Abandoned Mineral Lands in the National Parks

United States Department of the Interior
National Park Service

Talc mine, Death Valley National Monument, CA.

Kennicott Mill, Wrangell-St. Elias National Park and Preserve, AK.

Hazardous mine opening, Wrangell-St. Elias National Park and Preserve, AK.

Oil and gas extraction equipment, Big South Fork National River and Recreation Area, KY.

These images are not what we expect to see on a National Park Service brochure. Far different from the scenic, pristine vistas of Yosemite and Grand Canyon, these images are examples of the 4,000 abandoned mineral land sites that are scattered throughout the national park system. Deserted, these lands stand in silent testimony to those who pioneered this country in search of mineral wealth.

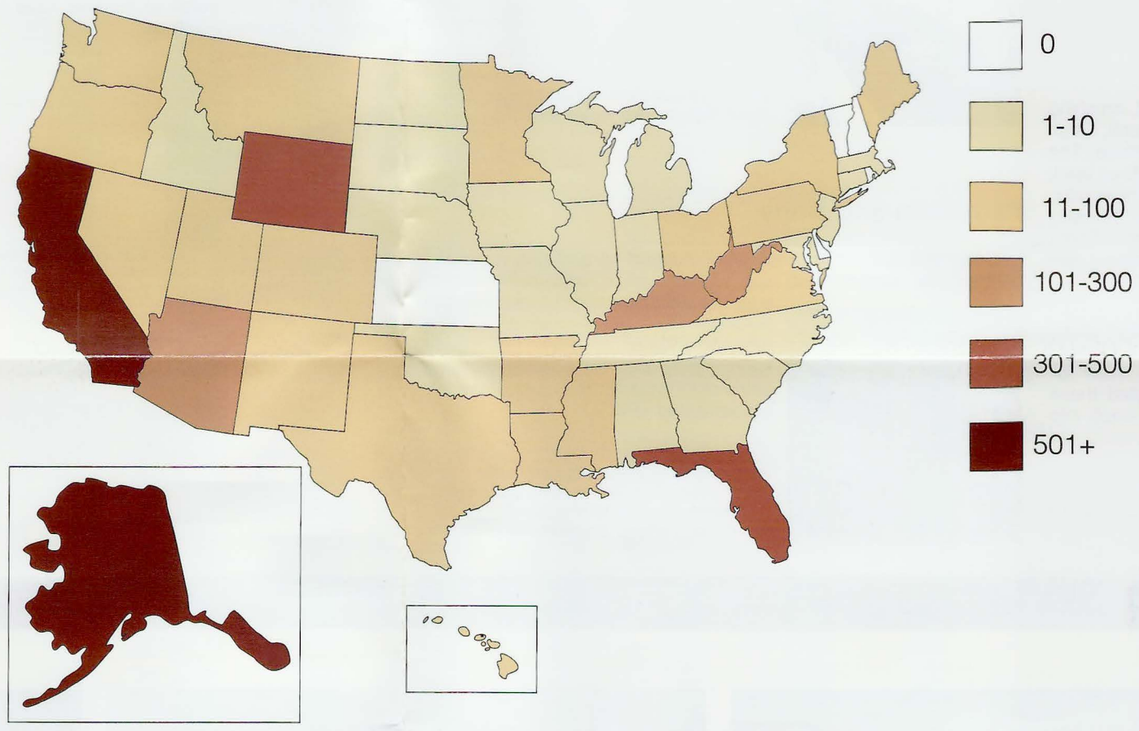
Legacy of Mineral Development. Not surprisingly, the legacy of abandoned mineral lands spans North America. Mining for flint, obsidian, and native copper for tools and weapons, turquoise for jewelry, and clay for pipes began with the arrival of prehistoric peoples. During the 16th century, expectation of mineral wealth drove Coronado's conquistadors beyond the edge of civilization to the heart of an unknown continent. Later, the lure of gold and the prospect of great wealth was responsible for Europeans settling in the western United States. With the beginning of the industrial age, the young nation, eager for growth, exploited its mineral resources of coal, copper, iron, oil, and gas, and this, too, left its mark on the land.

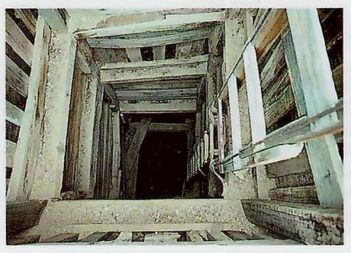
Did mining occur in national parks? Yes, in fact, mining still occurs today in some parks. The majority of abandoned mines located in national park boundaries, however, are not from recent mining operations, but are from operations that existed before parks were established.

