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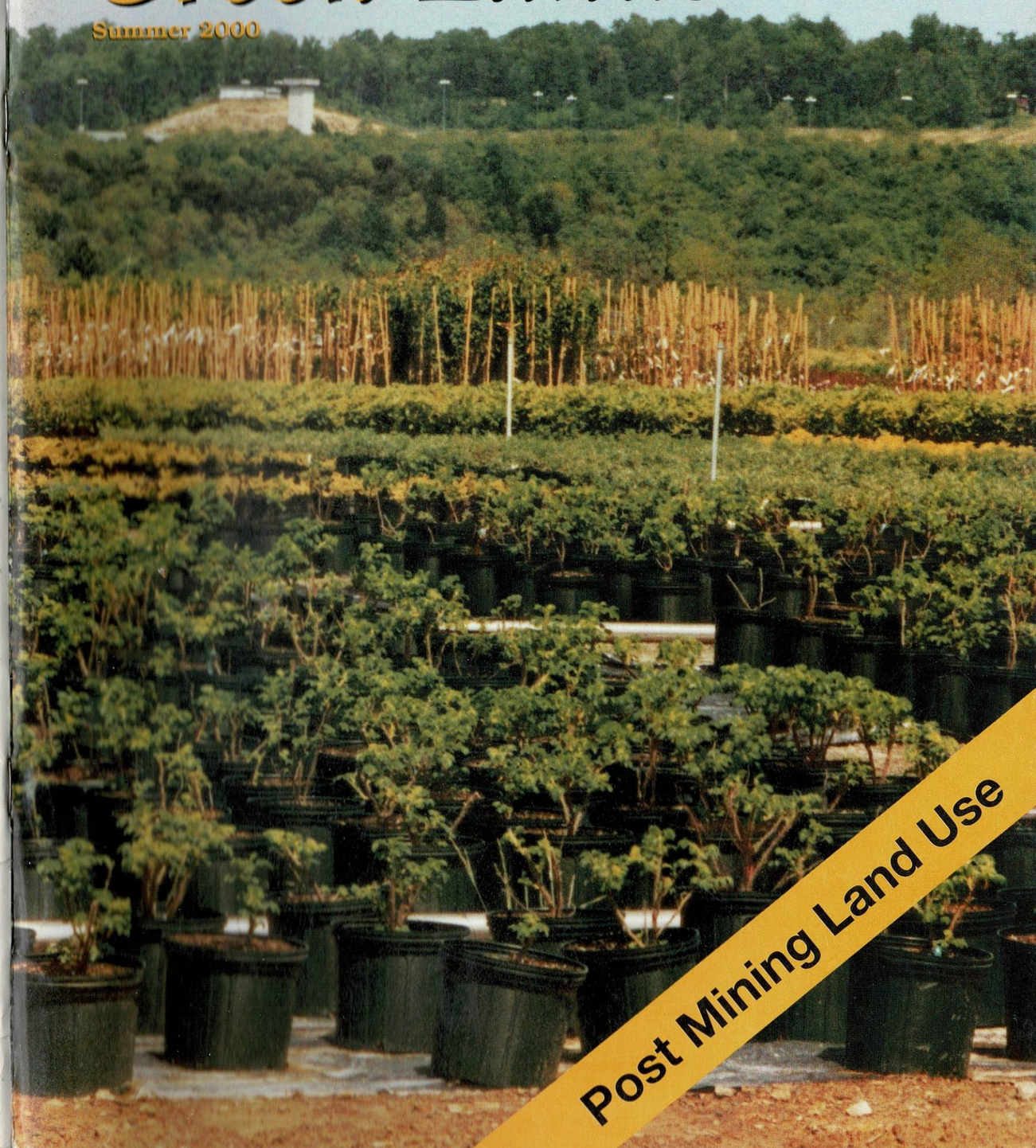

Post Mining Land Use

Green Lands

Volume 30 Number 3

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with offices at 1624 Kanawha Boulevard East
Charleston, West Virginia 25311
(304) 346-5318, FAX 346-5310
E-Mail: wvmra@wvmra.com

On the Cover

More than 60 varieties of shrubs and ornamental trees make up the newly created nursery, Mountain Greeneries, LLC. Overlooking the nursery in the distance is the Mount Olive Correctional facility. Both operations are located in Fayette County on the old Cannelton Industries site. See post mine land use story on page 18.

INDEX ADVERTISING

Catenary Coal Contributions Incorrectly Stated by *Green Lands*

In the last issue of *Green Lands* magazine, we incorrectly reported the contributions Catenary Coal Company attributed to the Abandoned Mine Lands program.

We said the company saved the AML fund $30 when it should have been $30 million.

Catenary Coal Company, at its Samples mine, voluntarily eliminated more than 25 miles of abandoned highwall and the total reclamation of two abandoned refuse piles totaling more than 150 acres.

This project alone saved the state's Division of Environmental Protection and the AML fund more than $30 million. This allows AML to use the money elsewhere for other projects.

The Samples mine property was extensively mined by surface and underground methods during the 1950s and 1960s.

Mining during this time left old highwalls, abandoned refuse sites, open auger holes and drift mine entries. All of these sites were potentially eligible for AML funding as well as created a hazard to the public and the environment.

Through the mining practices employed by the Samples operation, the hazards of the area were eliminated.

To date, the Sample operation has not only eliminated the many miles of abandoned highwalls, but the company also remined over 3 million tons of coal refuse, and reclaimed the abandoned coarse refuse pile.

As a result of these exemplary contributions, Catenary received the prestigious 1998 Callaghan Award from the West Virginia Mining and Reclamation Association for "voluntary elimination of more than 25 miles of abandoned highwall, remining more than 3 million tons of coal refuse and the total reclamation of two abandoned refuse piles totaling more than 150 acres. All of the completed sites were eligible for AML funding, but in a cooperative effort with the Division of Environmental Protection, more than 30 million dollars of environmental enhancement has been incorporated into the active mining operation with exemplary achievement in all phases of mining and reclamation representing the high standards of the West Virginia coal industry."

As a part of Surface Mining Control and Reclamation Act, Congress created Title IV that requires coal companies to fund the AML program by placing fees on every ton of coal mined in the United States.

Currently, 35 cents for every ton of surface-mined coal, and 15 cents for every ton of coal mined underground is paid into the AML fund.

A scenic view of an area reclaimed by Catenary Coal Company.

Senator Byrd Questions Capitol Power Plant Upgrade

Although coal makes up 95 percent of the U.S. fossil fuel reserves and the U.S. is heavily dependent on foreign supplies of oil, common sense did not appear to be available when recommendations for upgrading the power plant at the nation's Capitol were made recently.

As a result, U.S. Senators Robert Byrd, (D-W.Va.), and Mitch McConnell, (R-Ky.), sent a letter to Alan Hantman, architect of the U.S. Capitol, when they learned that coal was not being considered as the fuel source for upgrades to the Capitol power plant.

"We were troubled to learn that the proposed master plan would require the elimination of coal as a fuel for the Capitol steam plant and instead rely exclusively on fuel oil and natural gas," the senators said in their letter to Hantman.

"There is no question, based on the issues raised by Byrd and McConnell, we're re-examining it," Bruce Milhans said, a spokesman for Hantman.

Pointing out that the United States currently is helping developing nations build environmentally friendly energy policies around coal, Byrd said, "It is, therefore, rather ironic that the Architect of the Capitol's contractor did not examine even one option for using modern clean coal technologies before making a final recommendation on changing the Capitol's heating and cooling system."

Three Leaders Inducted Into Coal Hall of Fame 2000

Three leaders that helped shape the state's coal industry were inducted into the West Virginia Coal Hall of Fame in May at Pipestem State Park.

Inducted during the third annual Hall of Fame ceremony were: Benjamin C. Greene, president, West Virginia Mining and Reclamation Association, Charleston, W.Va.; John E. "Jack" Katlic, retired senior vice president, American Electric Power Service Corporation - Fuel Supply, Lancaster Ohio; and James R. Thomas II, retired chairman of the board, Carbon Industries, Inc., Charleston, W.Va.

Photo by Carolyn Perry

Inducted recently into the third West Virginia Coal Hall of Fame during a ceremony in Pipe Stem were (l-r): John E. "Jack" Katlic, retired senior vice president, American Electric Power Service Corporation - Fuel Supply, Lancaster Ohio; Benjamin C. Greene, president, West Virginia Mining and Reclamation Association, Charleston, W.Va.; and James R. Thomas II, retired chairman of the board, Carbon Industries, Inc., Charleston, W.Va.

It was in 1977 when Ben accepted the post as president of the West Virginia Mining & Reclamation Association.

For 40 years, he has been deeply involved with every aspect of reclamation, both from the regulatory and the industry perspective.

Jack served as president of the American Electric Power subsidiary coal and transportation companies. His work included projects in China, Australia, Russia, Kazakhstan and South Africa.

Jim spent the majority of his professional life devoted to Carbon Industries, Inc.

He completed his career with Carbon Industries, Inc., by serving as chairman of the board during 1982-1983.

Class of 1999

Herbert E. Jones, Jr.
F.B. "Fil" Nutter
John L. Schroder, Jr.

