracite region, dominating the visual landscape (Powell 1980, 17). One report written in 1902 described the breaker: "The breaker is a feature of the landscape—its size, its uniform black color, softened to gray by distance; its peculiar shape, unlike any other building in the world, and the long hill of refuse called the culm pile, make it an object that challenges attention" (quoted in Goin and Raymond 2004, 35). By the 1920s and 1930s, the breakers became more mechanized and were built larger and constructed of steel. Breakers dominated the landscape, and communities identified places in reference to the breakers found in the different patch towns. Each breaker had a distinctive whistle that allowed the community to identify place (Goin and Raymond 2004, 36). The anthracite coal extraction began to decline after WWI, and by the end of WWII the

The St. Nicholas breaker, near Mahanoy City, PA. It was constructed in 1931 and dismantled for scrap beginning in 2016. Image by Paul Shackel, 2014.

bottom dropped out of the industry. By the 1970s, it was common to drive through the anthracite region and see the remains of these hulking breakers silenced and in a state of abandonment and decay.

Over the next several decades these breakers were slowly dismantled and sold for scrap. Now that the breakers and many of the industrial structures associates with anthracite mining have vanished, the culm bank is one of the reminders of this industry that still exists on the landscape. Out of sight and undetected are the hundreds of miles of coal tunnels that have been abandoned and lie waiting for reclamation.

Tourism and Commemoration of a Forgotten Land

In the 1960s it was clear that the coal industry was fatally wounded without much of a chance to rebound as oil and natural gas gained significant ground in the market. The region's economy suffered from high unemployment as mine owners closed their facilities at an alarming rate. Geographers George Deasy and Phyllis Griess (1961, 1–8) noted that the scarred landscape is unattractive to both industry and potential workers and their families. However, they explained, the very factors that make the place unattractive for industries and workers could potentially make

Mining near Stockton, PA, showing the culm banks on both sides of the road. Image by Paul Shackel, 2012.

it attractive to tens of millions of visitors who are within driving distance of the anthracite region. Tourism could help diversify the economy.

Deasy and Griess described the landscape as rough and barren. The towns and houses are unattractive and "non-modern," offering "little aesthetic beauty." However, some of the most successful tourist attractions are not places of beauty. "Instead, they draw the visitor by featuring the grotesque, the bizarre, or the repulsive" (Deasy and Griess 1961, 3). Then, Deasy and Griess make reference to the slums of Paris and New York's Harlem and the Bowery. While visitors may find the anthracite landscape repulsive, it cannot be ignored. The impacted landscape in the anthracite region is one of the largest concentrations of disturbed terrain in the world. Billions of tons of debris in the form of culm banks and mine dumps are found throughout the landscape of abandoned strip mines. Deasy and Griess explain that, "In comparison, such engineering feats as the Suez and Panama canals and the pyramids of Egypt pale to insignificant" (1961, 3). They later refer to the area as a "man-made Bad Lands."

In 1961, the only facilities to cater to outside visitors were a small anthracite gift shop in Frackville and a mine for tourists operated by the City of Scranton (Deasy and Griess 1961, 4). Three year later, these authors identified a tourism effort underway in Ashland, PA (Greiss and Deasy 1964). In 1961, the Ashland Community Enterprises constructed a 3,000-foot narrow gauge steam railroad on the old railroad bed. Hidden behind the wooded slopes are the deep gashes in the mountainside and piles of mine waste, which can be visible by the tourist rail. At the termination of the rail line is an abandoned strip mine. There is an imposing 250-foot high carved wall of solid rock that extends as far west as they eye can see. It is, Griess and Deasy (1964, 215) exclaimed, "one of the great engineering wonders of the world." Civic leaders also developed an abandoned mine tour to cater to visitors (Greiss and Deasy 1964, 216). Today, the Pioneer Tunnel Coal Mine and Steam Train Tour in Ashland remains in operation and is one of three mine tours operating in the anthracite region.

Long-term Impact of Coal

Centralia is located in Columbia County, about six miles north of Ashland. The town had a population close to 2,500 around WW II and dwindled to about 1,400 in 1960. In 1962, Centralia Borough Council decided to burn trash in an abandoned strip mine in order to reduce refuse and control rodents. The fire appeared to be extinguished, although the refuse continued to smolder undetected. A month later bulldozers tried to smother the fire, and what they found was an opening at the base of the dump which led to a maze of abandoned mines. The fire continued to burn for the next two decades despite several attempts to extinguish it. The problem brought national attention in 1979, when a gas station owner realized that the temperature of the gasoline he was pumping from underground storage containers were 100 degrees above normal temperature of the fuel. Faced with this disaster, the U.S. Congress appropriated $42 million between 1985 and 1991 to relocate the remaining residents. In 1992, the state declared eminent domain. In 1980, a little more than 1,000 people resided in Centralia, and a decade later 63 people remained. The fire is still burning and spreading, releasing smoke and fumes, forcing residents to abandon their homes as the ground warms, destroying vegetation in its vicinity (Aurand, Nolter, and Vice 2004; Gordon and Malone 1994, 125; Stracher et al. 2006, 38). By 2010 about 10

people remained in Centralia. There are no plans to extinguish the fire, which is consuming an eight-mile seam containing enough coal to fuel the fire for 250 years.