Over 4,000 abandoned mineral sites can be found in the national park system, in all 10 regions of the system and in 45 states. This number translates to over 11,000 underground openings, 700 oil and gas wells, 1,000 quarries, and 33,000 disturbed acres. Additionally, the National Park Service estimates that 5,000 miles of abandoned access roads exist.

Abandoned mineral lands are those lands that have been disturbed by mineral extraction activities — underground mining, surface mining, dredging, and oil and gas exploration — and then abandoned. Abandoned mineral lands can be underground with numerous mine openings such as adits and shafts, or on the surface in the form of strip mines, quarries, open wells, or pits. In addition to the actual mine or well, abandoned mineral lands may include access roads and trails, historic buildings such as mills and company towns, tailings and waste rock piles, and abandoned machinery such as ore carts, steam engines, and pump jacks.

Abandoned Mineral Lands Sites in National Parks by State





Unprotected shafts can be an extreme safety hazard. Two-hundred-foot deep shaft, Lake Mead National Recreation Area, NV.

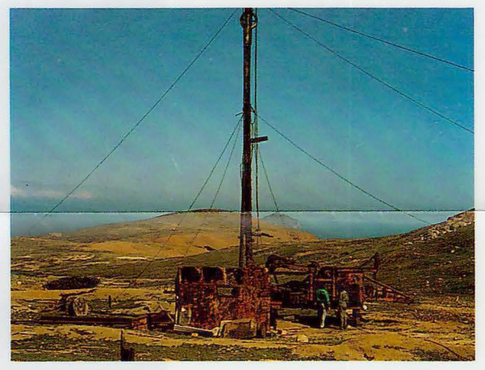
A mine access road, Wrangell-St. Elias National Park and Preserve, AK.

Sand and gravel pits make up a significant portion of the abandoned mineral lands in the national park system, Cuyahoga Valley National Recreation Area, OH.

Heavy metals contaminate the ruins of this mill and retort at an abandoned mercury mine, Big Bend National Park, TX.

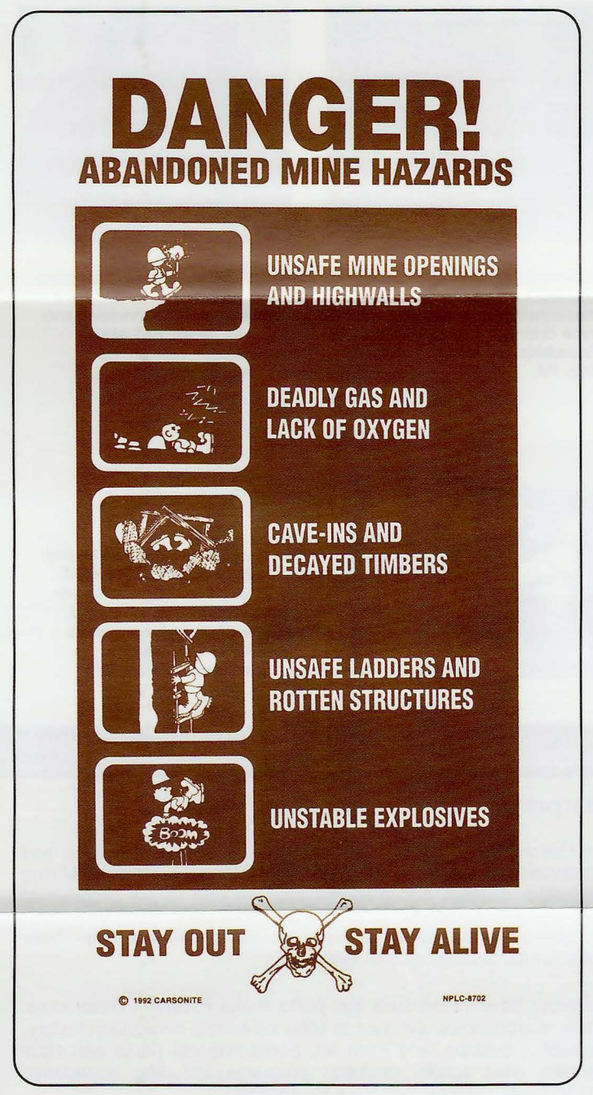
Pump jack, Guadalupe Mountains National Park, TX.