Class of 1998

B.R. "Bobby" Brown
C.E. "Jim" Compton
Lawson Hamilton, Jr.
James H. "Buck" Harless
Tracy W. Hylton, Sr.
E. Morgan Massey
Allen S. Pack
Robert H. Quenon
Raymond E. Salvati

West Virginia Coal Production Falls in 1999 For Second Straight Year

Nobody associated with the state's coal industry was surprise when the West Virginia Office of Miners' Health, Safety and Training announced that coal production dropped in 1999.

It was expected.

And it happened, for the second year in a row.

Last year, because of market conditions, a federal court decision and federal regulatory confusion, total coal production in West Virginia, according to MHS&T, was 169,206,834 tons. That's a reduction of more than 11.5 million tons from 1998 when 180,794,012 tons were produced.

The highly publicized *Bragg v. Roberston* lawsuit that was filed by environmental extremists, has already impacted the state's coal industry and could force radical changes to the way companies dispose of excess rock and soil from both deep and surface mines.

This has every coal operation in the state at risk. Consequently, very little major investment is being seen in West Virginia until the issue, now in the 4th Court of Appeals in Richmond, Va., is resolved.

In the state's overall coal production last year, Boone County continued to lead with just over 30 million tons mined.

In 1998 and '99 alone, Logan County coal production has dropped seven million tons largely due to the lawsuit filed by the West Virginia Highlands Conservancy.

Mingo County also kept its standing as the state's second largest producer even though overall tonnage dropped by about two million tons.

Unfortunately, Logan County, the hardest hit, continues to feel the impact of the environmental extremist's lawsuit.

In 1998 the county's production dropped by more than three million tons. In 1999, county production dropped another four million tons. In 1998 and '99 alone, Logan County coal production has dropped seven million tons largely due to the lawsuit filed by the West Virginia Highlands Conservancy.

In 1998 Logan County was the third largest coal producer in the state. In 1999, however, the county has dropped to seventh.

Unfortunately, the reduction has impacted more than just miners and the coal companies. Art Kirkendall, Logan County Commission president, has to work with a dramatic reduction in tax money funded to the county as a result of lower coal production.

Kirkendall said 30 county employees received layoff notices and funding for numerous county services had to be drastically curtailed due to the loss of coal production.

On the state level, coal severance taxes, money the state relies on to fund its programs, dropped by $20 million.

Logan County, once the leading surface mine producer, was replaced by Kanawha County which produced just over 10 million tons. Boone County ran a close second with 9.7 million tons and Logan fell to third with 7.2 million tons.

In underground coal production, Boone lead the state last year with just over 20 million tons mine. Mingo ran a distant second with 14 million tons and the Marshall mined 11.3 million tons.

1999 Coal Production By County

County	Underground Production	Surface Production	Total
Barbour	1,496,605	43,603	1,540,208
Boone	20,292,091	9,783,817	30,075,908
Braxton	1,179,409	0	1,179,409
Brooke	1,644,632	0	1,644,632
Clay	268,347	6,488,623	6,756,970
Fayette	1,269,675	748,938	2,018,613
Grant	112,686	344,560	457,246
Greenbrier	321,621	60,574	382,195
Harrison	6,503,185	261,400	6,764,585
Kanawha	4,858,390	10,200,755	15,059,145
Lewis	0	860	860
Lincoln	356,935	1,626,812	1,983,747
Logan	2,891,468	7,277,080	10,168,548
McDowell	3,190,249	1,506,564	4,696,813
Marion	1,118,359	4,790	1,123,149
Marshall	11,377,992	0	11,377,992
Mineral	0	48,415	48,415
Mingo	14,038,320	6,657,325	20,695,645
Monongalia	10,367,410	817,571	11,184,981
Nicholas	1,743,493	2,780,040	4,523,533
Preston	1,308,124	127,674	1,435,798
Raleigh	10,787,857	90,472	10,878,329
Tucker	0	172,424	172,424
Upshur	2,628,542	229,927	2,858,469
Wayne	7,781,819	76,890	7,858,709
Webster	1,311,047	3,022,385	4,333,432
Wyoming	7,251,134	2,735,945	9,987,079
TOTAL	**114,099,390**	**55,107,444**	**169,206,834**

1999 Coal Production By Surface Method

County	Surface Tonnage
Kanawha	10,200,755
Boone	9,783,817
Logan	7,277,080
Mingo	6,657,325
Clay	6,488,623
Webster	3,022,385
Nicholas	2,780,040
Wyoming	2,735,945
Lincoln	1,626,812
McDowell	1,506,564
Monongalia	817,571
Fayette	748,938
Grant	344,560
Harrison	261,400
Upshur	229,927
Tucker	172,424
Preston	127,674
Raleigh	90,472
Wayne	76,890
Greenbrier	60,574
Mineral	48,415
Barbour	43,603
Marion	4,790
Lewis	860
TOTAL	**55,107,444**

1999 Coal Production By Underground Method

County	Underground Tonnage
Boone	20,292,091
Mingo	14,038,320
Marshall	11,377,992
Raleigh	10,787,857
Monongalia	10,367,410
Wayne	7,781,819
Wyoming	7,251,134
Harrison	6,503,185
Kanawha	4,858,390
McDowell	3,190,249
Logan	2,891,468
Upshur	2,628,542
Nicholas	1,743,493
Brooke	1,644,632
Barbour	1,496,605
Webster	1,311,047
Preston	1,308,124
Fayette	1,269,675
Braxton	1,179,409
Marion	1,118,359
Lincoln	356,935
Greenbrier	321,621
Clay	268,347
Grant	112,686
TOTAL	**114,099,390**

Top Production Years in the West Virginia Coal Industry

	YEAR	PRODUCTION (In tons)			
1.	1997	181,914,000	6.	1999	169,206,834
2.	1998	180,794,012	7.	1948	168,589,033
3.	1996	174,008,217	8.	1995	167,096,211
4.	1947	173,653,816	9.	1991	166,656,171
5.	1990	171,155,053	10.	1944	164,954,218
			11.	1994	164,200,572

West Virginia's Top Producing Underground Mines in 1999

Company	Mine	County	Tonnage
1. McElroy Coal Co.,	McElroy Mine	Marshall	7,014,817
2. Mingo Logan Coal Co.	Mountaineer Mine	Mingo	6,556,329
3. CONSOL	Robinson Run	Harrison	5,317,122
4. Performance Coal Co.	Montcoal	Raleigh	5,078,259
5. EACC	Federal No. 2	Monongalia	4,648,000
6. CONSOL	Blacksville No. 2	Monongalia	4,512,175
7. CONSOL	Shoemaker Mine	Marshall	4,363,175
8. Rockspring Development	Camp Creek Mine No.1	Wayne	4,358,551
9. U.S. Steel Mining Co.	No. 50 Mine	Wyoming	4,171,915
10. EACC	Harris No. 1	Boone	2,999,810
11. Cannelton Industries	Stockton No. 1	Kanawha	2,111,992
12. Windsor Coal Co.	Windsor Mine	Brooke	1,644,632
13. Eastern Mingo Coal Co.	Marrowbone Creek	Mingo	1,572,267
14. Dakota Mining, Inc.	Dakota Mine	Boone	1,569,220
15. Independence Coal Co.	Justice No. 1	Boone	1,356,587

West Virginia's Top Producing Surface Mines in 1999

Company	Mine	County	Tonnage
1. Catenary Coal Co.	Samples Mine	Kanawha	5,906,553
2. Fola Coal Co.	Surface Mine No. 1	Clay	4,136,838
3. Hobet Mining	Westridge Surface	Boone	3,933,083
4. Arch of West Virginia	Ruffner	Logan	3,151,484
5. Evergreen Mining Co.	Valley Fill No. 2 and 3	Webster	2,928,425
6. Coal Mac, Inc.	No. 5	Mingo	2,455,813
7. Vandalia Resources, Inc.	MONOC No. 2	Clay	2,351,785
8. Independence Coal Co.	Twilight	Boone	2,118,247
9. Cannelton Industries	Dunn Coal & Dock	Kanawha	2,000,529
10. Elk Run Coal Co.	Black Castle	Boone	2,038,324
11. Pen Coal Co.	Copley Trace No. 1	Lincoln	1,626,812
12. White Flame Energy, Inc.	White Flame No. 9	Mingo	1,586,312
13. Alex Energy, Inc.	No. 1 Surface Mine	Nicholas	1,458,828
14. Princess Beverly Coal Co.	Kayford	Kanawha	1,133,134
15. Elk Run Coal Co.	Black Castle No. 4	Boone	1,293,930

School Groups Visit Coal Operations in Opposite Parts of the State

It is not unusual to see coal operators throughout the state provide tours to local school groups to help students better understand the industry.

Even though there is a certain amount of disruption to the operation when companies provide tours such as these, it is important that people see firsthand what is happening in the coal industry.

Recently, two groups of students were able to tour surface mine sites in opposite regions of West Virginia and learn about the coal operations first hand.

For the second year, White Flame Energy invited teachers and students at the Varney Grade School in Mingo County to see mining equipment and explain the process of its operation. The mine is located on the mountain overlooking the school.

Close to 300 students, ranging from kindergarten to third grade, were able to walk around and see up close several pieces of equipment used at the operation as well as coal being loaded onto trucks.

Employees of White Flame work very closely with the school on many different projects throughout the year.

Also, close to 100 of West Virginia's top enterprising high school rising juniors and seniors visited Buffalo Coal Company in Tucker County as part of the annual West Virginia Free Enterprise Conference.

