

# Mountaintop Removal Mining



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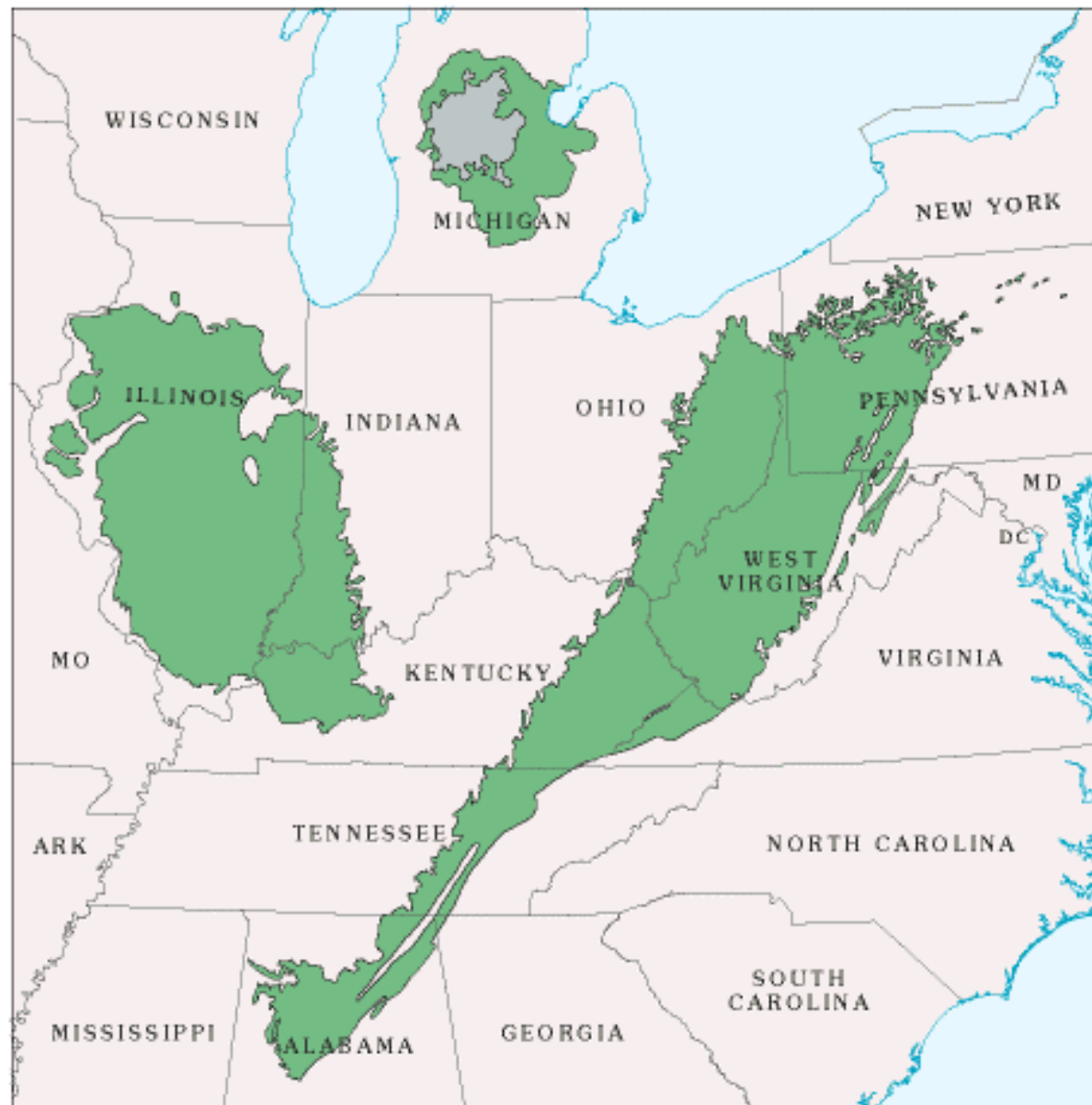
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introduction: geology



## introduction: geology

- geologists have concluded that this portion of Earth varied between marine, estuary and dry land as the climate changed between periods of glaciation – all the while slowly filling up with sediment and sand
- the mountains consist of layered, reasonably solid rock composed of sandstone, siltstone, limestone (the latter formed via calcium carbonate deposits and the skeletons of marine life forms)



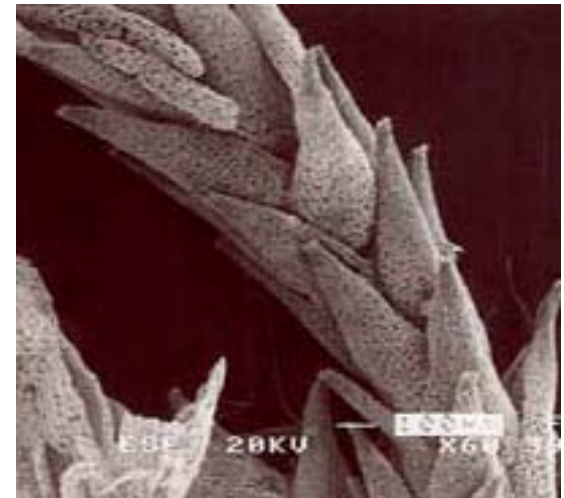
Pennsylvanian aquifers consist mostly of sandstone and limestone that are parts of repeating sequences of beds deposited during multiple sedimentary cycles.

