Shaded Relief of North Dakota

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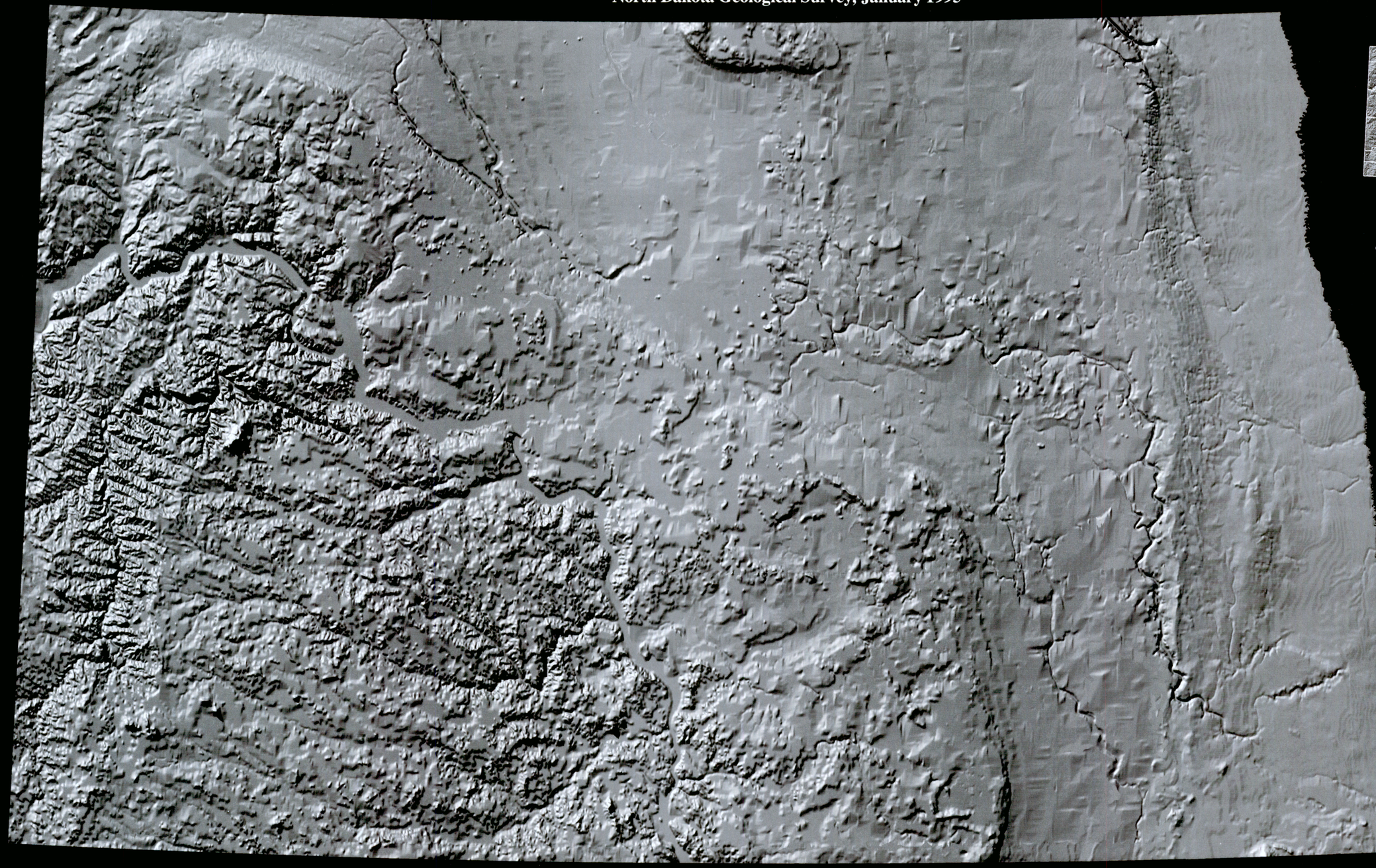
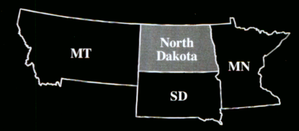


North Dakota County Boundary Index

The above map is intended for locating counties of interest without covering features on the main map.