This is the 10th year Buffalo has opened its operation to the group which visits not only active sites, but also reclaimed areas. This year, the group traveled on to see Mettiki Coal Corporation that afternoon as well.

The WVFEC is sponsored by the West Virginia Chamber of Commerce and the Ohio/West Virginia YMCA and is a six-day program at Camp Horseshoe near Lead Mine in Tucker County.

Companies Honored By Local School

During a recent tour, several companies were honored by the Varney Grade School for contributions to the school and local community.

Kenny Nicewonder (left), vice president of White Flame Energy receives a plaque from John Hatfield, Varney Grade School principal in recognition for the company's outstanding contributions to the school and community throughout the year.

The companies were White Flame Energy, Premium Energy, Walker Machinery, and Mingo Logan Coal Co.

During the presentation of the plaques, John Hatfield, Varney Grade School said "They serve as an example to other communities and businesses."

"It's important that we are an active part of the community," said Kenny Nicewonder, vice president of White Flame Energy. "I think it is vital students and teachers see exactly what is happening here and to learn more about the coal industry.

Participating in the tour and contributing with supplies for Varney School were: White Flame Energy, Premium Energy, Mingo Logan Coal Co., Walker Machinery, Mate Creek Energy, Ancar, Inc., Randy Scott Trucking, Cobra Tire, Engineering Dept., Poskas Oil, Virginia Battery, H&M Parts, Dyno Nobel Appalachian, Inc., Nelson Brothers Explosive, Logan Corp., Tigh Supply, Inc., General Engineering, WR Merlock & Son, and Maggard Sales.

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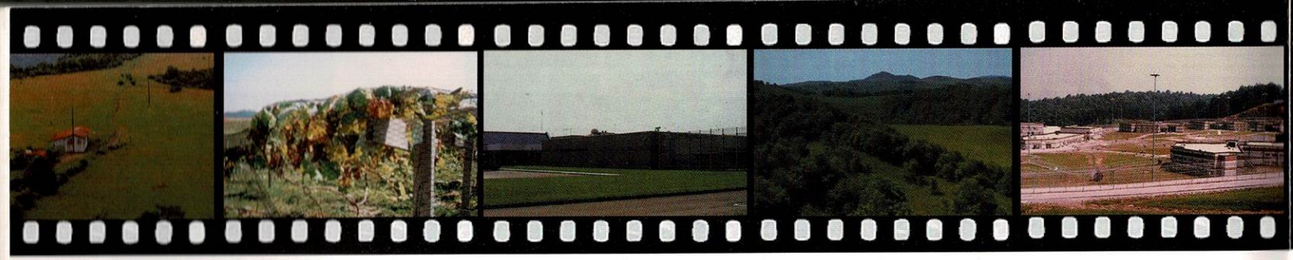
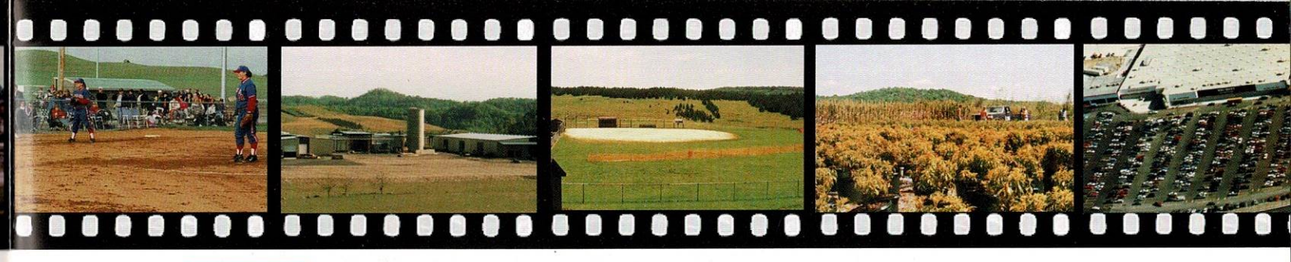


Post Mine Lands:



In the United States, coal is more plentiful than oil or natural gas. In fact, coal makes up about 95 percent of the nation's fossil energy reserves.

The most frequent use for coal is electricity, In fact, more than 56 percent of the nation's electricity is generated from coal while in West Virginia, 99 percent of the electricty comes from coal.

However, with high demands for coal, new mining technologies were developed. In West Virginia, the coal industry underwent a tremendous streamlining process and a technological revolution. All of which has led to the practice of mountaintop mining, an innovative mining technique pioneered in this state more than 30 years ago.

As prescribed by federal law, mountaintop mining involves moving all of the overburden from atop the coal seams to recover 100 percent of the mineral. This method represents the most modern surface mining technology and the most efficient method of recovery in the wise use of West Virginia's mineral wealth.

Surface mining, as a methodology, is an interim land disturbing industry. Unlike many other land disturbances, the reclamation process presents a second opportunity for utilization.

Once mountaintop mining operations are completed, the land will never be mined again, but

through today's sophisticated reclamation techniques, the restored site can be adapted for almost any post mining land use. Recreation has become an important part of our everyday life.

Some of the more popular sports, such as baseball, soccer and softball, require flat land that has to be molded into a suitable playing field. Such an area is rarely found in West Virginia without the help of earth moving equipment.

Yet West Virginians are discovering the importance of recreation only to be hindered by the lack of suitable playable areas. Maybe that is why more and more people are working with coal operators for the use of mine land now reclaimed and ready to be used to benefit the community in yet another way.

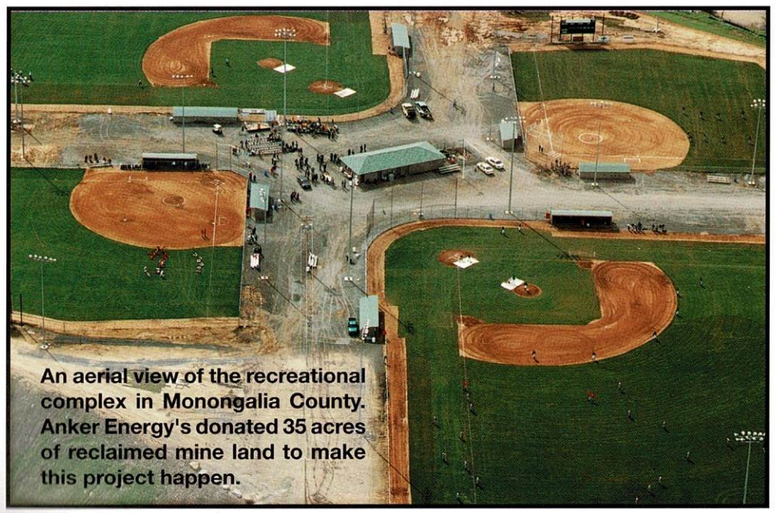
In Monongalia County, near Star City, a multipurpose complex was created with the intent to focus on educational, recreational and sports needs of the area.

Initially two baseball and two softball fields, all lighted, were constructed on what was deemed the "Acres of Dreams" by the Monongalia County Schools Foundation, Inc.

In September 1999, ground was broken on 35 acres of reclaimed surface mined land that was donated just outside of Morgantown by Anker Energy Corporation.

"Reclaimed sites provide the state with much needed developable land for projects such as these," said West Virginia Governor Cecil Underwood.

In April 2000, Gov. Underwood returned to the complex to throw out the first pitch and the games began.



An aerial view of the recreational complex in Monongalia County. Anker Energy's donated 35 acres of reclaimed mine land to make this project happen.

During the opening ceremony, Delegate Sheirl Fletcher (R-Monongalia) said "The athletic complex that we're standing on today is a shining example of what can happen when responsible surface mining reclamation takes place."

Buffalo Coal Co. constructed this baseball/softball field on a reclaimed mine site in Tucker County. It now hosts everything from T-ball to women's softball for the Thomas area.

Mark Nesselroad, president of the Monongalia County Schools Foundation, Inc., noted that the complex will eventually include football and soccer fields, a track, regulation practice fields, recreation center, 8,000-seat amphitheater and eventually an elementary school.

Yet baseball fields on reclaimed sites are nothing new, at least not in Tucker County.

In the early '80s, Buffalo Coal Co. reclaimed and did the site prep for a local baseball/softball field. The field was later taken over by the Knights of Columbus and now serves the community by hosting everything from T-ball to women's softball.

"That was a combination of remining and special reclamation job," recalled Steve Shaffer, vice president of engineering. "We knew it was going to be a ballfield, so we graded it that way with topsoil and used a special seed mix designed for playing fields."

As in any other state, golf is becoming more popular in West Virginia and land is needed to meet the demand.

Anker Energy donated reclaimed land for a recreational complex that currently has two baseball and two softball fields. The complex is planned to eventually include football and soccer fields, a track, regulation practice fields, recreation center, 8,000-seat amphitheater and eventually, an elementary school.

Recreation

Dave Fletcher (left) of Premium Energy and Jim Mullins of Mingo Logan Coal Co. stand in front of the active mine while explaining the plans for the future golf course to be constructed after coal is mined from the operation in Mingo County.

Even though golf courses do not need the type of flat land that soccer fields require, reclaimed surface mines provide an excellent area to place such a course.

Consequently, several courses are being considered as new ones are being built.