**EXPLANATION**  
■ Pennsylvanian aquifers—  
Gray where extent is buried.

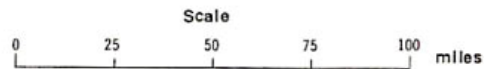
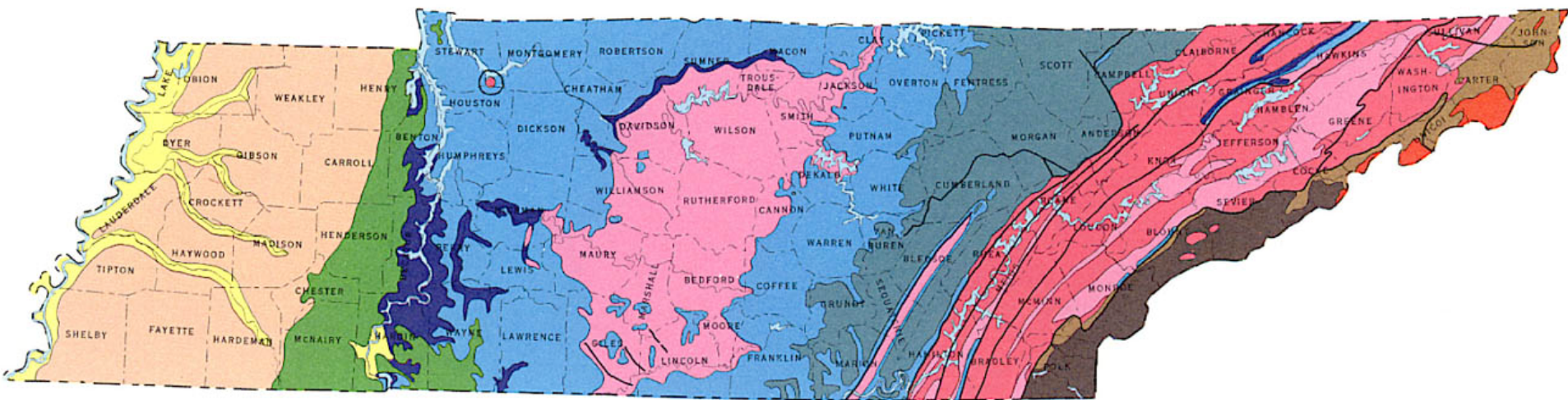
# characteristics/ life history

- *sphagnum* moss grows in a similar fashion to coral; it is alive and growing at the top of the plant, and dead at the base

- as the moss grows upward, the base layers are forced deeper underwater and are compacted. the lower layers die, but are not decomposed for the most part and therefore retain their nutrients, denourishing the surrounding environment



# introduction: geology



CENOZOIC		MESOZOIC		PALEOZOIC						PRECAMBRIAN	
<b>QUATERNARY</b>	<b>TERTIARY</b>	<b>CRETACEOUS</b>	<b>PENNSYLVANIAN</b>	<b>MISSISSIPPIAN</b>	<b>DEVONIAN-SILURIAN</b>	<b>ORDOVICIAN</b>	<b>ORDOVICIAN-CAMBRIAN</b>	<b>CAMBRIAN</b>	<b>SEDIMENTARY AND METAMORPHIC ROCKS</b>	<b>IGNEOUS AND METAMORPHIC ROCKS</b>	
Sand, silt, clay, gravel and loess	Sand, silt, clay and gravel	Sand, clay, silt and gravel	Sandstone, shale, conglomerate, siltstone and coal	Limestone, chert, shale, siltstone, sandstone and dolomite	Limestone, chert, shale, sandstone	Limestone, shale, dolomite, siltstone, sandstone and claystone	Dolomite, limestone, shale, chert, siltstone and sandstone	Shale, dolomite, limestone, sandstone, conglomerate, quartzite, arkose, graywacke and siltstone	Sandstone, conglomerate, siltstone, arkose, graywacke, quartzite, phyllite, slate and schist	Metamorphosed lavas and tuffs, metagabbro, rhyolites, diorite, granite, granitic gneisses, monzonite, quartz latites, anorthosite and diabase	

**GENERALIZED GEOLOGIC MAP OF TENNESSEE**



## introduction: mountaintop removal mining

various methods of mining:

