



SOUTH DAKOTA'S PHYSIOGRAPHIC REGIONS

What Are Physiographic Regions?

The science of physical geography, the study of land forms, provides us with a classification of the land by its physical appearance. Topography refers to the lay-of-the-land, describing the land according to its change in elevation and slope (*relief*). Topography usually varies from acre to acre, so it is difficult to show on small-scale (>1:50,000) maps, such as soil association maps. However, any particular area is usually dominated by certain topographic characteristics. Large areas of variation in the physical *relief* are called physiographic regions. Such large areas are described by terms such as hills, plateaus, or plains. Often these large areas are subdivided into smaller areas to provide us with a more precise understanding of the local geography and the forces that created the characteristics of the land.

What Physiographic Regions Are In South Dakota?

South Dakota is divided into 3 major physiographic regions: the Central Lowlands of eastern South Dakota; the Great Plains of western South Dakota; and the Black Hills. These 3 regions are subdivided into a total of 12 distinguish-

able areas called physical divisions. The map in Figure 1 describes these natural landforms of South Dakota. A significant physical boundary is that separating the Central Lowland from the Missouri Plateau (heavier line on Figure 1 in eastern South Dakota). This line lies in the Cool Dry Plain and the Warm Dry Plain areas.

The Minnesota River - Red River Lowlands (Division 1) is a broad, gently undulating, valley-like area with an elevation of 900 to 1,100 feet (274 -335 m) above sea level. According to Hogan (1995), these lowlands were formed by a large northward flowing river. Browns Valley, Minnesota, situated midway between Lake Traverse and Big Stone Lake, is the continental divide between drainage to the Arctic Ocean and to the Gulf of Mexico. The northeastern slope of the *Coteau des Prairies* rises sharply, nearly 1,000 feet (305 m), to form the western limit of this division lowland. A distinctive feature of this area, Mount Tom, can be seen between Milbank and Big Stone City. Mount Tom is a *moraine* deposited by the glacier that covered this region of the state. This lowland region is economically important for its underlying geology. Granite rock, believed to be several thousand feet deep, underlies this land and occasionally comes to the surface in outcrops near Milbank. This

granite is high quality and is commercially quarried for monuments and building stones.

The Coteau des Prairies (Division 2), the most conspicuous landform of eastern South Dakota, is a highland area between the Minnesota-Red River Lowland and the James River Lowland to the west. This landform is part of a plateau that extends through North Dakota into Canada. It slopes gently to the south and west with eastern and western slopes that are steep at the northern end and taper off on the south. Elevations range from 2,000 feet (610 m) above sea level on the north to about 1,600 feet (488 m) on the south. It is drained to the south by the Big Sioux River, whose tributary streams enter mainly from the east. West of the Big Sioux River, the surface of the *Coteau* is dotted with lakes and depressions, while very few lakes occur east of the river. During the Ice Age, the *Coteau* was covered by glaciers that deposited *glacial drift* over its surface. One hundred to 400 feet (30 - 122 m) beneath the surface is bedrock composed of *Pierre shale*. *Pierre shale* is a highly erodable rock made mostly of clay, including *bentonite*, with small amounts of sand (quartz).

The James River Lowland (Division 3) is a gently undulating plain lying considerably lower than the *Coteau des Prairies* on the east and the *Coteau du Missouri* on the west. Today the James River drains the area from north to south and occupies a rather narrow steep-sided valley. But, in the geologic past, ancient streams in this region flowed northward. According to Hogan (1995), more erosion has occurred in the James River Lowland than anywhere else in eastern South Dakota. Most of the topographic features of this area are the result of the effects of glaciers. Elevations range from 1,300 to 1,400 feet (396 - 427 m) above sea level.

The Lake Dakota Plain (Division 4) is the nearly level surface formed by deposition of sediment when Glacial Lake Dakota was filled with water. The area is

sandy at the northern end with silty clay *loam* and silty clay textures elsewhere. The flatness of this plain is remarkable, with a change in *relief* of less than 10 feet (3 m). Elevation is about 1,310 feet (399 m) above sea level.

The James River Highlands (Division 5) is a group of three ridges located at the southern end of the James River Lowland. The ridges are remnants of former stream divides. From east to west, these highlands are Turkey Ridge (the largest), James Ridge (the smallest), and Yankton Ridge. These highlands are *glacial drift* deposits over bedrock. Below the *glacial drift* of all 3 ridges is a core of Niobrara chalk overlain by *Pierre shale*. Turkey Ridge is more than 40 miles (64 km) long, 10 miles (16 km) wide, and is more than 300 feet (91 m) higher than the surrounding country. Yankton Ridge forms the northern bluff of the Missouri River Valley from Yankton westward for 15 miles (24 km). James Ridge, located west of the James River and a few miles above its mouth, is 9 miles (14.5 km) long, 1.5 miles wide (2.4 km), and 100 to 260 feet high (30 - 79 m). The depth of glacial drift material varies from 30 to 200 feet (9 - 61 m).

