Mining: Minerals and Coal

Non-Renewable Mineral Resources

- **Extracted from Earth's Crust**
  - Metallic (iron, copper, aluminum)
  - Nonmetallic (salt, clay, sand, phosphates)
  - Energy (coal, oil, natural gas, uranium)

- **Most metals are not in pure form when extracted**
  - *Ore*: rock containing sufficient concentration of resource to be profitable to process

USGS classification of non-renewable mineral resources

- ***Identified:*** known location, quantity, and quality

- ***Reserves:*** identified resource which can be mined profitably at current prices (*how is this different from "identified"*?)

- ***Undiscovered:*** potential assumed to exist based on geologic knowledge and theory

Extracting Mineral Resources: Surface Mining

- Useful for Shallow Deposits
- Remove "*overburden*" (trees, soil, rock)
- Overburden is discarded as "*spoils*"

- *Four Techniques:*
  - Open pit – iron, sand, gravel
  - Dredging – underwater
  - Strip mining
  - Mountaintop removal

- *In U.S., Surface Mining extracts:*
  - 90% of nonfuel mineral resources
  - 60% of coal

Extracting Mineral Resources: Subsurface Mining

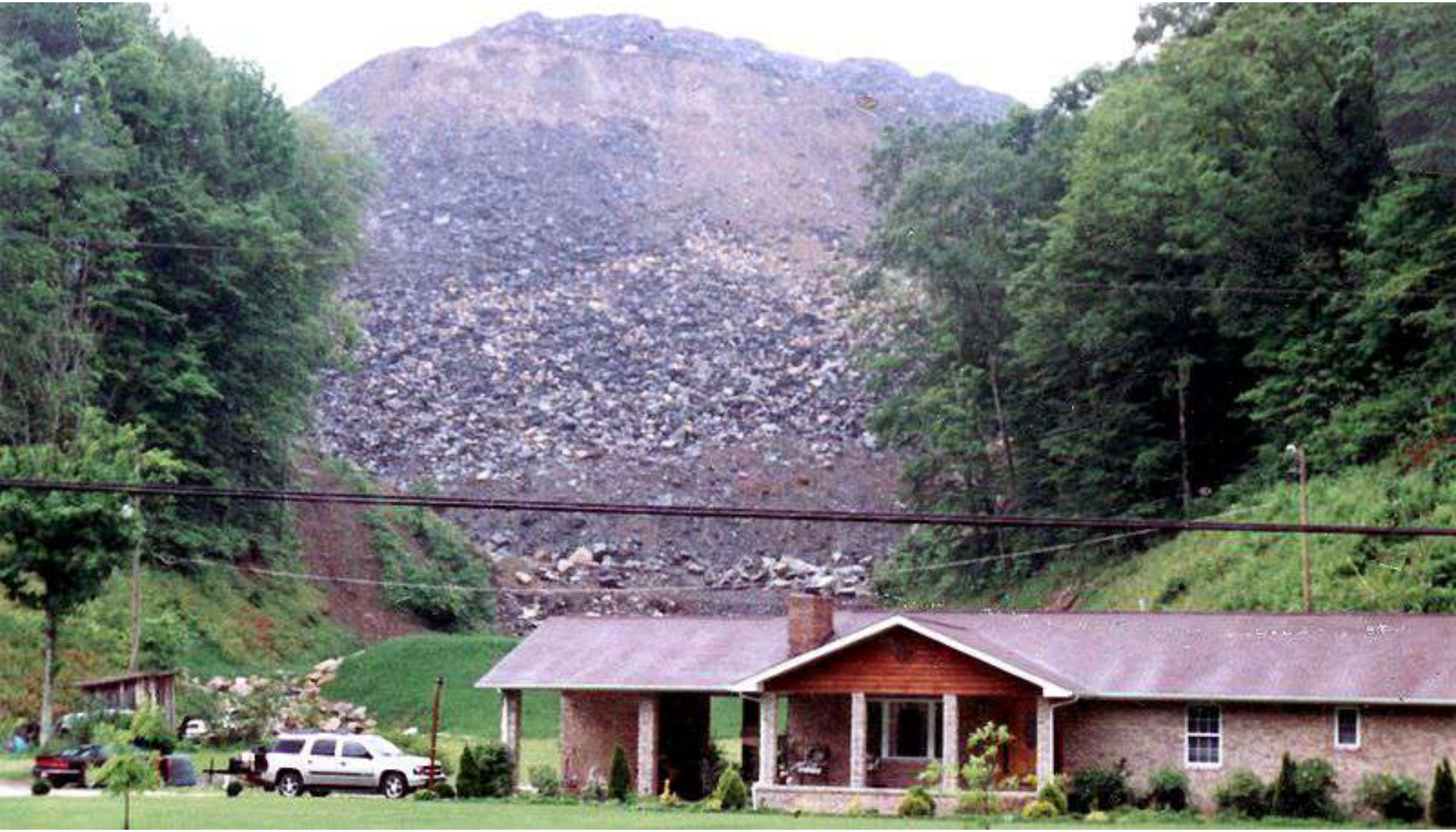
- Deep deposits
- More hazardous
- More expensive