As residents left Centralia, the state demolished the vacant buildings. With only a few residents remaining, the place is looking like a ghost town and a visible reminder of the devastation and destruction of a community. Centralia is now one of the top ten visitor destinations in Pennsylvania. Visitors can see the abandoned streets, with only curbs, crumbling sidewalks and an occasional stop sign. The few remaining houses are scattered throughout the town. The fire is now travelling away from the center of town. However, at one time you could walk through parts of Centralia, and you see smoke and steam from the mine fire escaping through the ground. Subsidence is evident throughout the area. Close to the town's cemetery is "Graffiti Highway," part of Rt. 61, which became necessary to abandon due to the fire and subsidence activity.

Driving through Northeastern Pennsylvania there is a general scene of abandonment and decay. The anthracite region is littered with relics of the coal mining industry. Strip mines, coal dumps, and culm banks are separated by shrinking towns. Goin and Raymond (2004, 39) note that the culm banks scattered throughout the landscape are viewed by the miners and descendants of the miners as monuments to the hard work performed by numerous anonymous immigrants who toiled and survived in this industry. These features have become part of the vernacular landscape.

Towns in the anthracite region are being depopulated at an alarming rate, by some

Abandoned Centralia, PA. Image by Paul Shackel, 2012.

estimates perhaps 10 percent per decade starting in the 1970s (Marsh 1987). It is common to see abandoned houses and boarded-up store fronts throughout the region. Some towns have a higher vacancy rate than others. One news report described some of these communities as ghost towns, since a growing number of them have vacancy rates for homes and businesses approaching or above 25 percent. People are leaving these towns and abandoning their homes and businesses without selling them. Because of the high vacancy rate, many of the homes for sale in these communities sell for less than $15,000 (Bohman 2012).

Underground mining subsidence has been an issue in the anthracite region for well over a century. Holes, as a result of subsidence, can occur without any warning and they are scattered throughout the landscape. Some are more noticeable than others, and some have had significant impacts on the landscape with tragic outcomes. The most noted and well commemorated is the Stockton Mine disaster. The Stockton Mine subsidence occurred at 5:00 A.M. on December 18, 1869, claiming 10 lives. Active mining was underway beneath a residential area in Stockton, when two houses were swallowed into the ground, falling 40 feet and smashing the houses to splinters, killing everyone who was in the

Abandoned housing and vacant lots are common on the coal patch town landscapes in Northeastern Pennsylvania. Image by Paul Shackel, 2013.

houses. A third home went into the subsidence, although all who were in the house eventually escaped (*New York Times*, December 19, 1869, December 20, 1869). Today, at the disaster site, there is a stone memorial surrounded by a fence, and a wooden sign at the site commemorating the event.

Subsidence events still occur throughout the region. Roads are often in disrepair because of subsidence, and usable building sites are rare. In some places, structures lean and they give way to subsidence activities. "Structures slowly settle and pitch, and frame buildings lean precariously toward the road, waiting for the owners to adjust the house jacks to this month's topography (Marsh 1987, 347). After a recent subsidence event on a residential property, the Department of Environmental Protection drilled holes around the property to determine if there were any voids underneath the surface. If there are voids, they would fill them. There are more than a million homes in Pennsylvania that sit on top of abandoned coal mines (Gallo 2017).

Contemporary Environmental Issues

Coal contains sulfur and other elements, such as mercury, lead, and arsenic. When it is burned, these, as well as other elements, are released into the atmosphere. Large amounts of carbon dioxide (CO_2) is also released, which increases the greenhouse effect in the atmosphere. Some power companies still use coal to generate electricity and only recently have there been innovative

Memorial commemorating those who died in the Stockton Mine disaster in 1869, Stockton, PA. Image by Paul Shackel, 2014.

ways to control the damaging outcomes of burning coal. There are several innovations being developed to make coal burn cleaner. Integrated gasification combined cycle (IGCC) technology converts coal into gas and it removes sulfur and metals. The gas generates the electricity while sulfur and metals are collected, and eventually sold. This technology is now being developed to capture CO2 emissions. Another technology, carbon sequestration, helps to capture and store carbon underground rather than releasing it into the atmosphere. Some coal burning plants store the carbon in abandoned underground mines, while others pump the carbon into sedimentary rocks or below the ocean floor.

