SOUTH DAKOTA BADLANDS

What Are Badlands?

Badlands are semiarid regions with sparse vegetation that experience high rates of *erosion*. Water and wind, instead of carving gentle hills and broad valleys, sculpt soft sedimentary rock into intricate mazes of narrow ravines, v-shaped gullies, knife-sharp ridges, *buttes*, and colorful pinnacles. Badlands are found throughout the world; however, a special set of geological conditions must be present for the formation of badlands *topography*.

How Are They Formed?

For badlands to form, the land must be composed of alternating layers of hard and soft rocks and soil. When easily eroded material, such as clay or mud stone, is topped by more resistant material, such as sandstone, the harder horizontal layers offer some protection to the beds of soft deposits below. Uncovered layers of softer rocks or soil wash away quickly, while protected deposits form nearly vertical walls beneath the harder material.

The primary agent of *weathering* and *erosion* is usually water. Rain in these semiarid regions often falls in sudden, heavy showers. The water moves swiftly, washing down the exposed hills, loosening grains and particles of rock. Deep gullies and channels are the result.

The composition of the soft clay also has an effect on the rate of *erosion*. Badlands clay soaks up precipitation somewhat like a sponge. As it dries the exposed soil cracks and crumbles, leaving loose rubble several inches deep on the surface of the ground. This rubble begins to wash away immediately, often during the next severe storm. Lack of dense ground cover or heavy vegetation means there are no root systems to hold the soil and impede *erosion*.

Finally, the area being worn down usually lies well above the main drainage basin. When land is high water drains quickly, and the streams cut the bottoms of channels faster than the sides, forming deep and narrow ravines.

Where Are Badlands Found In S. D.?

Badlands are common in South Dakota west of the Missouri River, in the area known as the Missouri Plateau. Badlands formations often occur along the bluffs of the larger river valleys or on the sides of sizable *buttes*. Just west of the Little Missouri River, at the headwaters of the Moreau River, is an area known as the "Jump Off" badlands. Smaller areas of badlands can also be found along the edges of the Slim *Buttes* and Cave Hills

and in the valleys of the Grand and Moreau Rivers.

The most famous badlands in the state, and perhaps the world, are the White River Badlands of southwestern South Dakota. In fact, the generic geological term "badlands" originated with the name given to this region by French trappers. The White River Badlands are approximately 100 miles (161 km.) long, and range from three to five miles in width. The area's irregular shape makes precise boundaries difficult to define.

Why Are They Important?

Fossil Site - South Dakota badlands are famous as the source of fossil specimens of extinct mammal species. These mammals lived in the late *Eocene* and *Oligocene* epochs, between 57 and 26 million years ago.

Underlying the White River Badlands is the Pierre Shale, formed from the mud of a shallow inland sea that covered the mid section of the North American continent 80 million years ago. *Fossils* of *ammonites, baculites,* and other marine creatures are commonly found in Pierre Shale.

Around 65 million years ago, the land was forced up, and the sea slowly drained away. A jungle developed on the exposed seabed, transforming the mud and shale into a bright yellow soil. During the *Oligocene*, the climate, at first warm and humid, became cool and dry.

As the lands to the west rose even higher, *sediment*-loaded floods washed over this level region, depositing layer after layer of mud, volcanic ash and sand. Under the pressure of successive layers, these sediments became soft rock. Throughout this period, a wide variety of mammals roamed the area. Some of these creatures died and were covered by the layers of *sediment*. Their remains, buried under the rock, fossilized. Beginning half a million years ago, *erosion* began to expose these *fossils*.

Today, these rocks contain the best and most complete record of animals from the *Oligocene epoch*. The White River Badlands have been a rich source of information for *paleontologists* throughout the world, as they trace the development of ancient life forms.

Geological Resource - Geologists studying the formation of badlands *topography* and the recent geological history of the earth also find much valuable evidence in the South Dakota badlands.

Wildlife Habitat - Although by definition badlands contain very little vegetation, some plants, particularly prairie grasses, are found in South Dakota's badlands regions. *Sod tables*, remnants of the prairie that have resisted *erosion*, provide platforms for vegetation (see Figure 1). Cliff swallows, bighorn sheep and deer find protection in the maze-like gullies and ravines of badlands, a unique wildlife habitat.

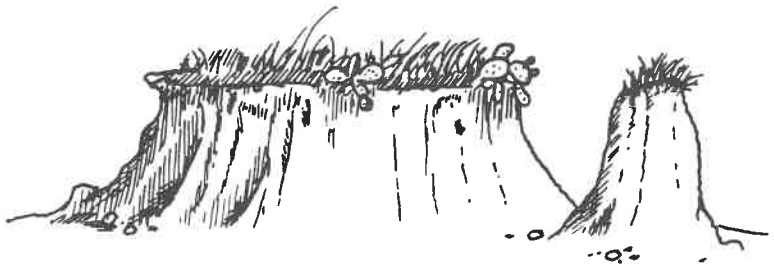

Figure 1: Sod Tables

Endangered Species Habitat - Black-footed ferrets, a federally listed endangered species once common in South Dakota, are being considered for reintroduced to the state in the White River Badlands of the Badlands National Park. The park is under evaluation because of the appropriateness of its habitat, the presence of ferrets' primary food, prairie dogs, and because of the protection the park offers.