- open pit
- strip mining
- dredging
- longwall
- mountaintop removal



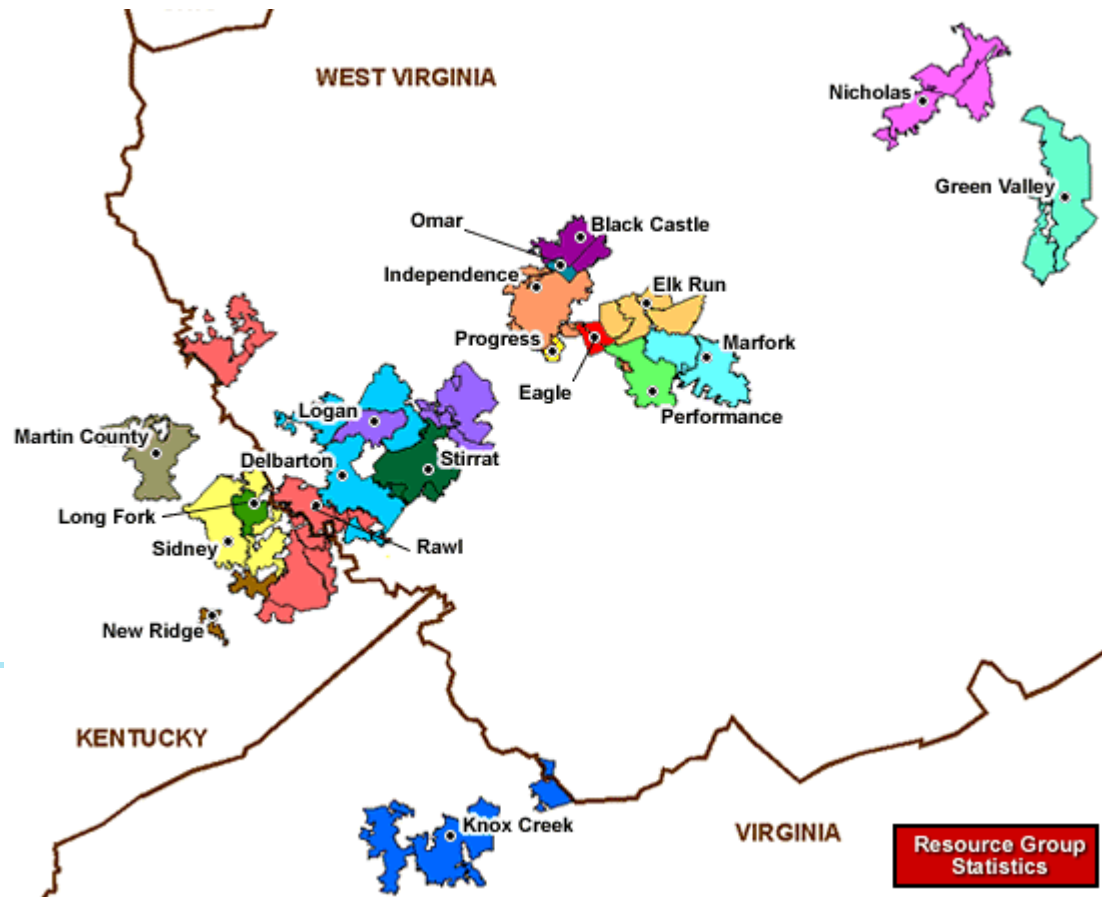
## introduction: mountaintop removal mining



- mountaintop removal mining is a method of surface mining in which the top portion of a mountain (500-700 ft) is blasted apart using dynamite and then removed to expose underlying seams of coal which are then mined
- the excess waste rock, or spoil, is then used to fill valleys adjacent to the mountain, and held stable via earthen containments, creating flat land



# introduction: mountaintop removal mining



## introduction: mountaintop removal mining

- mountain top removal mining has been prevalent in Appalachia since the 1970s, especially in West Virginia where there are several coal seams in the top 1,000 ft of the mountains

- regulation of mining activity is controlled via the Surface Mine Control and Reclamation Act (SMCRA) and the Clean Water Act



- SMCRA was enacted to ensure a balance between mining activities (especially coal mining) and proper care of the environment
- the Clean Water Act (specifically section 404) protects waterways (creeks, streams, rivers) from unrestricted dumping of mine and construction waste, raw sewage and other harmful pollutants

# introduction: mountaintop removal mining

agencies that create and enforce national standards and regulations (or do they?):

- Environmental Protection Agency
- USGS
- DOI, Office of Surface Mining
- DOI, Department of Energy
- DOI, Bureau of Land Management
- state specific departments of environmental protection



## The Office of Surface Mining

is a bureau of the U.S. Department of the Interior with responsibility, in cooperation with the states and Indian Tribes, to protect citizens and the environment during mining and reclamation, and to reclaim mines abandoned before 1977.