The Coteau du Missouri (Division 6) is part of the Missouri Plateau of the Great Plains Province, separated from the main body of the Missouri Plateau by the Missouri River. This highland area is covered with glacial deposits and underlain by *Pierre shale* and older formations. Several broad *sags* traverse the *Coteau*, which mark the positions of former stream valleys of eastern continuations of the Grand, Moreau, Cheyenne, Bad, and White rivers (Flint, 1955). There is no major stream that drains the *Coteau du Missouri* today.

The Missouri River Trench (Division 7) contains the Missouri River and its reservoirs. The valley averages a little over a mile (1.6 km) in width with the valley floor 300 to 600 feet (91 - 183 m) below the tops of the steep, dissected bluffs. The river flows south-southeast with a

gradient of about one foot per mile (19 cm per km). Erosion and deposition are believed to be in equilibrium in the trench. Early travelers to the region reported the river water to be *turbid*. Rapid erosion apparently was in progress before the advent of agriculture. Cultivation in the tributary regions has added significantly to the sediment load in the river. The dams, built on the river between 1946 and 1966, have slowed the flow, and siltation is now a problem for the river.

The Northern Plateaus (Division 8) is a series of plateaus and isolated *buttes* underlain by Fox Hills sandstone and younger *Cretaceous* strata. The plateaus range from 2000 to 3000 feet (610 - 915 m) above sea level, but according to Hogan (1995), these areas used to be at least 1,000 feet (305 m) higher in elevation. This loss is the result of water and wind erosion. Hogan (1995) considers the Slim Buttes and Short Pine Hills areas of the Northern Plateaus to be some of the loveliest landscapes in the state.

The Pierre Hills (Division 9) consist of a series of smooth hills and ridges with rounded tops. This region is underlain by the Pierre *shale* formations and has lower elevations (1,800 to 2,800 feet or 549 - 854 m) than the plateau country to the north and the south.

The Black Hills (Division 10) is a mountainous area consisting of a series of up-turned *sedimentary* strata (*hogbacks*), arranged concentrically around a core of *igneous* and *metamorphic* rocks. It is an oval region approximately 125 miles (202 km) long and 60 miles (97 km) wide. Elevations range from 3,200 to 7200 feet (976 - 2,195 m) above sea level. These hills have been described as miniature versions of the Rocky Mountains, and were formed by the same forces at about the same time.

The Southern Plateaus (Division 11) are divided into two regions. The large area in the southwestern part of the state

consists of a series of benches and *buttes*, underlain by *Tertiary* sandstones, *siltstones*, and *shale*. Elevations range from 2,800 to 3,600 feet (854 - 1098 m). The Badlands comprise the northern part of the southwestern region. The second region of the Southern Plateaus is located in southeast South Dakota, primarily in Lincoln and Union counties. This area is a stream-dissected highland underlain by a thick mantle of *loess*. Elevations range from 1,200 to 1,500 feet (366 - 457 m) above sea level.

The Sand Hills (Division 12) is a South Dakota extension of the Sand Hills region of Nebraska. It consists of a series of rounded hills interspersed with low, swampy areas. The area is underlain with *eolian sand*. Elevations range from 3,000 to 3,600 feet (915 - 1098 m).

Significance

All of these landforms are included in the political region known as South Dakota. These diverse land forms give South Dakota its character and influence the plants and animals that survive here. The variation in physical relief in our state ranges from a low of 965 feet (294 m) above sea level at Big Stone Lake in northeastern South Dakota to our highest peak in the Black Hills, Harney Peak at 7,242 feet (2,208 m). The South Dakota landscape has been shaped over many years by many different forces, each of which has left its unique mark on the land. The up-lifting and warping of the land in the west that created the hills, the movement of the glaciers in the east that formed *coteaus*, and the wind and water erosion that created badlands and buttes, all contributed to the beauty we appreciate today. The rocks and soils that make up these regions provide a wealth of resources upon which life in the state is based.