Conservation Measures

Throughout the last half of the nineteenth century and into the twentieth century, scientific expeditions removed tons of *fossils* from the White River Badlands for study and display in museums and universities. Amateur collectors and sightseers combed the area, eager to find souvenirs. The fossil record was threatened.

A portion of the White River Badlands, "big badlands", in southwestern South Dakota now forms part of the 243,302 acres designated as Badlands National Park. Authorized by Congress in 1929, Badlands National Monument was proclaimed in 1939 by President Franklin Roosevelt to preserve the scenery, protect the *fossils*, and conserve the remnants of mixed grass prairie in the region. Congress declared the Monument a National Park in 1978, further emphasizing the value of the resources of the area. Collecting or disturbing *fossils*, plants, animals, or rocks is forbidden in Badlands National Park. Today, the spectacular scenery, the *fossils* and the prairie ecosystem are preserved by the National Park Service for all Americans, present and future.

Glossary

Ammonites - extinct ocean-dwelling invertebrates with coiled shells, classified in the same group as squid and octopus in the phylum Mollusca.
Baculites - extinct ocean-dwelling invertebrates with straight shells classified in the same group as squid and octopus in the phylum Mollusca.
Butte - a steep sided hill that usually has a smaller summit than a table or mesa.
Drainage basin - the area drained, through a valley system, by a river and its tributaries.
Eocene - the name given to the period of earth's history between 57 and 32 million years ago.
Erosion - the process by which earth or rock material is loosened or dissolved and removed from any part of the earth's surface.
Fossils - the preserved remains or traces of animals or plants that once lived on the earth.
Oligocene - the name given to the time of earth's history between 32 and 26 million years ago.
Paleontologist - a scientist who studies life of past geological ages based on the study of fossils.
Sediment - solid material, mineral and organic, that is suspended in water, air or ice, and is being transported from its place of origin.
Sod table - uneroded remnants within the badlands on which soil and plant life flourish.
Topography - the physical features of a district or region, the relief and contour of the land.
Weathering - the process, including chemical action of air and water, plants and bacteria and the mechanical action of changes in temperature, whereby exposed rocks decay and crumble into soil.

References

Durant, Mary and Michael Harwood. 1988. This Curious Country. Badlands National Park Badlands Natural History Association.
Harris, Ann G. & Esther Tuttle. 1990. Geology of National Parks, 4th ed. Kendall/Hunt Publishing, pp. 110-123.
Hauk, Joyce Keve. 1969. Badlands, Its Life and Landscape. Badlands Natural History Association.
O'Harra, Cleophas C. 1920. The White River Badlands Bulletin No. 13. Department of Geology, South Dakota School of Mines and Technology.
Rothrock, E. P. 1943. A Geology of South Dakota, Part 1: The Surface. S.D. State Geological Survey, pp. 58-67.
T. Skwara, Old Bones and Serpent Stones. 1992. A Guide to Interpreted Fossil Localities in Canada and the United States, Vol. 2: Western Sites. The McDonald and Woodward Publishing Company, pp. 151-154.

Resources for Teachers

Available from Badlands National Park, P.O. Box 6, Interior, SD 57750. Phone: 433-5361:

Badlands Teachers's Packet, a free collection of brochures and suggested activities on the Badlands for the classroom teacher, grades 1- 6

Badlands Junior Ranger Program, free activity booklets for children aged 5-8 and 9-12. Upon completion of the booklets, children are registered as official Junior Rangers of the Badlands. The booklets are designed for children to complete while on a summer visit to the park and are not available through the mail.

Special guided hikes, ranger talks, and presentations on the Badlands are available for South Dakota school groups in spring and fall by request.

Available from Badlands Natural History Association, P.O. Box 6, Interior, SD 57750. Phone: 433-5364:

Buried Fossil, Living Treasure, the official 18-minute video of the park that tells the story of the natural and human history of the Badlands. Suitable for all ages. Cost: $19.95 plus postage and handling.

The North American Prairie, A Vanishing Vista, a full color, 2' x 3' poster made from an original painting of the Badlands showing 65 native plants, animals, and natural features of the Badlands. The reverse side has a key to all species depicted and a map of different prairie regions. Cost: #6.95 plus postage and handling.

Written by:
Joan Steiner, Badlands National Park, Interior, SD 57750. © 1993.

Reviewed by:
Joe Zarki, Chief of Interpretation, Badlands National Park, Interior, SD 57750.

Illustration was provided by the Badlands National Park.

Publication of the *Badlands* fact sheet was funded by the Badlands Natural History Association, Interior, SD.