The most prominent course under construction on reclaimed land is by Premium Energy. The company is currently mining a site in Mingo County and is developing a golf

course as a part of its reclamation process. The course is made possible through a partnership with Premium Energy, Mingo Logan Coal Co. and Pocahontas Land Company.

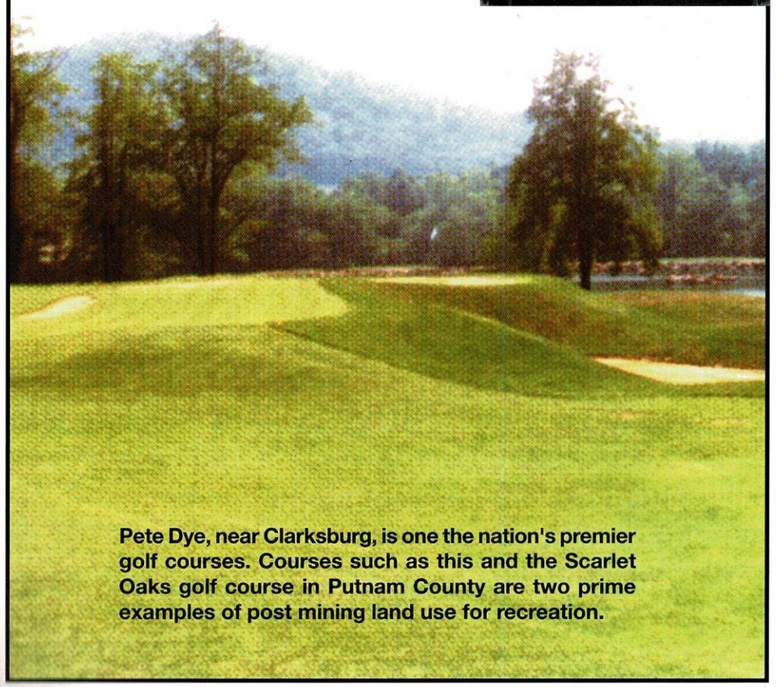
Golf courses on reclaimed sites have already gained a foothold in West Virginia. Pete Dye, near Clarksburg, is one of the top golf courses in the nation. And, the Scarlet Oaks course in Poca, Putnam County, is considered to be one of the premier golf courses in the state. Two prime golf courses, both of which are built on old mining sites.

Baseball and softball are not the only sports with high popularity. During the past few years, soccer has grown by leaps and bounds in West Virginia.

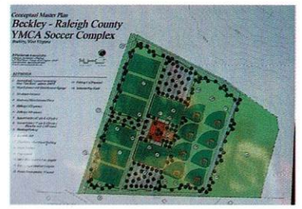
Officials knew it was time to expand when the Beckley YMCA held a soccer tournament and had to turn away 65 teams, last year.

The YMCA called upon Beaver Coal Co. headed by Woody Duba. The company donated 75 acres of land to the YMCA to build a massive recreational facility.

YMCA CEO Gary Prince also said how surprised he was to find this much flat land in Beckley.



Pete Dye, near Clarksburg, is one the nation's premier golf courses. Courses such as this and the Scarlet Oaks golf course in Putnam County are two prime examples of post mining land use for recreation.



Beaver Creek Coal Co. donated 75 acres for a recreational facility in Beckley. The Oak Hill girls soccer team stands on the future site of the Beckley recreational complex with (l-r) Dave Laraba, president of the West Virginia Soccer Association, Woody Duba, Beaver Coal regional manager; and Hank Steinbrecher, secretary general of the U.S. Soccer Federation. At right are the plans for the recreational complex. Soccer games are expected to start here by the end of the summer or early fall.

"I was amazed how flat it was and how much topsoil is here," he said. "We are not going to have to bring in much topsoil which will save us money."

Initial plans for the complex near the Raleigh County Armory Civic Center include eight first-class lighted soccer fields with a center soccer stadium that will seat nearly 2,000 and two tournament size fields that will seat 300-400 people.

"We expect to be playing on the fields in September," Prince said.

The complex also has land for baseball fields, walking trails and other facilities that are planned for the near future.

Dave Laraba, president of the West Virginia Soccer Association, said of the new Beckley soccer complex "It will bring $1 million into the local economy. There will be no other complex like it within three or four states."

Properly reclaiming mine land made it all happen.

Popular outdoor recreation also includes hiking, mountain biking or riding an ATV. That is why the Hatfield-McCoy Trail came into existence.

Designed for ATVs, horseback riders, mountain bikers and hikers, the Hatfield-McCoy trail will initially have 300 miles of trails, but ultimately

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have 2,000 miles of trail throughout southern West Virginia in Boone, Lincoln, Logan, McDowell, Mingo, Wayne and Wyoming counties. The trail is planned to eventually expand into southwestern Virginia and eastern Kentucky as well.

Once expanded to the full 2,000 miles of trail it will cover more than 5 million acres, an area the size of Massachusetts.

Organizers said they are making this trail to be above and beyond any other trail system in the nation. They are expecting the trail to generate $107 million each year as well as providing 400 jobs for the seven counties.

It is evident that without reclaimed surface mining land, much of this may not have been possible. However, this trail exists because of private landowners that signed an agreement with trail officials.

Pocahontas Land Co., the largest land owner in the state, was the first company to agree to provide its land to the trail system.

Other private landowners that signed agreements with the Hatfield-McCoy trial officials include: W.W. McDonald Land Company, Dingess-Rum Properties, Inc., Coal and Crane Real Estate Trust, The Forestland Group, LLC, Kelly-Hatfield Land Company, Gilbert Imported Hardwoods, Mingo/Wyoming Coal Land Corp., and Crown Industries.

Designed for ATVs, horseback riders, mountain bikers and hikers, the Hatfield-McCoy trail will ultimately have 2,000 miles of trail throughout seven counties in southern West Virginia. This trail exists because of private landowners signing an agreement with trail officials.

Every state needs economic development to survive. West Virginia is unique in the fact that usable land for such growth is scarce without moving a lot of earth.

Mountaintop mining and other types of surface mining provide some relief to this equation.

When starting its nursery, the only suitable land Mountain Greeneries could find was a mountaintop mining site in Fayette County.

Mountain Greeneries, LLC, a subsidiary of Standard Labs, is a nursery that discovered the importance of a reclaimed mining site when it started operations last year.

"We visited 11 sites," said Todd Stallard, president of Mountain Greeneries about the search. "The only sites in West Virginia that were viable for us were reclaimed mountaintop mining sites. We couldn't find level land that could be expanded to 40 or more acres."

The site finally selected was 55 acres in Fayette County, originally owned and mined by Cannelton Industries, Inc., which is near the Mt. Olive Correctional Facility.

Although the nursery will not be in business until next spring, it currently is growing about 40,000 plants and by September expects to have 80,000 on hand. By next spring the nursery will increase the number to 120,000 which will include more than 87 varieties of shrubs and ornamental trees.

When the town of Davis in Tucker County, needed to expand its cemetery, landowner Western Pocahontas Properties Ltd. donated the area mined and reclaimed by Buffalo Coal Co. (foreground) to the town. This is the only known cemetery in the United States located on a reclaimed surface mine.

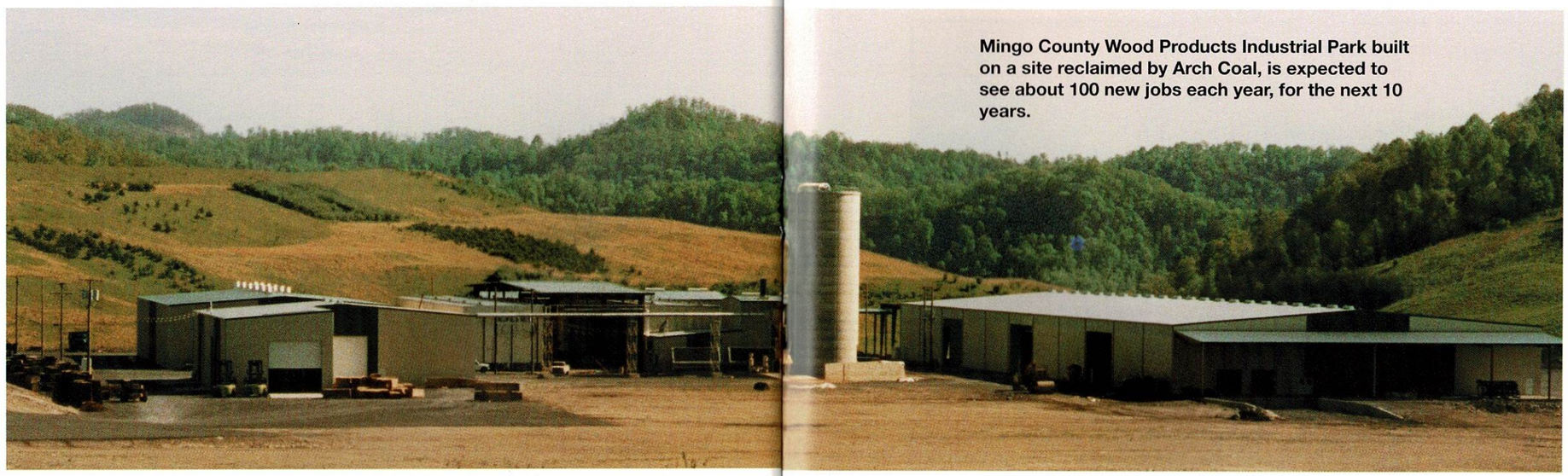
According to Stallard, they have invested $1 million before one plant is sold. "It will take us about three years before they know how well we are doing," he said.

