

LANDSLIDE AREAS IN HETTINGER COUNTY, NORTH DAKOTA

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2024

LANDSLIDES IN HETTINGER COUNTY

Landslides are masses of rocks and sediment that have tumbled or slid down a slope under their own weight. These geologic hazards can destroy buildings, roads, railroad tracks, pipelines, transmission lines, and other types of infrastructure. Landslides are generally characterized in the field by steep, near-vertical slopes (the scarp) that are upslope from a mound of displaced rock (the body). The body of the slide may be relatively intact, or it may be severely fragmented. Recent or relatively new landslides are generally characterized by a fresh (well-exposed rock) scarp and a sparsely vegetated body. Older slides are typically more difficult to identify in the field because the topography of the scarps and bodies may be smoother and more subdued due to weathering. They may also be covered with vegetation and mature trees obscuring the underlying topography. Landslides are most readily identifiable from LiDAR data, supplemented with aerial imagery.

Landslides in Hettinger County were mapped from LiDAR data collected in 2008 along with NAIP digital imagery from 2016 to 2022 and a complete set of historical aerial photographs that were flown in July 1967 at a scale of 1:20,000. It is unfortunate that these photographs were taken when leaves were on the trees because groves of leaf-bearing trees tend to obscure landslides, especially small ones. On the other hand, leaves can sometimes make it easier to identify these features. Trees and bushes are often aligned within very distinct parallel-, transverse-, and/or semi-circular-depressions that generally occur within the body of the landslide. The use of LiDAR elevation data allows us to see through most of the areas previously obscured by vegetation in the historical imagery and aerial photography and greatly increases our ability to identify additional landslide areas.

Slopes fail for various reasons including the steepness or angle of the slope, rock type, bedding, and moisture content of the rocks. Most landslides in western North Dakota are rotational slumps that have a well-defined head and toe. Typically, the part of the slope that breaks apart slides down the slope as a single unit and the beds tilt back in the direction of the slope. The failed mass of rock is, however, almost never a cohesive unit; tension cracks generally cause the failed material to splinter into smaller portions. Successive landslides may occur at the same location. Over time, the accumulated material from multiple, adjacent landslides can cover an area that is several thousand feet wide and several miles long.