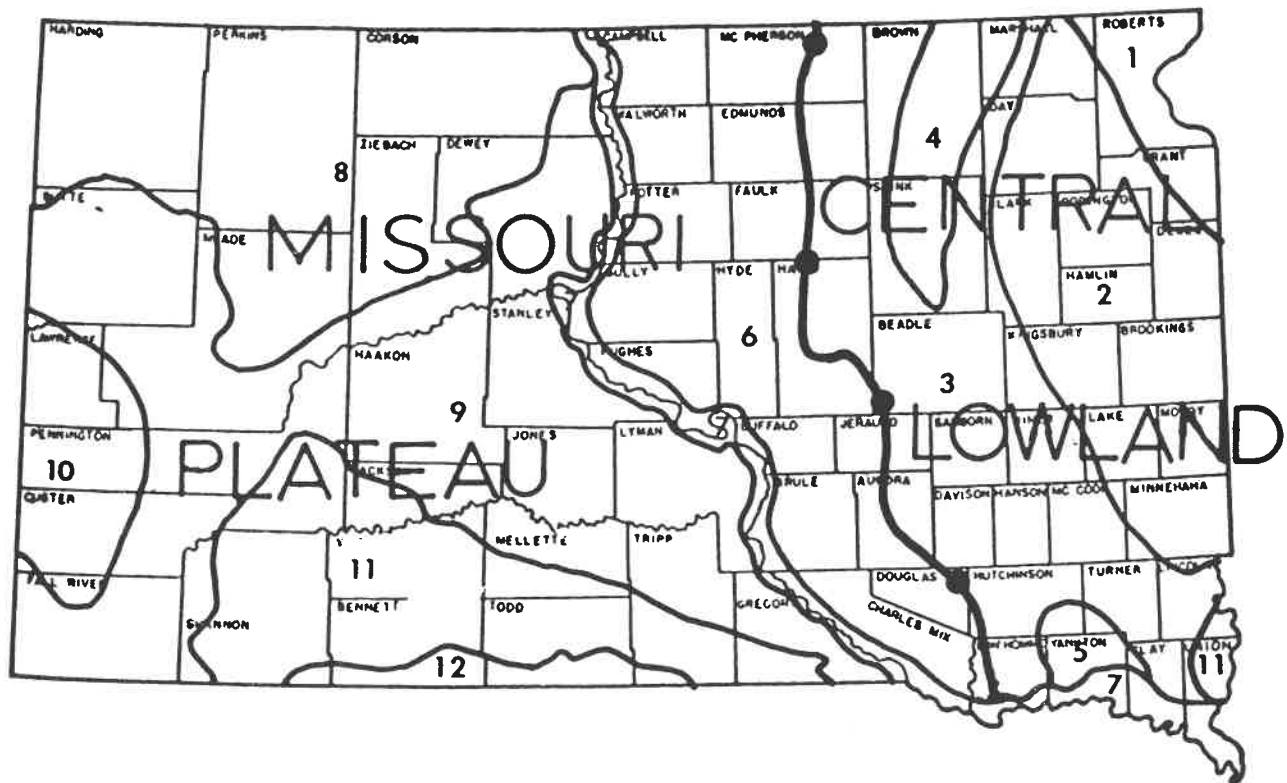


Figure 1. Physical Divisions of South Dakota.

- Division 1: Minnesota River-Red River Lowland
- Division 2: Coteau des Prairies
- Division 3: James River Lowland
- Division 4: Lake Dakota Plain
- Division 5: James River Highlands
- Division 6: Coteau du Missouri
- Division 7: Missouri River Trench
- Division 8: Northern Plateaus
- Division 9: Pierre Hills
- Division 10: Black Hills
- Division 11: Southern Plateaus
- Division 12: Sand Hills

Glossary

- Bentonite** - a soft, porous clay that results from weathered volcanic ash.
- Buttes** - an isolated, usually flat-topped hill characterized by steep slopes often capped with a resistant layer of rock. When the summit area increases in size the buttes are called mesas.
- Coteau** - a high treeless plain, or a small hill.
- Cretaceous** - the period in the geologic history following the Jurassic Period and ranging from about 135 million years ago until 65 million years ago.
- Eolian sand** - coarse (0.05 to 2 mm) material accumulated through wind action; commonly refers to sandy material in dunes. Can be deposited like blankets on the surface.
- Glacial drift** - rock material (from clay particles to boulders) transported by glacial ice and then deposited by or from the ice, or by running water emanating from a glacier.
- Hogback** - a sharp-crested, symmetric ridge formed by highly tilted resistant rock layers; produced by differential erosion of interspersed resistant and weak rocks with dips greater than about 45%.
- Igneous** - rock formed by solidification from a molten or partially molten state (i.e. granite, basalt).
- Loess** - a fine-grained deposit composed, dominantly, of silt-sized particles, deposited by the wind.
- Metamorphic** - any rock that has been altered by mineralogical and/or structural changes by heat, pressure, chemical environment, and movement (e.g. quartzite, slate, marble).
- Moraine** - an accumulation of earth, stones, and other debris carried and deposited by a glacier.
- Relief** - differences in height in land forms.
- Sags** - lowland areas that are the result of ancient stream valleys now covered by glacial drift.
- Sedimentary** - rock resulting from the consolidation of loose sediment that has accumulated in layers, or formed by the precipitation from solution (e.g. sandstone, shale, limestone).
- Shale** - sedimentary rock formed by the consolidation of a clay or mud and having the tendency to split into thin layers.
- Siltstone** - sedimentary rock like shale but lacking in the tendency to split into layers.
- Tertiary** - a period of the Cenozoic Era of geologic time (65 to 2 to 3 million years ago).
- Turbid** - having sediment in the water; muddy; cloudy.

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Publication of the *South Dakota's Physiographic Regions* fact sheet was funded by the Northern State University CUEST Center for Environmental Education, Aberdeen, SD.