Unstable adits and structures are common hazards at abandoned mines. Talc mine, Death Valley National Monument, CA.



Remnants of an oil and gas rig, Channel Islands National Park, CA.

Safety Hazards



Occasionally, adventurous people enter abandoned mines or well sites. Some are injured or do not make it out. These people fell victim to one or more of the many hazards associated with abandoned mineral sites.

Vertical Mine Openings

Falling down vertical openings is the number one cause of death and injury in abandoned mines. Darkness, loose debris, and false floors can hide vertical openings. Weathered rock at the edge of an opening can break away and slide into the hole under the weight of a person.

Deadly Gases and Oxygen Deficiency

Lethal concentrations of methane, carbon monoxide, carbon dioxide, and hydrogen sulfide can accumulate in underground passages. Pockets of still air with little or no oxygen can be encountered. By the time a person feels ill, it is often too late to react.

Cave-Ins

Mines can cave in at any time! The effects of blasting and weathering destabilize once-competent bedrock through time.

Unsafe Structures

Support timbers, headframes, ladders, cabins, pump jacks, tanks, and other related structures may seem safe, but can easily crumble under a person's weight. Do not be fooled by appearances!

Unstable Explosives

Unused or misfired explosives are deadly. Because old explosives become unstable, minimal vibrations caused by a touch or footfall can trigger an explosion.

Highwalls

Vertical cliffs from which material was extracted are common features of open pit mines and quarries. These highwalls can be unstable and prone to collapse. Do not climb near or on highwalls.

Radioactivity

Some materials that were mined, such as uranium and thorium, are radioactive. Because the effects of radiation exposure are cumulative through a lifetime, any excess exposure can be harmful or eventually fatal to humans, wildlife, and plants.

Water Hazards

Many abandoned mines become flooded. Even shallow water can conceal sharp objects, drop-offs, and other hazards.

Pits

Mud pits once used for oil and gas operations can contain hazardous materials, and may have the consistency of quicksand.

Designed for the Short-Term

Mines were constructed and maintained to be safe only while they were in operation. When the miners departed in search of more lucrative deposits, they often left vertical openings uncovered and removed the water pumping and ventilation systems. Support structures, timbers, and ore pillars were removed or left to rot.

Mines Are Not Caves

Caves are formed naturally over thousands or even millions of years. Mines, in contrast, are formed in comparatively short periods of time through blasting, a process that fractures and destabilizes the surrounding rocks. Most underground mines do not have natural ventilation and, consequently, can have lethal air traps. Even experienced cavers can die exploring mines.

Rescues

Mine rescue attempts are extremely hazardous. Mine rescue teams, despite their extensive training, are at significant risk every time they enter an abandoned mine. The tragic and unfortunate reality is that most mine rescues turn into body recoveries.

Definitions

Adit: A horizontal mine opening, open to the surface at one end.

Headframe: A structure erected above a shaft for hoisting purposes.

Mill: The building or machinery in which ore is crushed and otherwise processed to extract the desired minerals.

Open pit mine: A mine at which the ore is excavated from the surface.

Ore: Rock that contains an economic or profitable amount of the desired commodity such as gold or silver.

Pump jack: Surface equipment that pumps petroleum from an oil or gas reservoir.

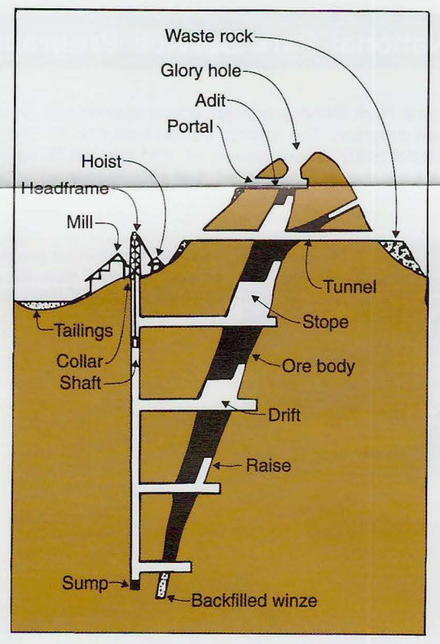
Reclamation: The process of returning disturbed lands to a desired use — for example, farming, grazing, wilderness, or recreation.

Restoration: The process of restoring lands to its predisturbed use.

Shaft: A vertical mine opening, similar to an elevator shaft.

Tailings: Excavated rock that has been crushed and processed in a mill or dredge.