- Techniques:
  - Shafts and tunnels
  - Room and pillar
  - Longwall

- Less impact on environment
- Lower recovery

Environmental Effects of Mining

- Scarring and Disruption of Land Surface
- Subsidence
- Mining Wastes – carbon dioxide, sulfur dioxide, ash (tailings)
- Acid Mine Drainage

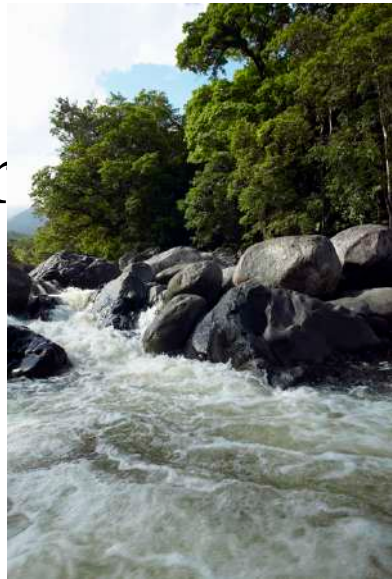


Spotlight on Acid Mine Drainage

- Mining is often done below the water table. Once mine closes and pumping of water stops, water fills the mine and oxidizes the metals.

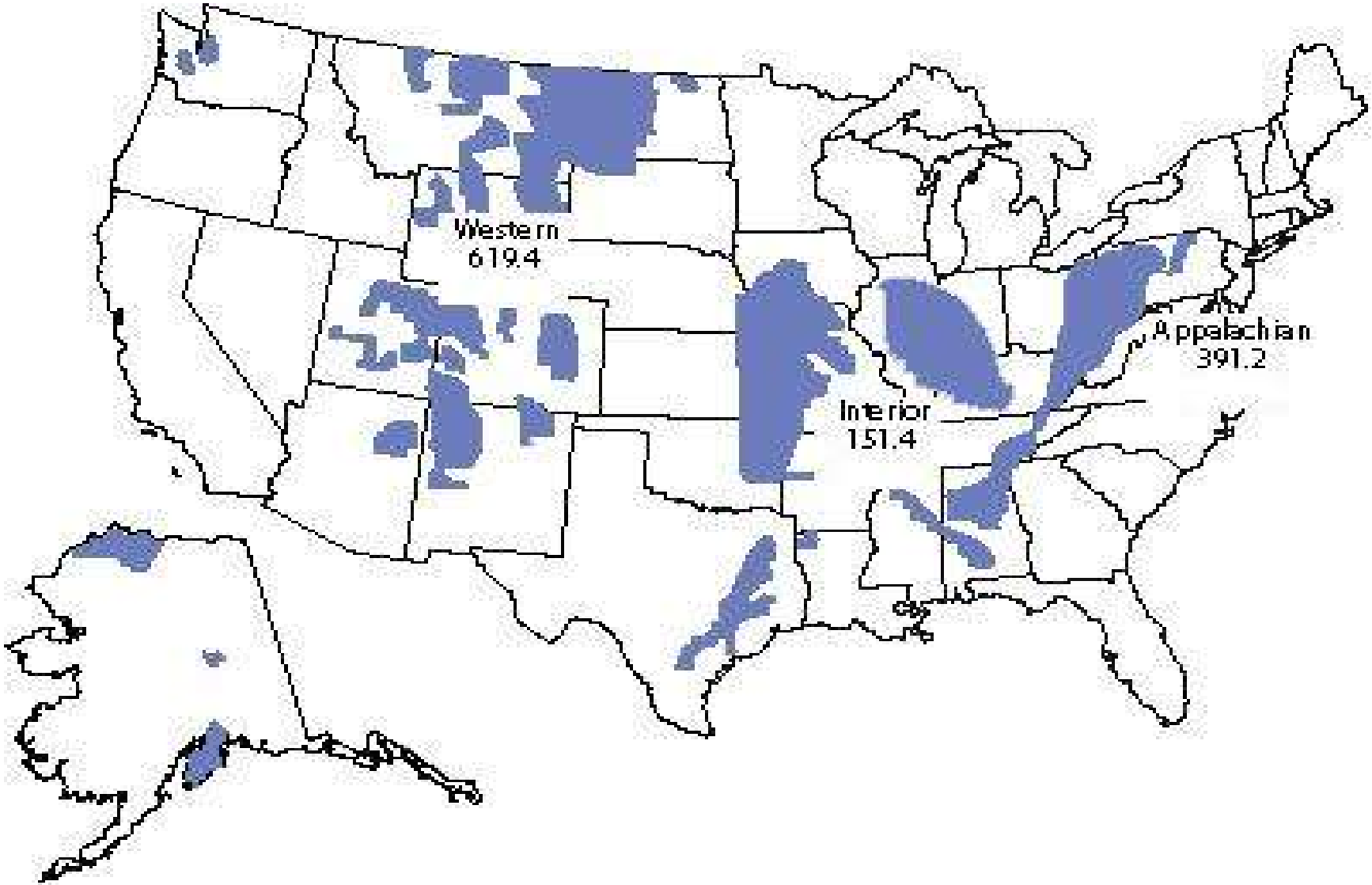
- Rainwater carries low pH (acidic) water to nearby streams, ponds, etc

- Impact on wildlife – few things can gr there.



Coal

- Plentiful (200+ year supply – data in tons)
- Provides over 50% US electricity



1500 MW Coal Power Plant

Coal

- **Example:** Mohave coal-fired electric plant:
  - Burns 8000 tons of coal/day
  - Produces 1000 MW electricity

  - ***BUT…..per day:***

  - Also 20000 tons of CO_2
  - Also 800 tons of SO_2
  - Also 800 tons of fly ash (light)
  - Also 800 tons of boiler ash (heavy)

NOTE: Text data – EU estimates order of magnitude lower

Highest Moisture, Lowest Energy Content

- Peat
  - Not coal
  - Low heat content
- Lignite
  - Brown coal
  - Low sulfur
  - Limited supply
- Bituminous
  - Soft coal
  - High sulfur
  - Large supply
- Anthracite
  - Hard coal
  - Low sulfur
  - Highly desirable
  - Limited supply

Lowest Moisture, Highest Energy Content

Coal

Advantages

- Ample Supply
- High Net Energy Yield
- Low Cost
- Existing Technology
- Can Reduce Pollution

Disadvantages

- High Environmental Impact
- Severe Land Disturbance
- High Land Use
- Threats to Human Health
- High CO_2 Emissions
- Release of Particulates

Coal Mining: http://www.youtube.com/watch?v=cptJNaft2PI