0 10 20 30 40 50
Miles
0 10 20 30 40 50
Kilometers

Scale 1:1,000,000
1 inch represents approximately 16 miles
Lambert Conformal Conic Projection



1895 - North Dakota Geological Survey's - 1995 Centennial Year

The North Dakota Geological Survey was created by an act of the North Dakota Legislature in 1895, six years after statehood. Now celebrating its one hundredth year, the Survey still serves as the primary source of geological information in the State. Its mission over the years has grown and is now threefold: to investigate the geology of North Dakota; to administer regulatory programs and act in an advisory capacity to other state agencies; and to provide public service and information to the people of North Dakota

Geographic Information Systems Center

This shaded relief map is a model of North Dakota's surface topography which was created by using digital elevation models (or DEMs). Although it looks very similar to a satellite image, it should not be mistaken as such. Whereas a satellite image is essentially a photograph of the Earth's surface, a DEM is a data file containing measurements of surface elevation taken at regularly spaced intervals across the land. The interval between data points for this model is approximately 200 feet, requiring more than 30 million data points to create this map of the state. Each of the measurements in a US Geological Survey DEM file has a known geographic location that allow special computer programs known as geographic information systems, or GIS, to analyze these data and produce the models. The shaded relief map, therefore, is a model that represents, but is not a "photograph", of the surface of the Earth.

To best illustrate the topography of the entire state, the GIS was instructed to simulate the sun shining on the Earth's surface from the northwest at an angle of 40 degrees above the horizon. Although these conditions do not occur in nature, this simulation provides the shadowed effect that makes the hills and valleys appear three-dimensional. Areas of steep terrain, such as in the Badlands of the west-central part of the state, show a mottled texture of grays ranging from light to dark that represent sunlit and shadowed slopes. This contrasts sharply with the relatively uniform gray shades illustrating the flat surfaces of the Red River Valley of east-central North Dakota. These are good examples of the distinct differences between the relatively subdued terrain north and east of the Missouri River, and the more varied topography south and west of the river.

The integration of these DEM data into the North Dakota Geological Survey's GIS allows the generation of a "picture" of the state's topography that is much more accurate than any satellite image could provide. Many geologic features can be more readily seen because the computer is able to emphasize features that are quite subtle. While aerial photographs covering small areas (hundreds of feet) are commonly used for geologic studies, a surface model like the shaded relief map allows geologists and geographers to identify features that are very large (covering hundreds of miles). For example, the diversity of landscape mentioned earlier is a result of relatively recent continental glaciation that "bulldozed" and flattened all but the southwestern part of the state. Features like these are easily seen on a map of this scale as opposed to an aerial photo which typically covers an area the size of Bismarck.

The NDGS uses a GIS called Arc/Info to manage, manipulate, and analyze its map information. The unique capabilities of this GIS allow the creation of products such as the shaded relief map. Electronic maps stored in a GIS can contain much more information than just the location of lines, points, and polygons. Associated information, or attributes, can be related to each of the features on the map. For example, any given line representing a road can have any number of various attributes, such as names or pavement types, attached to it. In the case of the shaded relief map, the elevation values are the attributes attached to point locations on the map. A GIS is unique in its ability to model geographic relationships between map features (such as roads, rivers, and terrain) and their related attributes. By using these capabilities, the NDGS can test various "what if" scenarios by changing variables in a model. For example, the existence of relationships between geology and topography can be investigated by simply overlaying the geology map on the DEM model. Watershed basins can be easily defined, or measurements of slope can be quickly calculated. There are many ways in which the NDGS' GIS can be used to relate the spatial information that surrounds us all.

R.E. Bassler, Cartographer
January 1995

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