Waste rock: Rock that was excavated to reach high-grade ore.



Environmental Impacts

Abandoned mineral lands can cause detrimental environmental impacts affecting soils, water, plants, and animals. In many cases, the extent of these impacts in national park system units is not known. Inventories are incomplete and parks are still evaluating sites. The following examples are common environmental impacts associated with abandoned mineral lands. Not all of these impacts would be found at any one site.

Water Resources

Water is one of the resources most frequently impacted by abandoned mines and wells. Water is also the main vehicle that carries abandoned mineral land impacts beyond the immediate site. Elevated concentrations of metals and increased amounts of sediment, acidity, petroleum, and brine threaten surface and underground water quality and aquatic habitats.

Acid Mine Drainage

Acid is created as metals oxidize in sulfide ore and waste rock. Acid allows toxic metals to dissolve and wash into streams and lakes. Acid mine drainage occurs at only a few of the abandoned mines in the national park system. At some of these sites, the water coming out of the mines is so acidic that it can actually burn a person's skin.

Acid mine drainage at a coal mine, Big South Fork National River and Recreation Area, KY/TN.

Metal Contamination

Mining for metals requires extracting ore from the ground, crushing it to the size of sand grains, and removing the desired mineral. Often the excess material — tailings — is deposited on the surface. The tailings still contain relatively large amounts of metals such as lead, iron, zinc, copper, and cadmium. During storms and snowmelts, water flows over and through the tailings pile. The water interacts with the metals, and transports them to nearby streams. Some metals, at concentrations as small as a few parts per million, can damage or kill aquatic plants and animals.

During the oil and gas drilling process, a circulating fluid called "mud" is used to remove the cuttings from the well bore. This fluid often contains additives that are laden with heavy metals such as chromium and barium. In the past, once a well was completed, these muds were often left at the site, allowing the metals to leach into streams, lakes, and aquifers.

Wildlife and Vegetation

In many instances, historic mining practices have caused impacts throughout the ecosystem. Vegetation and topsoil were stripped away and lost forever. Often, the area left behind is barren and incapable of supporting plant and animal life. Bare soil continues to erode and is carried away from the site to nearby streams and rivers. Here, the sediment clogs stream channels, reducing fish habitat and interfering with natural flow patterns.

Soils and water contaminated with heavy metals or chemicals from mineral processing may be harmful to wildlife. These contaminants can become increasingly concentrated in animals higher up the food chain in a process called biomagnification. Affected animals may die, fail to reproduce, or reproduce with genetic defects.

Erosion and Sedimentation

Disturbed lands and unprotected slopes are susceptible to erosion. Uncontrolled surface drainage can remove soil materials and may cause larger areas to become unstable. Every year, sediments transported away from mineral extraction sites cause significant impacts on downstream resources.

Erosion of unreclaimed tailings piles, Lake Mead National Recreation Area, NV.

Petroleum and Brine

Leaking well fluids from improperly plugged oil and gas wells can contaminate surface and subsurface waters and public water supplies. Contamination of this type can continue for years without being detected. Water supplies for natural springs may also be affected, causing detrimental impacts miles away from the contaminated well.

Improperly plugged and leaking wells affect groundwater and surface resources. Oil coating the surface of a pond, Big Thicket National Preserve, TX.

Hazardous Materials

Mining and drilling operations, like other industrial processes, use a variety of chemicals either in processing or maintenance. Discarded drums and tanks are often found at abandoned mineral land sites inside underground passages, buried in waste rock piles, or just haphazardly scattered around the site.

Abandoned lead-acid batteries are one resource of hazardous materials at mine sites, Glen Canyon National Recreation Area, UT.

Scenic Resources

Although some mine and well sites are historically significant, most others are simply eyesores. Piles of trash and debris, open pits, waste rock piles, and access roads blemish the otherwise pristine landscapes of the parks. Surface mines and quarries often have the greatest impacts on scenic vistas. In some cases, hundreds of thousands of cubic yards of material have been removed, making restoration extremely difficult.

Contaminated mine waste creates long-lasting scars on the landscape, Denali National Park and Preserve, AK.