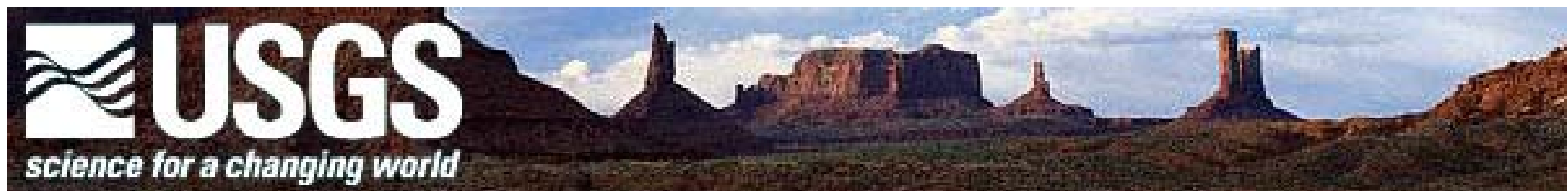
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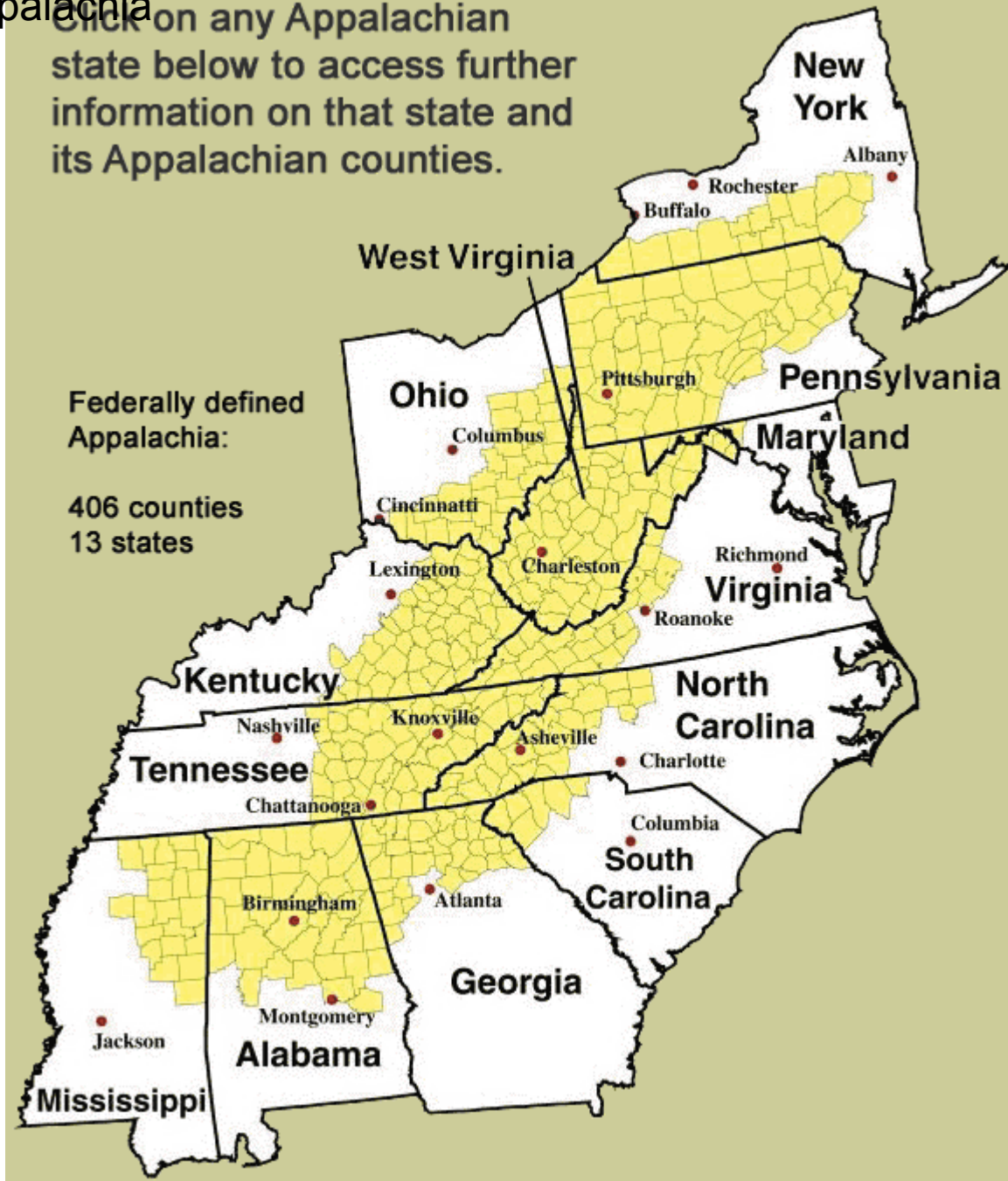