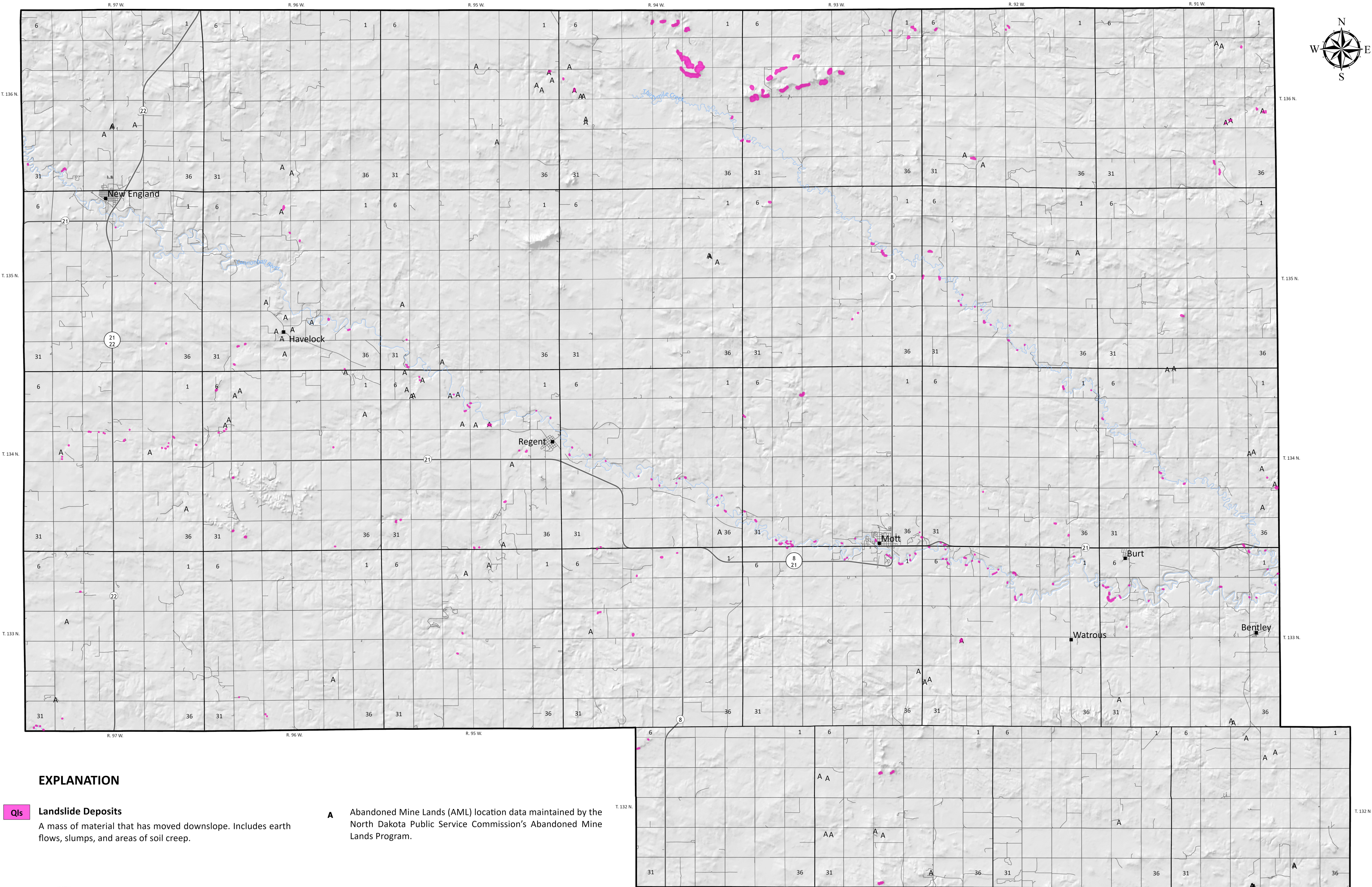
The geology of Hettinger County consists dominantly of Tertiary (Paleogene) age sedimentary bedrock of the Fort Union Group which contains terrestrial deposits of the Bullion Creek, Sentinel Butte, and Golden Valley Formations. All three of these formations contain sandstones, siltstones, claystones, mudstones, and lignite. Most landslides in Hettinger County (89%) are slumps along the valley of the Cannonball River with some larger landslide areas flanking the larger buttes in the north-central part of the County. Most of these slides cover less than 10 acres (fig. 1) but, a few landslide complexes are up to 100 acres or more in size.

There are several historical abandoned coal mines in Hettinger County. These small coal mines, commonly referred to as wagon mines, are scattered across the central portion of the county around Havelock, Regent, and south of Mott. Also included are locations with no obvious surface modification, but a mine is known to have occurred in the area according to records compiled by the North Dakota Public Service Commission. It can be difficult to determine whether small surface irregularities along drainage slopes are old mines or slumps, further complicated as abandoned mines are susceptible to slope failure. Thus some areas mapped as landslides may include the collapse of abandoned mine headwalls.

Small landslides, 10 acres or less in size, are common throughout the rugged topography of western North Dakota. Many of these, as well as larger landslides, are typically obscured by slopewash or colluvium. Layers or blankets of slopewash typically cover the lower portion of a slope and extend horizontally from the base of a slope. Thick, smooth layers of slopewash often completely obscure the broken, jumbled beds of landslide material. In some areas, smaller landslides, or landslides that are very old and have been inactive for a long period of time, are only visible if slopewash is thin or absent, or the beds are sufficiently jumbled to create subtle irregularities at the surface.

A total of 278 landslide areas, along with 98 former AMLs, were identified in Hettinger County. Some of these slides are complexes, consisting of multiple landslides formed from multiple events. Therefore, the number of individual landslides in this county may be slightly higher. Collectively, these landslide areas cover less than a square mile (470 acres). Most of the landslides occur within the Cannonball River Valley. The Thirtymile Creek Valley also contains a large number of landslides.

An area with a large number of landslides suggests that the local slopes may be predisposed to future slides in the area. Even when landslides are not identified in these types of settings, these areas often remain vulnerable to slope failure and should be evaluated prior to the development of any civil works or energy infrastructure projects and, when possible, be avoided.



EXPLANATION

QIs

Landslide Deposits

A mass of material that has moved downslope. Includes earth flows, slumps, and areas of soil creep.

A

Abandoned Mine Lands (AML) location data maintained by the North Dakota Public Service Commission's Abandoned Mine Lands Program.