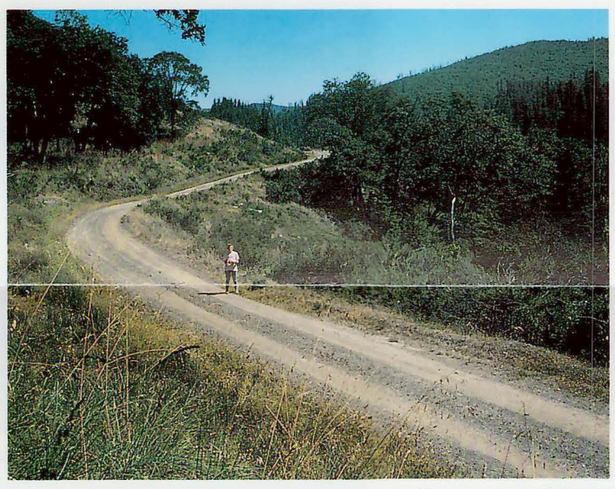
Mines as Habitat

Abandoned mines do not always have negative impacts. They sometimes provide habitat for wildlife, including a few rare or endangered species. Some bats, owls, salamanders, and wood rats make use of mines as habitat. In many parks, special mine closures have been installed that both protect critical habitat and correct safety hazards.

Some bat species that are endangered because their native habitats have been destroyed have begun to inhabit abandoned mine openings. When conditions are suitable, bats can use mines for summer roosts, winter hibernation, nurseries for raising young, and migratory stop-overs. Out of the 43 bat species native to the United States, 29 rely on mines for a portion of their habitat. The continued survival of several bat species may depend on the few mines and remaining caves that meet their habitat needs.

Townsend's big-eared bat in a mine, Colorado National Monument, CO.

Mitigation and Reclamation



Virtually all mineral activities require access roads. The erosion and visual scars related to abandoned roads impact park resources. Abandoned road prior to restoration, Redwood National Park, CA.

The road corridor is restored to its original contours, which stabilizes the slope and reestablishes the natural drainage pattern, Redwood National Park, CA.

Once the vegetation is established, it is difficult to tell that a road existed. Recovery shown after one season, Redwood National Park, CA.

Mitigating Hazards

Mitigating and reducing abandoned mineral lands hazards is often a complicated and expensive procedure. The National Park Service establishes the priority for mitigation by considering the level of danger and potential for resource impact. Each site is unique. The method chosen for mitigating a hazardous site depends on several things: materials available at the site, the type of rock, the accessibility of the site, and the amount of money available.

Parks use a variety of methods to close hazardous mine openings. Due to limited funding, parks can often only afford to fence off the hazard and post signs — a temporary solution. Other common mine closure techniques include backfilling, blasting, using expandable foam, constructing rock and mortar walls, and metal bat gates.

During mitigation of abandoned oil and gas sites, well bores are properly plugged and capped. Cementing the well bore with concrete at both the production zone and the groundwater zone prevents contamination of water supplies.

Reclamation and Restoration

Scars on the land may last thousands of years even if mined areas stabilize and the vegetation recovers. Carefully planned reclamation work can restore natural processes and greatly speed up site recovery. Reclamation work in the national park system focuses on reestablishing landscapes and environments that mimic the surrounding undisturbed lands. If mine structures such as mills, shops, headframes, etc. are of historic value, they are stabilized and preserved. Otherwise, the pre-mine condition is restored wherever possible.

Reshaping the surface stabilizes slopes and drainages, waste rock piles, tailings ponds, highwalls, and access roads. This reshaping often requires the use of heavy equipment that contours the land to look and function like the surrounding undisturbed lands. The restoration of stream channels also provides for the reintroduction of plants and animals lost because of mining activity. The same type of earthmovers that created the scars are often the best suited to remove them.

Cleanup or treatment of toxic materials can prevent further impacts to the environment. Small quantities of mining related materials, such as chemicals or fuels used in the mining and milling process, are completely removed. Large quantities of naturally occurring materials, such as unweathered waste rock that produces acids, may be treated onsite. Applications of lime may provide a buffer to prevent acids from being generated. In more severe cases, limestone drains or artificial wetlands filter heavy metals and reduce acidity.

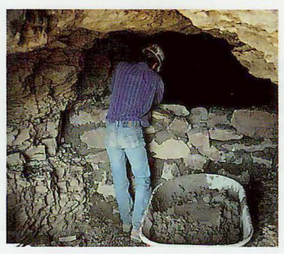
The goals for revegetation of mine sites in the national park system are to restore native plant populations and patterns. The first consideration is the suitability of the soil for revegetation. In harsh conditions topsoils, compost, or specific nutrients can be added. Specialized nurseries may be needed to propagate suitable plant materials. Sometimes, revegetation work is focused on establishing pioneering species to allow for natural succession to take place. Time and nature then restore the site to its natural productivity.