I have been in anthracite communities and residents have showed me how pollution from coal mining affects the daily lives of people living in patch towns next to active mining. While a few coal mining operations remain open, this prosperity for a few has meant environmental and health problems for many. In late June and early July 2012, many of the residents in a coal patch town became quite vocal about the dust particles in the air as a result of the quarrying and coal mining. White houses were becoming a bit grayer as coal dust settled on domiciles throughout the patch town. People also noticed the fine black residue on cars, as well as in swimming pool filters. One resident told me that she power washed her house in the spring time. Then she wiped her finger across the window sill and left a streak behind. Her finger was blackened. This residue was not pollen or dust. It does not come off easily with just water, as it tends to leave a greasy film behind. Only a chemical wash will get it clean, although the formula is harmful to the surrounding vegetation and the water table. Some residents were spending more time indoors because of the new pollution. Some were complaining about allergy-like symptoms—sore throats and/or running nose. Some of the town's elderly residents complained about respiratory problems.

The Pennsylvania Department of Environmental Protection performed two years of air quality monitoring. The levels of dust monitored at four locations were significantly lower than the minimum accepted standard. However, the company was told to work on minimizing dust from their operations (Rowland 2015). Interestingly, community members stated to me that they believe that the company has a right to make a profit, and they were reluctant to get the government involved. However, the community is not happy with the company, and their anger is amplified because they feel the Commonwealth of Pennsylvania and the local government have not provided adequate environmental protection for their community. People feel that they are fighting big corporations and a government agency that is siding with the mining companies.

Much of the anthracite mining today focuses on strip mining in areas of abandoned deep underground coal mines. As a result of the Surface Mining Control and Reclamation Act, 1977, after stripping the land and retrieving the coal, the mines are then filled and reclaimed. The mining companies then plant grasses and trees, which helps to redirect water flow away from the abandoned mines and tunnels. In addition, the federal government has levied a mining reclamation tax paid into the Abandoned Mine Land (AML) reclamation fund administered by the Office of Surface Mining. The tax of $0.35 per ton pays for the reclamation of strip mines abandoned before 1977. After the mines are daylighted, meaning stripped until the old mines are reached and exposed, the old abandoned mines are closed off and backfilled at a cost of about $10,000 per acre. This restoration creates new drainage patterns that are beneficial to the environment (Blaschak Coal Company 2017; Pennsylvania Anthracite Council 2017; Zawacki 2015).

The abandoned deep mines have not only led to subsidence events throughout the region, they have also had a long-term impact on water resources in the region. The Commonwealth of

Pennsylvania has more than 250,000 acres of abandoned mine lands—a total that is higher than any other state. These abandoned mines have impacted 5,000 miles of waterways from pollution and acid mine drainage (Earth Conservancy 2017; Zawacki 2015). It is common to see streams and rivers that have waters that have travelled through abandoned mines flowing with different colored water, orange being the predominant color. In 2000, one resident described Panther Creek, which feeds into the Little Schuylkill, "I've seen it black, green, orange—almost like an orange oxide color. I've seen it purple. I've seen it red. I've never seen it clear" (quoted in Mailer 2000).

While deep mining proceeded under the natural water table, the water naturally finds its way to the lowest point, the deepest point of the mine. Mine operations used pumps to keep the mines from flooding, a costly operation. However, when deep mining ceased throughout the anthracite region the mines filled with water, mixing and reacting with the coal. Eventually the mine waters began spilling into streets, basements, and streams. The New York Times (May 30, 1924) reported as early as 1924 the condition of some of the abandoned mines and described how they filled with water. As a result of this flooding the federal government drilled boreholes in the abandoned mines to relieve the mine water from destroying property. Now, the majority of the mine water drains into waterways, creating another environmental disaster, known as acid mine drainage (AMD), or sometimes referred to

These mine pools have orange oxygenated water with high levels of iron hydroxide. Image by Gabby Zawacki, 2016.

The Jeddo Tunnel, A Discharge in Freeland, PA. Image by Joe Michel, 2001.

as abandoned mine drainage, or most recently as acid rock drainage (ARD).