# introduction: Appalachia

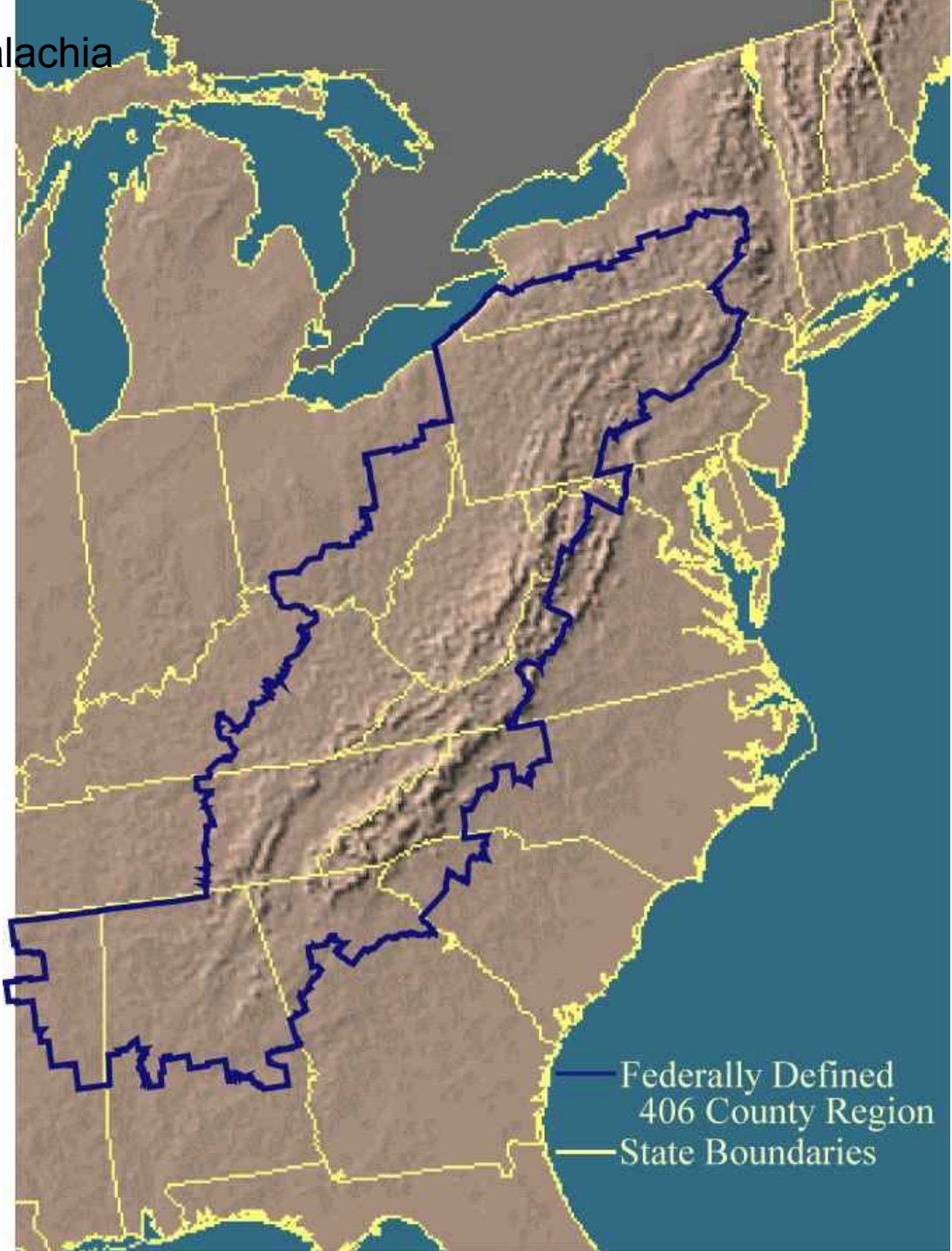
Click on any Appalachian state below to access further information on that state and its Appalachian counties.

Federally defined Appalachia:

406 counties  
13 states

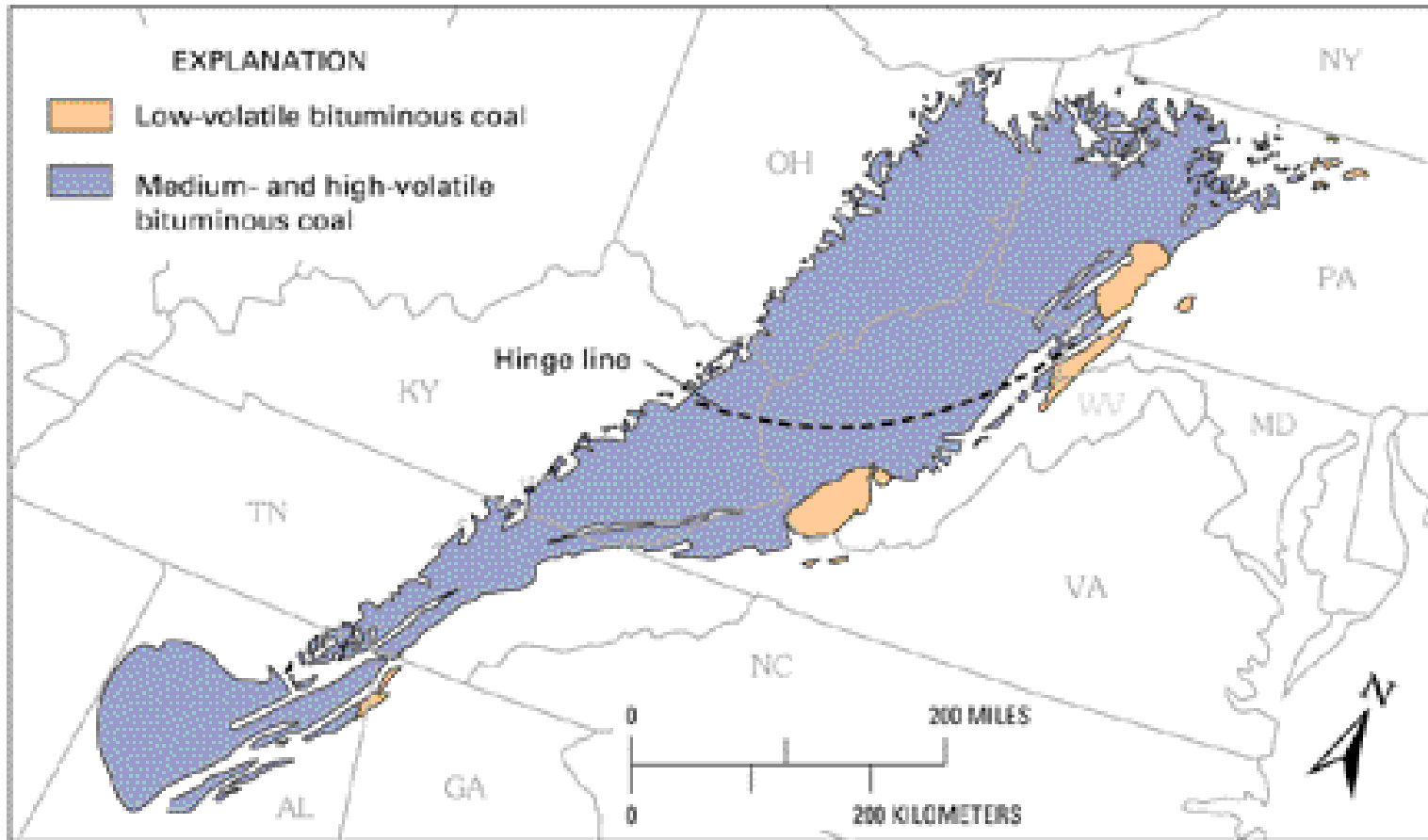


introduction: Appalachia



# introduction: Appalachia

Coal (2001) : 1,904.0 (billion kilowatt hours)



- approximately 40 percent of the nation's coal is produced in the central Appalachian region

- 25% of the world's coal reserves are found within the United States. Coal supplies more than half the electricity consumed by Americans, and over 99% of the electricity consumed by the states of central Appalachia

introduction: Appalachia



## introduction: Appalachia

- central Appalachia has the highest rates associated with persistent poverty in the nation (17% of the population lives below the poverty line, as opposed to 13% nationally)