National Park Service geologist surveying a quarry to design reclamation, Olympic National Park, WA.

Topsoil and soil amendments are spread on a reclaimed rock quarry to encourage rapid revegetation, Redwood National Park, CA.

Artificial wetlands, specifically designed to filter heavy metals and reduce acidity, can be a cost-effective treatment for acid mine drainage. Experimental site, Friendship Hill National Historic Site, PA.

Native plants are grown in nurseries and then transplanted on reclamation sites to speed recovery in harsh environments such as desert and alpine ecosystems, Joshua Tree National Monument, CA.

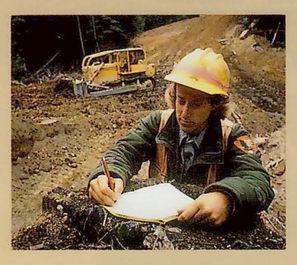


Adits can be permanently closed to eliminate health and safety hazards. Abandoned uranium mine, Glen Canyon National Recreation Area, UT.

Bat gates are designed to allow bats to fly through the bars unhindered. Where gates have been improperly designed, bats are forced to land, becoming easy prey for predators such as snakes and coyotes, Capitol Reef National Park, UT.

The National Park Service Program

The National Park Service has an active abandoned mineral lands reclamation program. The agency closes between 10 and 100 mine openings and plugs 5 abandoned oil and gas wells each year. In 1993, the Park Service estimated that reclamation of all remaining abandoned mineral land sites in the system would cost $200 million.

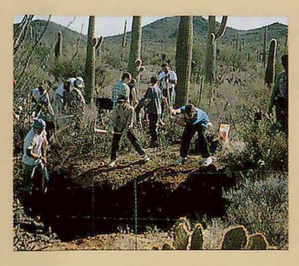


National Park Service geologist carefully monitors reclamation work in progress, Redwood National Park, CA.

Volunteer and Cooperative Projects

Each year, national parks benefit from the hard work of thousands of volunteers. Volunteers can assist in inventorying abandoned mines and wells, constructing mine closures, and revegetating mine sites. Without volunteers, the Park Service could not afford to do these labor-intensive projects.

Often, the National Park Service uses outside specialists to conduct scientific research for park projects. The Park Service has established cooperative agreements with several other federal agencies, state agencies, and universities to study environmental impacts at abandoned mineral land sites in park units.

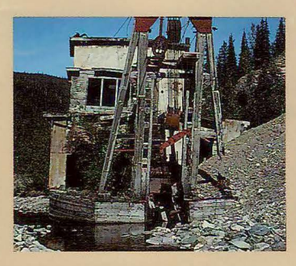


Labor-intensive work completed by volunteers helps keep costs low and encourages public stewardship of public lands, Saguaro National Monument, AZ.

Cultural Preservation

Many parks boast rich mining histories and are active in preserving mining-related historic structures and landscapes. Three park units were established with the specific purpose of preserving the American mining heritage: Klondike Gold Rush National Historical Park, Yukon-Charley Rivers National Preserve, and Keewanaw National Historical Park. The first two of these parks commemorate the Alaskan gold rush of 1898, while Keewanaw, established in 1992, celebrates the internationally significant copper mines in the upper Michigan peninsula.

Evidence of earlier mining can also be visited in the national park system. Alibates Flint Quarries National Monument in Texas and Wupatki National Monument in Arizona preserve the remains of prehistoric extraction sites, while Pipestone National Monument in Minnesota protects the pipestone (red mudstone) quarries of the Yankton Sioux.



This historic dredge dug and processed gravel from stream bottoms in search of GOLD! Yukon-Charley Rivers National Preserve, AK.

Interpretation and Education

The National Park Service wants people to know that mining and abandoned mineral lands are often part of the park scene. Mining interpretive displays and presentations are part of the program at several parks. Other parks celebrate special regional events such as discoveries and local gold rushes. Visitor centers often have books on mining history and folklore.

Educators have recognized that parks make excellent classrooms. Mining-related topics are used to enhance school curricula in history, geography, science, and even art. Some national parks and state agencies offer school outreach programs including abandoned mineral lands safety information for children.

For More Information

To learn more about abandoned mineral lands in the national parks, write to: Chief, Mining and Minerals Branch, Land Resources Division, National Park Service, P.O. Box 25287, Denver, CO 80225-0287.

D-904

Printed on recycled paper