One of the distinct features of Mountain Greeneries is that it is a container nursery, which is a new trend in the nursery business.

According to Stallard, containers provide an extended planting season, transportation costs are lower, less handling damage and higher chance of survival.

Stallard expects the territory for the nursery will be from North Carolina to the New England area.

"We will market to landscapers, home and garden companies and mass merchandisers," he said.



Mingo County Wood Products Industrial Park built on a site reclaimed by Arch Coal, is expected to see about 100 new jobs each year, for the next 10 years.

Economic Development

"The problem is there is no good usable flat land in West Virginia," Stallard said, "and that is why mountaintop mining areas are great sites. Flat land in this state is not cheap."

In what appears to be a major coup, one of the newest examples of economic development has cropped up on a reclaimed mine site in Mingo County.

Reclaimed by Arch Coal, at its Hobet 07 site, the ground was officially broken on January 7, 1999 headed by Mingo County Wood Products Industrial Park officials.

The park is expected to have 100 people employed there by the end of the summer. And, if all goes according to plan, the Mingo-Logan County area will see about 100 new additional jobs each year, for the next 10 years.

> ***"I would invite anyone to find a five-acre site, out of the flood plain that is flat. They simply do not exist."***
>
> ---- Mike Whitt, Executive Director, Mingo County Redevelopment Authority

Currently, the park has six of the anticipated 12 dry kilns running. When at full capacity, it estimated that the park will produce more than 10 million board feet of lumber every year.

These grapes, along with apples, blueberries and corn, were grown on eight acres of the old Anker Energy surface mine site in Ragland, Mingo County.

Photo courtesy of the F.B.I.

The F.B.I. center in Clarksburg has become a very important part of the city's growth. The facility has more than 3,000 employees and is located on 986 acres of reclaimed land.

Officials of the Mingo County Redevelopment Authority purchased 680 acres from Georgia-Pacific, Coal and Crane and Ark Land Company.

According to Mike Whitt, executive director of the MCRA, there was no infrastructure on the property, which resulted in additional costs.

As stipulated by law, all infrastructure must be removed when the operator reclaims the site unless otherwise stated in the mining permit.

"We could have saved money if the mining company was allowed to keep the land flat when they were finished mining," Whitt said. "The cost of site prep for the entire area is projected at a half million dollars."

Nonetheless, MCRA officials said during the ground-breaking ceremony that this reclaimed site was selected due to the degree of the level land compared to any other site in the area.

The three limited liability corporations that partnered together with the MCRA to make this project possible were International Industries, Gilbert, W.Va.; Glen Oak Lumber, Montello, Wisc. and Columbia Forest Products, Portland, Ore.

Although Mingo County is known for it surface mining operations, it is second in underground tonnage.

(Continued on page 36)

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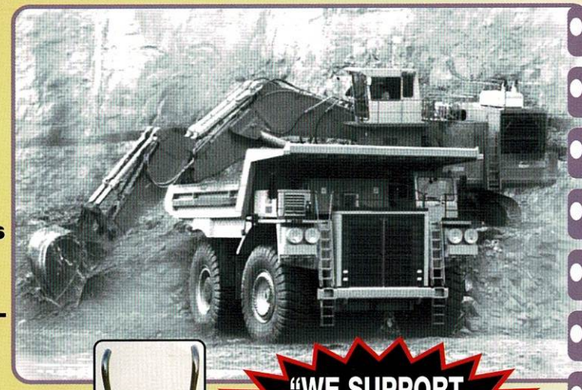

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Even though reclaimed mine sites are more highly publicized as a need for post mine use, underground mines sometimes can cause a dilemma in "what diversification can be done after mining."

Mingo Logan Coal Co., a major coal producer in the county has helped the MCRA come up with an idea in one of its underground mines.

There is still water runoff from a completed mine that has high water quality, located at Thacker Fork, which is the head of Pigeon Creek.

Whitt worked with Mingo Logan and Pocahontas Land Co. as well as the Freshwater Institute creating the Mingo Country Fish Hatchery which raises Arctic Charr.

Although the hatchery just began growing the eggs, full-grown Charr will not be ready for sale on the world market for another 36 months.

The land for the hatchery was donated by Pocahontas Land Co. and there were many in-kind donations by Mingo Logan.

"Without Mingo Logan, Pocahontas Land, and community support," Whitt said, "the project would not have materialized. They have gone above and beyond being cooperative on this project. Companies like Mingo Logan Coal and Pocahontas Land Corp. make economic diversification so much easier."

Another project in Mingo County is on the old Anker Energy mine site near Ragland which has taken the form of a "farmers market." James Simpkins, owner of Crown Industries, donated five acres that once was a surface mine on which now grows apples, grapes, blueberries, peaches, and even corn.

This demonstration site is a cooperative effort with MCRA, the W.Va. Department of Agriculture and the W.Va. Dept. of Forestry.

Due to the limited supply of accessible, sufficient, large, level tracts of undeveloped land in West Virginia, planners for the Mt. Olive Correctional Complex considered building two correctional facilities to replace the civil war-era Moundsville Penitentiary. However, it was later discovered that numerous reclaimed surface mine sites in the Upper Kanawha Valley had the potential for redevelopment.

Whitt said the grapes themselves had a high sugar content and were very high quality.

"We didn't have to do a lot of site prep," he said, "but we did fertilize the soil."

The goal is to have five acres of vineyard on these types of sites. He noted that there is definitely a market because the law says 80 percent of the grapes bought for winery must be grown in state.

Whitt always welcomes a good reclaimed mine site in Mingo County.

"I would invite anyone to find a five-acre site, out of the flood plain that is flat. They simply do not exist," he said.

State officials who were involved in building the new Mt. Olive Correctional Complex seem to agree with Whitt.

Once mountaintop mining operations are completed, the land will never be mined again, but through today's sophisticated reclamation techniques, the restored site can be adapted for almost any post mining land use.

Completed in 1994, planners searched numerous sites across the state without finding anything suitable to meet their needs. Due to the limited supply of accessible, sufficient, large, level tracts of undeveloped land in West Virginia, planners considered building two correctional facilities to replace the civil war-era Moundsville Penitentiary.

This solution would have been more costly and less efficient, duplicating programs and services causing operating expenses to be higher than acceptable for West Virginia taxpayers.

However, it was later discovered that numerous reclaimed surface mine sites in the Upper Kanawha Valley had the potential for redevelopment.

Ultimately, the site decided upon for Mount Olive was 120 acres in Fayette County, originally owned and mined by Cannelton Industries, Inc. The facility, a $60 million investment, has more than 380 employees with another 500 indirect jobs.

In Harrison County, surface mine land has seen much economic development on reclaimed sites. The F.B.I. center in Clarksburg has become a very important part of the city's growth. Completed in July 1995, this

facility has grown to more than 3,000 employees and is located on 986 acres of reclaimed land.

At the Interstate 79 and U.S. 50 interchange, LaRosa Fuels, Inc. and Thompson Coal and Construction Company, created commercial real estate that has been heavily developed via surface mining. Today, it has become one of the busiest interchanges in the state with an estimated 100,000 plus vehicles traveling on the interchange every day. Employing about 2,000 people in just this one area, the mining site is approximately 2 miles long and has numerous business retail stores, city buildings, hotels and malls.

Buffalo Coal Co. has always made a positive mark in Tucker County and the surrounding area. Employees there realize the importance of community relations.

"It is important that we keep close contact with the community," Shaffer said. "This is where we live, where we work and we're a part of the community."

Yet sometime the company's presence is more visible in other times. In this case, Buffalo Coal came to the aid of the town of Davis as they searched for new land to expand the town cemetery.

> ***"The problem is there is no good usable flat land in West Virginia and that is why mountaintop mining areas are great sites. Flat land in this state is not cheap."***
>
> --- Todd Stallard, President, Mountain Greeneries, LLC

As luck would have it, Buffalo Coal mined and reclaimed land that was across the county road from its current cemetery. The land was later donated to the town by landowner Western Pocahontas Properties Ltd. Town officials used this land to expand the local cemetery.

"This is the only known cemetery in the United States located on a reclaimed surface mine," Shaffer said. "We had to be extra careful with our topsoil placement considering the land use. We were glad to go to the extra trouble because it was such a worthy cause."

Buffalo Coal completed mining on the site in 1983. Officials started using the land for its cemetery shortly afterwards.

"When we can, we are always happy to help," Shaffer said.

Coal is West Virginia's most recognizable product. The industry provides a valuable resource and jobs. Once reclaimed, mining sites can continue to contribute even more to the economic benefit for West Virginia.

West Virginia will continue to be the economic frontier for companies in all industries well into this century.

As they seek land to construct new facilities, it has become more evident that surface mining sites provide prime building locations.

Coal Calendar 2000

July

14-16 **Contractor Association of West Virginia Annual Meeting,** The Greenbrier, White Sulphur Springs, WV. Contact Mike Clowser, (304) 342-1166.

17 **TVMI 6th Annual Everett Thompson Memorial Scholarship Golf Outing,** Lavalette Country Club, Huntington.