### **BOONE COUNTY**

Per Capita Income (1999)\$19,843

### **LOGAN COUNTY**

Per Capita Income (1999)\$17,291

### **LINCOLN COUNTY**

Per Capita Income (1999)\$14,261

### **WAYNE COUNTY**

Per Capita Income (1999)\$15,988

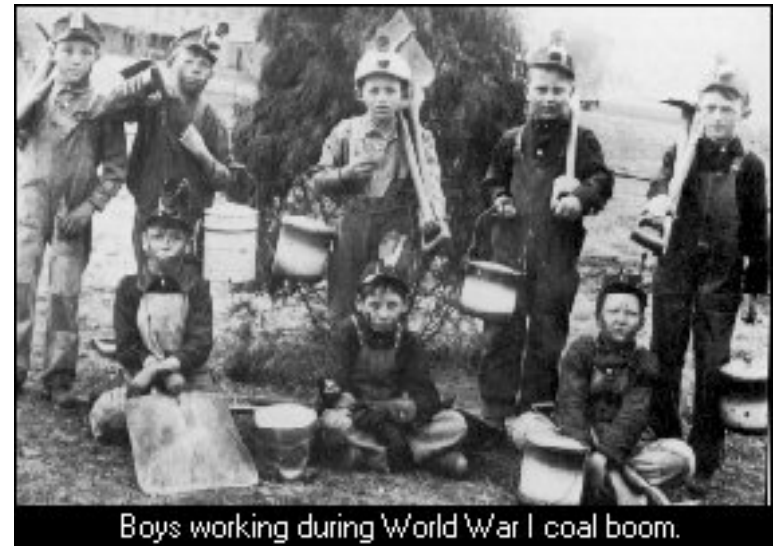
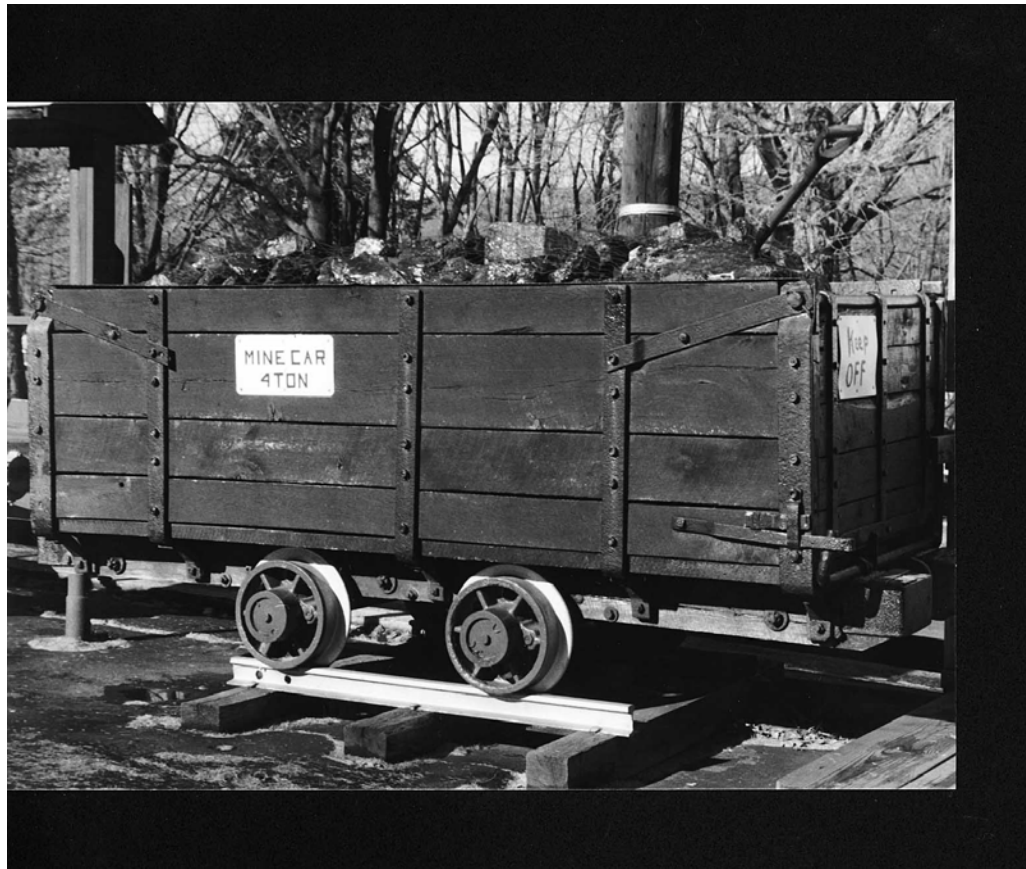
### **WYOMING COUNTY**

Per Capita Income (1999)\$14,606



## part 1: the people and the benefits

- Appalachian residents have been mining coal since the 1800s because of advances in technology and the boom of the industrial revolution



## part 1: the people and the benefits

- the coal industry began hiring Appalachian locals because of their extensive Knowledge of the mountains. Coal was mined, in the beginning, only where overlying land had been eroded and coal seams were protruding from the ground
- as the industry and profits grew, operations became larger and more efficient
- the average surface mine permit is drafted now for hundreds of square acres



## part 1: the people and the benefits

- mountaintop removal mining is the most efficient method of mining, currently  
coal cost (per ton) mountain top removal: \$15  
coal cost (per ton) underground mining: \$27
- coal production in Appalachia went from 95 million tons in 1977 to 181 million tons in 1998, largely because of the use of mountain top removal mining



## part 1: the people and the benefits

- mountaintop removal mining is also a comparatively safe method of mining, accessing the coal seams from the top as opposed to the bottom of the mountains prevents the need for manual labor underground
- however, higher efficiency and less dependency on manual labor means a reduction of jobs, as more company employ mountaintop removal



part 1: the people and the benefits

**Method of Coal Production**

CONVENTIONAL	441,045	451,140	187,843	437,748
CONTINUOUS	72,443,553	68,039,484	68,935,016	61,442,619
LONGWALL	41,084,041	40,824,822	41,477,390	38,272,692
OTHER	130,751	79,700	0	447,199
SURFACE	55,107,444	59,975,456	64,452,608	63,296,632
<b>TOTAL</b>	<b>169,206,834</b>	<b>169,370,602</b>	<b>175,052,857</b>	<b>163,896,890</b>

## part 1: the people and the benefits

### production:

- in 1998 the United States produced 1118.7 million tons of coals
- annual production value of coal in the United States: \$19,599,200,000
- 77,000 coal miners are employed in the United States annually
- West Virginia, Kentucky and Pennsylvania rank 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> in terms of national annual coal production

### consumption:

- in 1998 the United States consumed 1038 million tons of coal, about 23% of the world's coal consumption
- 973,076 thousand tons of coal were burned in 2001
- compared to petroleum and natural gas, coal consumption for generation of electricity is over 60% cheaper
- coal burning generated 1,903,380 megawatt hours of electricity in 2001

part 1: the people and the benefits



part 2: the environment and the consequences





part 2: the environment and the consequences



## part 2: the environment and the consequences

- the most ecologically detrimental factor in the mountaintop removal controversy is the association of these mining operations with valley fills
- there are over 450 valleys fills already in place throughout Appalachia, and there are another 300 in the works, pending permits
- these valley fills have buried an estimated 1,000 miles of streams, are a source of pollution such as acid mine drainage, and effect downstream groundwater systems and stream health