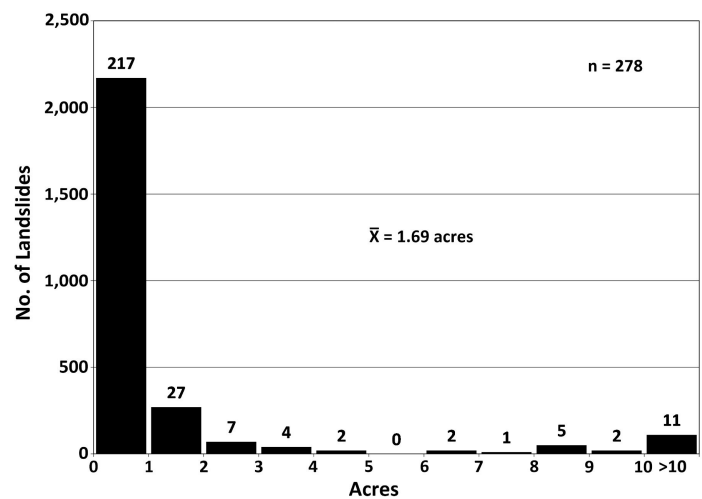
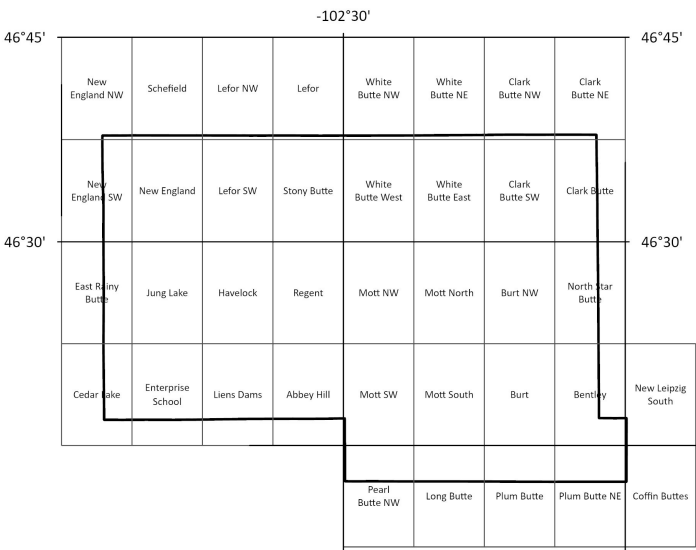
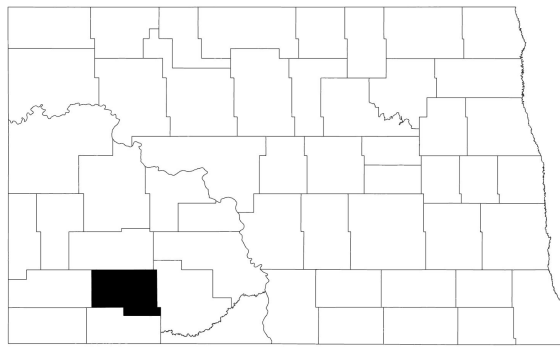


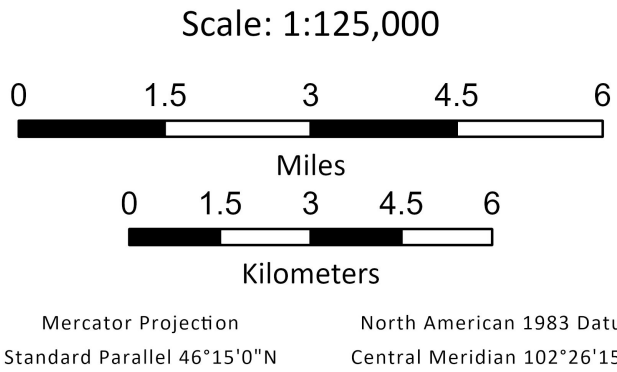
Figure 1. Distribution of landslide areas mapped in Hettinger County. Most landslide areas (78%) cover less than an acre. Some slides (3.9%) are over ten acres in size. The mean (X) landslide area size is 1.69 acres. The number of landslide areas (n) in this distribution is 278.










Index to 1:24,000 Quadrangles



Hettinger County, North Dakota



ROAD CLASSIFICATION

Expressway  Highway 
Local Road 
Interstate Route  US Route  State Route 
Water  Railroad 