Generally, AMD refers to the low pH found in waters draining from active and abandoned mines. Sulfides in the rocks react to water and oxygen to form sulfuric acid and iron oxide. These waters also carry heavy metals, such as iron, aluminum, arsenic, and lead, to nearby streams. In the northern fields most of the AMD discharges have a heavy concentration of iron with a pH around 6.5. In the Middle and Southern Fields the discharges are more acidic at 4.0 pH with heavy concentrations of aluminum (Zawacki 2015). The runoff is sometimes visible, as streams and rivers with a high level of iron-oxide turn the water an orange color. The cloudiness of the water inhibits sunlight from penetrating into the rivers, which prohibits photosynthesis, thereby damaging the lowest level of the food chain. In some cases the heavy metal runoff is not detectable. Also the high acid content not only kills wildlife, it also impacts structures in water and can dissolve bridge piers (Marsh 1987). In order to address AMD, water discharge from mines is usually held in ponds until it can be treated and neutralized, which also allows sediments to sink to the bottom of the pond. The United States Geological Survey (USGS) recommends acidic water produced at active mines must be neutralized to between pH 6-9 before being discharged to a stream (USGS 2017).

The Jeddo Tunnel was constructed over three years and completed in 1894 at a cost of about $1 million. When completed the five mile tunnel was hailed as a major engineering feat and was the largest mine drainage tunnel in the world. While mining is mostly defunct in the area, the tunnel still drains an average of 40,000 U.S. gallons of water per minute, and at times up to 100,000 gallons per minute. The average pH of the Jeddo Tunnel drainage is 4.3. More than 90,000 pounds (41,000 kg) of acid drain from the Jeddo Tunnel into the Susquehanna River (via Little Nescopeck and Nescopeck Creeks) every day. An average of 2,900 pounds (1,300 kg) of aluminum, 1,350 pounds (610 kg) of manganese, and 860 pounds (390 kg) of iron flow from the Jeddo Tunnel each day (Coal Age 1914, 391; Mendinsky and Dempsey 2004).

One successful nonprofit group addressing the environmental degradation as a result of mining is the Earth Conservancy. In 1992, the organization was able to begin a program to purchase 16,300 acres of mined land once belonging to the bankrupt Blue Coal Corporation in Ashley, PA. The communities impacted by the company's mining are located only a few miles west of Wilkes-Barre. The Earth Conservancy is dedicated to reclamation, conservation, and economic revitalization of the mined landscape in Northeastern Pennsylvania. The organization obtained a grant for $14 million and secured an additional $2 million in private loans in 1994 to return the lands to productive use. To date, Earth Conservancy has reclaimed nearly 2,000 of its 16,300 acres at a cost of $42.8 million (Earth Conservancy 2017).

Conclusion

Historian John Bodner (1983, 11) wrote, "No other American industry inflicted more heedless destruction on men and the environment than anthracite mining." The decline of the anthracite coal industry has left the region with relatively high unemployment rates and people are migrating out of the region at an alarming rate. A 2015 study ranked the 10 worst places to live in Pennsylvania, which included 258 towns and cities with a population over 5,000 residents. The study used data from the federal census, FBI crime data, Bureau of Labor Statistics and

Sperling's Best Places, and examined issues such as population density, unemployment rates, adjusted mean income, housing vacancy rate, education (expenditure per students and student teacher ratio), and crime rate. Six of the top 10 worst places to live in Pennsylvania are in the anthracite region: Nanticoke (2), Wilkes-Barre (4), Shenandoah (5), Hazleton (7), and Tamaqua (9) (James 2015).

While the region is finding ways to celebrate a heroic past it must also deal with the long-term impact of environmental degradation related to the coal industry. The anthracite region is the most disturbed rural landscape in Pennsylvania. Diverse hardwood forests filled with wildlife have been replaced with a lunar-like landscape, absent of vegetation and only unstable, acidic, black shale that undulates through the terrain. The scarred landscape is dotted with mine waste, torn earth, and culm banks, all a reminder of the prowess of the region's industrial past. The mined areas will remain scarred for decades and acid mine drainage will continue as mine reclamation slowly progresses. Vegetation colonizes the region at a very slow pace, first with lichens, then wiry clumps of grass, goldenrod and briar bushes, then with birch and locust trees (Marsh 1987, 347; Zawacki 2015). While coal is no longer the backbone of the region's economy, there are many reminders of the heedless destruction—on the landscape and in the environment—as the community strives to find ways to remember its past.

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About the Author

Paul A. Shackel earned his Ph.D. in 1987 at the State University of New York and worked in the National Park Service 1989-1997. He joined the faculty at the University of Maryland in 1997 where he is now professor and chair in the Department of Anthropology. He has worked on issues of labor and heritage at Harpers Ferry National Historical Park; race and civic engagement at New Philadelphia, Illinois; and labor, race, and migration in Northeastern Pennsylvania. His most recent books include *Archaeology, Heritage and Civic Engagement: Working Toward the Public Good* (with Barbara J. Little, Left Coast Press, 2014); and *Remembering the Lattimer Massacre: Migration, Labor and the Making of the Pennsylvania Anthracite* (University of Illinois Press, due 2018).