23-27 **Coal in the Classroom Seminar,** Mining Health and Safety Administration Academy, Beckley, WV. Contact Sandi Davison at the WVCA, (304) 342-4153.

24-27 **9th High Tech Blasting Seminar,** Orlando, FL. Contact Frank Chiappetta, (610) 530-7415.

August

3-6 **WVMRA Annual Meeting,** The Greenbrier, White Sulphur Springs. Contact Patty Bruce (304) 346-5318.

7 **Workshop on Coal Mine Roof Support,** Lakeview Conference Center, Morgantown, WV. E-mail Donna M. Opfer, National Institute for Occupational Safety and Health, dbo0@cdc.gov.

8-10 **19th International Conference on Ground Control in Mining,** Lakeview Conference Center, Morgantown, WV. Contact Karen Centofanti (304) 293-5708.

18 **13th Annual Kentucky Professional Engineers in Mining Seminar,** Holiday Inn North, Lexington KY. Contact Julie Back (606) 257-4634.

24 **Tug Valley Mining Institute Meeting,** Brass Tree Restaurant, Williamson, WV. Speaker - Gov. Cecil Underwood. Meeting sponsor - Jenmar Corporation. Call (304) 664-4006 for dinner reservations.

27-30 **31st Annual Institute on Mining Health, Safety, and Research,** The Hotel Roanoke, Roanoke, VA. Contact Terry Pettinger, (540) 231-2525.

Soil Horizon Development on a Mountaintop Surface Mine in Southern West Virginia

by

K.A. Thomas, J.C. Sencindiver, J.G. Skousen, and J.M. Gorman

Abstract

Mountaintop surface mining for coal has been practiced in West Virginia for over two decades. Only recently has this practice been increasingly scrutinized by the public and regulatory agencies. Increased attention has focused on the environmental impacts of this mining process.

Even after reclamation, citizens and regulators have expressed concerns about soil and water quality and post-mining land use. Therefore, a study was initiated to evaluate the quality of soils developing on a reclaimed mountaintop removal surface mine in southern West Virginia.

Minesoils of four different ages (2, 7, 11, and 23 years) were described and sampled. Six pits were dug on each minesoil age class and three pits were dug on adjacent native soils.

O and A horizons were found in all native soils and A horizons were found in all minesoils. Thickness of A horizons varied from 10 cm on the 23-year-old site to 6 cm on the 2-year-old site. All native soils and one 23-year-old minesoil had Bw horizons and were classified as Inceptisols (soils showing some development). All other minesoils were Entisols (showing little to no development).

When compared to native soils, the minesoils had much thinner sola (combined thickness of A, AC, and Bw horizons). However, all minesoils except those on the 2-year-old site had thicker A horizons than the native soils. Seeding of grasses and legumes and extensive root establishment undoubtedly caused the increased thickness of A horizons on minesoils.

Aggregate stability tests showed more water-stable aggregates in native than in minesoils, but aggregation of the minesoils increased with age. Surface horizon bulk density tended to be higher in minesoils than in native soils. However, bulk density with depth was similar for all soils. Minesoil pH tended to be between 5 and 6, while native soil pH was between 4 and 5.

All of the minesoils showed evidence of soil development that increased with age.

Introduction

The process of mountaintop removal mining results in reclaimed landscapes that commonly differ from the original landscapes. Relief has generally been reduced and excess spoil is often placed in head-of-hollow or valley fills. The soils developing on these mined and filled areas differ from the original soil, but they have not been widely evaluated.

Minesoils are very young soils developing from mixtures of fragmented rock and fine earth material. The original soil profiles have been disrupted and often partially or totally replaced by earth materials from depths below the original profile. Studies have shown that upon exposure to the surface environment, the geologic materials placed at the surface experience accelerated weathering, thereby increasing soil development (Ciolkosz et al., 1985). Accelerated physical weathering of rocks caused by blasting and movement during both mining and reclamation, and the addition of organic materials during reclamation, increase the rate of soil development (Sencindiver and Ammons, In press).

Smith et al. (1971) studied soil genesis in 70- to 130-year-old mine sites in West Virginia. They found the minesoils to have deeper root zones, higher bulk densities, and weaker soil structure than native soils. The general conclusion drawn from Smith's study and from other studies (Sencindiver and Ammons, In press; Schafer et al., 1980) was that minesoils were superior to native soils in some respects, yet inferior in others.

Few studies on soil development on mountaintop removal sites have been performed. Little information is known about long-term environmental changes on these sites. Therefore, we initiated a study to evaluate the quality of soils developing on a reclaimed mountaintop removal mine in southern West Virginia. The objective of this study was to document soil formation and to correlate minesoil property differences to age. This paper, a preliminary report of the study, compares development of soil horizons in native and different-aged minesoils. Further analyses of physical and chemical properties are ongoing.

Materials and Methods

Study Area

In July 1999, minesoil pits were dug and soil samples were collected on a mountaintop removal site near Sharples, Logan County, West Virginia. The coal beds mined at this site were within the Kanawha formation, which is composed of approximately 50% sandstone and 50% shale, siltstone, and coal. There are several marine zones found throughout the formation (Cardwell et al., 1968). Most of the soils in the unmined area are moderately deep to very deep Inceptisols or Ultisols (Table 1) forming in residuum (soil formed in place by natural weathering) or colluvium (soils formed from materials transported downslope by gravity). General slope classes of the premined and the mined and reclaimed areas were gently sloping to very steep. However, the general relief of the reclaimed areas is less than the premined landscape.

Elevation of the native landscape where samples were collected ranged from 561 to 568 m (1845-1863 ft), and the reclaimed mined land elevations ranged from 442 to 525 m (1450-1720 ft). The average temperature during the summer months is 22.8° C (73° F), and in the winter 1.0° C (34° F). The annual precipitation is 112 cm (44 in), 55% of which falls between April and September. The major vegetation before mining was predominantly forest which consisted of northern red oak (*Quercus rubra*, L.), black oak (*Q. velutina,* Lam.), yellow poplar (*Liriodendron tulipifera*, L.), hickory (*Carya* sp.), scarlet oak (*Q. coccinea*, Muench.), white oak (*Q. alba*, L.) and American beech (*Fagus grandifolia*, Ehrh.) (Wolf, 1994).

Field and Laboratory Studies

Four different ages of reclaimed mined land were sampled in 1999. These sites were reclaimed in 1976 (23 yrs), 1988 (11 yrs), 1992 (7 yrs), and 1997 (2 yrs). Vegetation on the 2- and 11-year-old minesoils was predominantly grasses and legumes, and the 7-year-old vegetation was a combination of grasses, legumes, and shrubs. The 23-year-old minesoil had predominantly forest cover of a few prominent trees with a sparse understory of grasses and legumes. Although several tree species were found on the site, the prominent species were black locust (*Robinia pseudoacacia* L.) and red maple (*Acer rubrum* L.) (Skousen et al., 1999).

Six replications of each of the minesoil age classes were sampled. One very deep and two moderately deep undisturbed native forest soils representing the major soil series in the county were sampled for comparison. The very deep soil developed in colluvium, and the moderately deep soils developed in residuum. Soil pits approximately 1 m wide x 2 m long x 1 m deep were excavated at each sampling point. Each pedon was described using standard soil survey procedures (Soil Survey Division Staff, 1993). Bulk samples were collected from every horizon described.

Aggregate stability was determined using the wet sieve method developed by Kemper and Rosenau (1986). Soil clods were collected in triplicate from each subsurface horizon, coated with a saran resin, and analyzed for bulk density by a water-displacement method (Soil Survey Staff, 1996).

Surface horizons were normally too thin and too friable for clod sampling. Therefore, all surface horizons were sampled using a frame excavation bulk density procedure (Robert Grossman, personal communication). All bulk density values were corrected for rock fragments and reported as bulk density of the <2 mm fraction.

The pH was measured by a 1:1 soil to

Table 1. Description of 12 soil orders used for classifying soils.

Soil Order	Derivation	Description
Entisols	Recent	Little profile development showing few horizons.
Inceptisols	Beginning	Young soils showing development of weak B horizons.
Mollisols	Soft	Deep, rich soils of plains and grasslands.
Alfisols	Pedalfer	Forest soils of humid, moderate climates with clay accumulation in the B horizon.
Ultisols	Ultimate	Forest soils of humid, hot climates. More acid than alfisols.
Oxisols	Oxides	Very deep, highly weathered soils of tropical areas.
Vertisols	Inverted	Soils containing swelling clays; deep cracks form when soil is dry.
Aridisols	Arid	Dry soils developing in arid climates.
Spodosols	Podzol	Forest soils of humid and cold climates.
Histosols	Histos	Organic, peat and bog soils having >30% organic matter.
Andisols	Andesite	Soils formed from volcanic ejecta.
Gelisols	Gelatine	Ice soils found in extremely cold climates.

water suspension method using a standard pH probe on an Accumet 915 pH meter (Method 8C1, Soil Survey Staff, 1996).

Results and Discussion

Horizon Development

Native soils have been formed during the past hundreds to thousands of years where physical and chemical weathering has acted on geologic materials. Minesoils also develop through physical and chemical weathering processes, but they are much younger.

Minesoils show signs of similar kinds of weathering, but some physical and chemical characteristics are due more to mining and reclamation methods than natural factors. Human influences include blasting of rocks into small fragments, compaction due to grading, addition of organic materials, additions of lime and fertilizer, and the seeding of grasses and legumes, or the planting of trees.