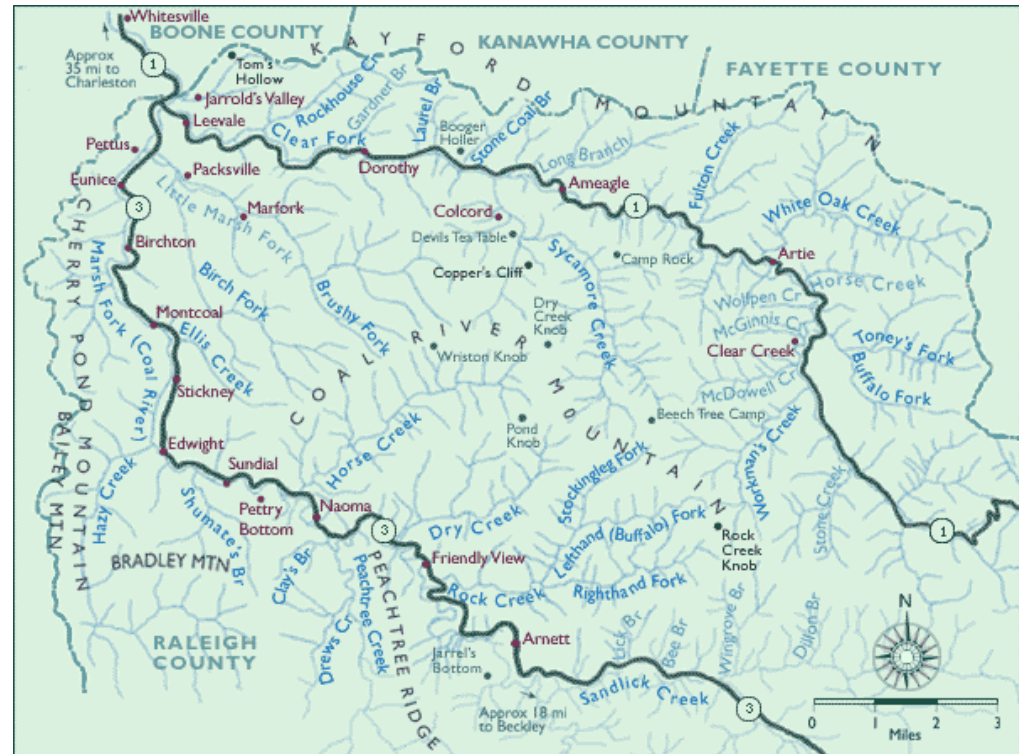
## part 2: the environment and the consequences

- valley fills are a necessary part of mountaintop removal mining, it would be extremely cost-ineffective to make fills illegal, however their total environmental consequences are as of yet unknown
- a change in the definition of 'fill' material led to the inclusion of all forms of waste rock from mine sites and construction sites



## part 2: the environment and the consequences

- the American rivers organization named West Virginia's Big Coal River as the 9<sup>th</sup> most endangered river in 1999 and the 6<sup>th</sup> in 2001
- over 200 miles of headwater streams of the Coal River have been buried by valley fills associated with mountaintop removal mining



## part 2: the environment and the consequences

- as the average size of mountaintop removal operations increases, so does the area of streams impacted by valley fills. The average length of stream burial has risen 224% since 1995.
- the streams being buried are headwater streams that run only seasonally, as permanent streams are protected (somewhat) by the Clean Water Act. However, these streams may be just as ecologically important as those that are permanent



## part 2: the environment and the consequences

- in 2003 the EPA released an environmental impact statement done on mountaintop removal mining and valley fills in central Appalachia



- the conclusions of this report were:
- seasonal streams support the same organisms and ecosystems as permanent streams
- seasonal streams provide nutrients to organisms downstream in permanent streams and larger rivers
- lowland areas that support seasonal streams play a key role in flood control during period of heavy precipitation
- biomass does not completely disappear with the disappearance of water in these streams, rather many organisms burrow in the soft sediment to return once water is flowing again
- reclaimed streams do not support the ecosystem as do natural streams
- additional research must be undertaken to fully comprehend the importance of seasonal streams

## part 2: the environment and the consequences

- acid mine drainage is an addition concern for environmental as well as human health
- acidic water high in magnesium, aluminum, and iron accumulates in groundwater and pollutes drinking water, streams, rivers, and lakes
- acid mine drainage occurs when sediment high in iron-sulfide is exposed to air and water



## references

United States Geologic Survey

[www.usgs.gov](http://www.usgs.gov)

American Rivers

[www.americanrivers.com](http://www.americanrivers.com)

Mountain Area Information Network

[www.main.nc.us](http://www.main.nc.us)

Massey Coal Company

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Ohio River Valley Environmental Coalition

[www.ohvec.org](http://www.ohvec.org)

Arch Coal, Inc.

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West Virginia Rivers Coalition

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