Processes of soil formation resulted in similar horizon development in each of the native soils (Table 2) where each soil had an O, A, Bw, and C horizon (see descriptions of these horizons in Table 3). The A horizons had weak or moderate granular structure, while the Bw horizons had weak or moderate subangular blocky structure. The Bw horizons in native soils fit criteria to be classified as Inceptisols (Soil Survey Staff, 1998).

Sixteen of the 24 minesoil pits (6 pits x 4 ages) had O horizons and all (24 pits) had A horizons (Table 2). Most minesoils had AC horizons, which are transition horizons between the A and C horizons with no B horizon. Structure of the minesoil A horizons was predominantly weak or moderate granular with some subangular blocky. Structure of the AC horizons was predominantly weak subangular blocky with some granular. In general, structure was strongest in the 23-year-old minesoil and weakest in the 2-year-old minesoil.

We described Bw horizons in one 23-year-old and one 7-year-old profile. These horizons had weak subangular blocky structure. Since the structure of the AC and the Bw horizons was similar, the two horizons were separated primarily by color. The AC horizons had colors similar to the A and/or C horizons. The Bw horizons had colors with higher value and/or chroma than the A and C. The Bw in the 23-year-old minesoil fit criteria to be classified as an Inceptisol, but the 7-year-old Bw did not (Soil Survey Staff, 1998). Therefore, with the exception of the older minesoil, all other minesoils classified as Entisols.

Table 2. Percent of pits having specific horizons as described and classified by standard soil survey techniques.

Horizon	Native[1]	1976	1988	1992	1997
O	100	100	33	33	100
A	100	100	100	100	100
AC	0	83	67	67	67
Bw	100	17	0	17	0
C	100	100	100	83	100
R	66	0	0	0	0

[1]Three native pits were dug, while each minesoil age had 6 pits.

As expected, solum (combined A, AC, and Bw horizons) development was considerably greater in native soils than in minesoils (Figure 1). However, minesoil solum thickness tended to increase with age. Our study and other minesoil studies indicate that minesoil development is more rapid in the first few years after reclamation.

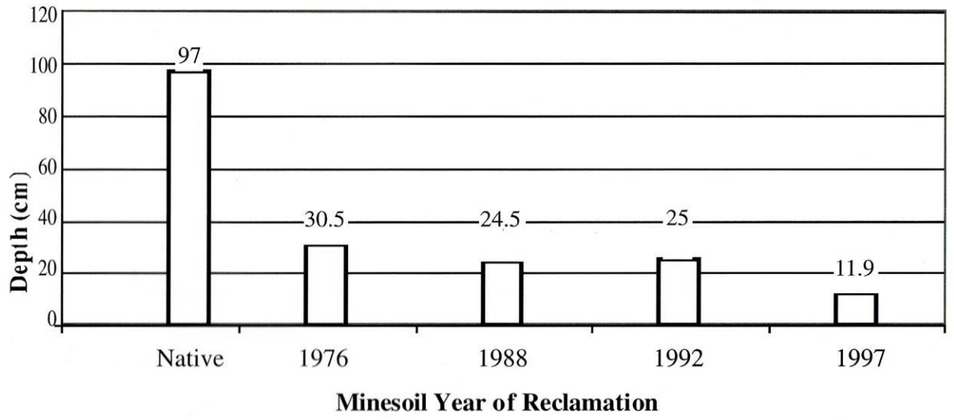
Interestingly, the A horizons of the native soils were thinner than all minesoil A horizons, except the 2-year-old site (Figure 2). We think this difference is primarily the result of human activities. Revegetation techniques normally disturb a 5- to 10-cm layer at the minesoil surface, and include some organic amendment. Also, it is highly probable that the native soils had experienced logging activities during the last 50 to 100 years.

If logging had occurred, then the O and A horizons would most likely have been removed by equipment and subsequent erosion, and the soils have been redeveloping without human influence. For the minesoils, A horizon thickness tended to increase with age (Figure 2). The actual thicknesses described were very similar to A horizons described in studies on sites mined by methods other than mountaintop removal. Roberts et al. (1988b) found that a 4-cm-thick A horizon developed on a nontopsoiled minesoil and a 6-cm-thick horizon developed on a topsoiled minesoil in one year. When sewage sludge was added to the minesoil, a 1-yr-old A horizon was 11-12 cm thick. Studies of 23 to 29-yr-old minesoils (Ciolkosz et al., 1985; Thurman and Sencindiver, 1986) show that A horizons of 9 to 13 cm thick had developed.

One of the first characteristics recognized when these minesoils were described was the large amount of weakly consolidated fragments of primarily sandstone and shale. The average rock fragment content of all described horizons was approximately 60%.

Roberts et al. (1988a) documented that percent rock fragments in surface horizons decrease with time. However, this general trend was not documented in our study. Surface rock fragment content in our study varied as follows: 11yrs < 23 yrs < 2 yrs < 7 yrs. The 23-year-old minesoils had higher rock-fragment

Figure 1. Average solum (A, Bw, AC) depth of native soil and minesoils.



contents in the C horizons compared to all other minesoils.

Also, the 2-year-old minesoils had fewer rock fragments in their subsoils than any other minesoil. These rock-fragment differences are probably due to differences in mining (blasting) and reclamation techniques rather than weathering.

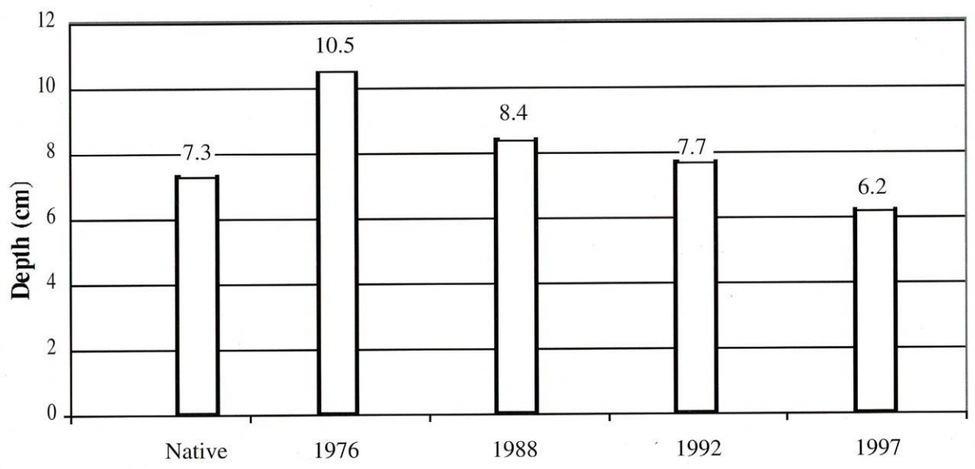
Aggregate Stability

Soil properties vary in the degree of their vulnerability to external forces. One measure of a soil's vulnerability to erosion is aggregate stability (Kemper and Rosenau, 1986), which expresses the resistance of soil structural aggregates to breakdown when subjected to disruptive processes. Freezing and thawing, wetting and drying, additions of organic matter, secretions of microorganisms, earthworm activity, and presence of clay-size particles are some of the factors affecting aggregation in soils. Aggregates generally become more stable over time, and thus total aggregation generally increases as processes of soil genesis develop soil horizons. The native soils, with an average of 63% in the surface horizon and 62% in the subsurface horizon, had higher water-stable aggregation than any of the minesoils (Figure 3). In minesoils, aggregation increased with age from a low of 12% in the subsurface horizon of the 2-year-old minesoil to a high of 54-56% in the surface horizon of the 11-year-old minesoil and the surface and subsurface horizons of the 23-year-old minesoil.

For the 2-, 7-, and 11-year-old minesoils, aggregation of the surface horizon was greater than in the subsurface horizon. These differences can be related to the time of soil development. As these soils age, aggregation should increase and the two horizons should become more similar as is indicated by the 23-year-old minesoil and the native soil.

On a site in northeastern West Virginia, Gorman and Sencindiver (1999) observed water-stable aggregation of 58% in the top 8 cm of the minesoil and 51% in the 8-16 cm depth in a 9-year-old minesoil. Also, they found that aggregation had increased over time from zero to 9 years.

Figure 2. Average thickness of A horizons on native soils and minesoils.



Bulk Density

Bulk density of the minesoils in the surface horizon was somewhat higher than that of the native soils (Figure 4). Bulk density of the minesoil A horizons ranged from a high of 1.1 Mg/m^3 in the 11-year-old site to a low of 0.87 Mg/m^3 in the 23-year-old site. Bulk density tended to increase with depth in all soils, but the values were similar for minesoils and native soils below the A horizon.

pH

In general, minesoil pH tended to decrease with age, and native soils had lower pH values at all depths than the minesoils (Figure 5). For all soils, pH tended to increase with depth.

Summary

Although minesoils in this study are very young compared to native soils of the region, they show evidence of soil development. The data indicate that soil properties are changing with time, and that the minesoils are becoming better developed with increasing age. Thickness of A horizons, thickness of the solum (A and B horizons), and total aggrega-

Table 3. Descriptions of horizons found in native soils and minesoils.

O Horizons	These horizons are comprised of organic horizons that form above the mineral soil. They result from litter derived from dead plants and animals.
A Horizons	These are the topmost mineral horizons. They generally contain enough partially decomposed organic matter to darken the soil color more than that of the lower horizons.
AC Horizons	These horizons contain properties that are similar to the upper A horizon and the lower C horizon. They are transition zones where weathering has not distinguished this zone to be classified as a B horizon.
B Horizons	These are subsurface horizons in which an accumulation of materials transported from above has taken place. In humid regions, the B horizons are the layers of accumulation of materials such as clays and iron and aluminum oxides. The Bw horizon designates a weakly developed B horizon, which shows a distinctive color or structure from the A or C horizons.
C Horizons	These are horizons that are partially weathered or unconsolidated bedrock. The C horizon is outside the normal zone of biological activities and is generally little affected by the processes that formed the horizons above it.
R Horizons	Consolidated rock normally considered the bedrock, which shows little to no effect of weathering.

tion have increased with age in the minesoils. Structure within the solum of some of the older minesoils was similar to comparable depths within the native soils.

Minesoil bulk density was comparable to the native soils. Minesoil pH is somewhat higher than native soil pH because of the presence of alkaline shales or other high pH materials being placed at the surface during reclamation.

Acknowledgments

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Figure 3: Average water-stable aggregation of the top two horizons.

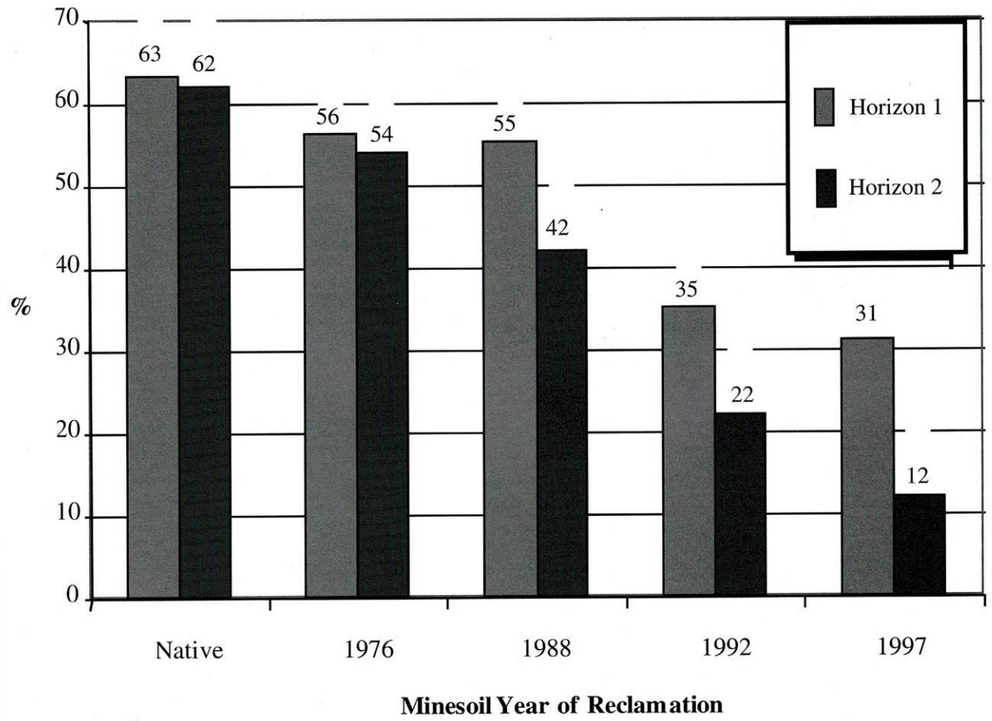


Figure 4. Average bulk density (<2mm) with depth of minesoils and native soils.

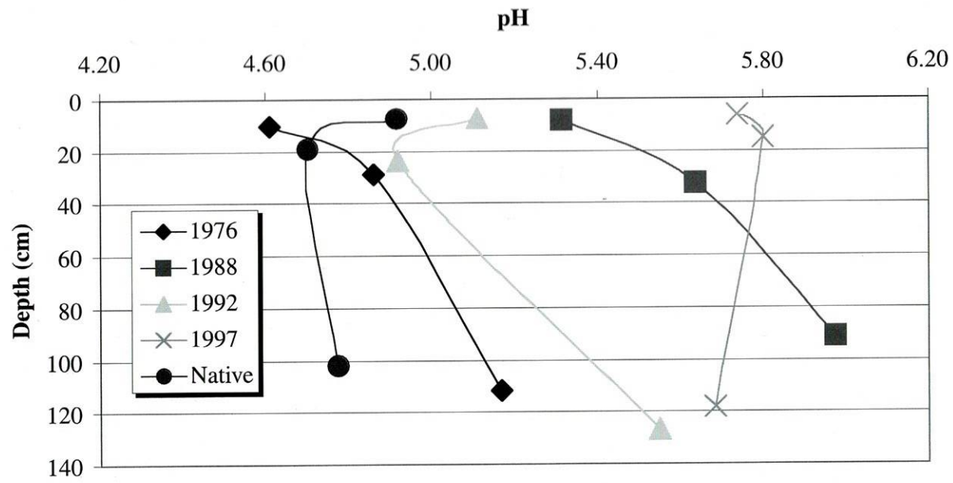
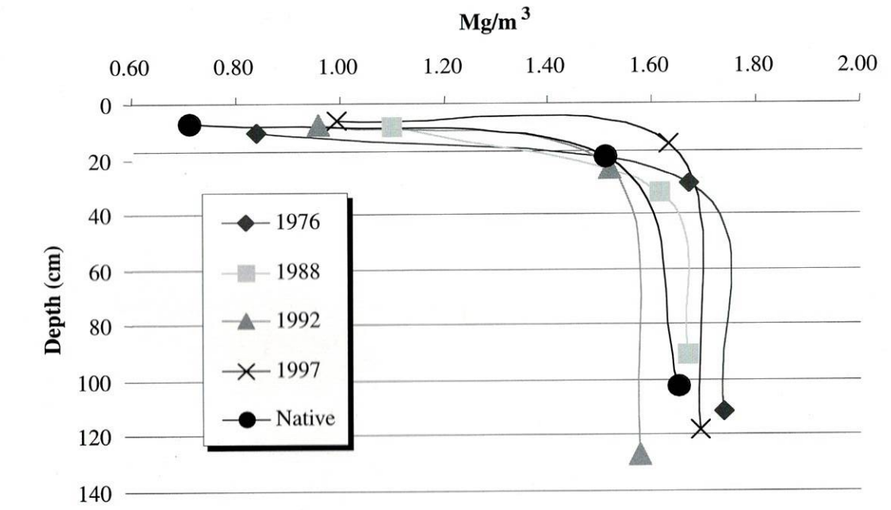


Figure 5. Average pH values with depth for native soils and minesoils.



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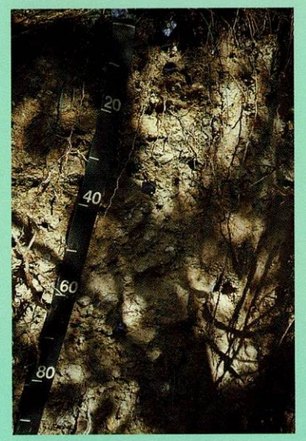
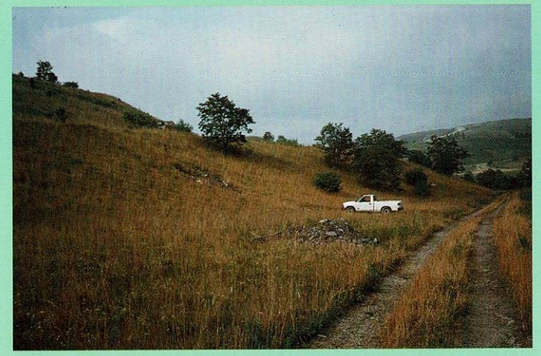
Picture 1. Soil profile for an unmined soil adjacent to the mountaintop removal surface mine near Sharples, West Virginia.

Picture 2. Landscape of the area surface mined in 1976, which was mined 23 years ago. The site had been colonized by a number of weedy species and trees. Sericea lespedeza, a common seeded legume during the 1970s is also still present.



Picture 3. Minesoil profile of the site mined 23 years ago. This profile showed development of a weak B horizon.

Picture 4. Landscape of the area surface mined in 1988, 11 years ago. The site had a few trees and shrubs, but was mostly still covered by seeded grasses and legumes.



Picture 5. Minesoil profile of the site mined 11 years ago. The profile shows a distinct A horizon, underlain by a layer containing various sizes of rock and soil material.

Picture 6. Landscape of the area surface mined in 1992, 7 years ago. The site showed a variety of shrub species, which had been seeded during reclamation, along with a grass and legume cover.

Picture 7. Minesoil profile of the site mined 7 years ago. The A horizon is underlain by a very weak B horizon. This profile does not have as many rocks in the C horizons as some of the other profiles.

Picture 8. Landscape of the area surface mined in 1997, 2 years ago. The vegetation on the site was comprised of only the species that had been seeded during reclamation. Trees or shrubs had not become established yet.

Picture 9. Minesoil profile of the site mined 2 years ago. The A horizon is relatively thin on these very young soils, but will continue to increase in thickness as roots move into lower depths.