

USGS Cooperative Landslide Hazard Mapping and Assessment Program

Award Number: G24AP00421

Title: North Dakota Phase III Landslide Inventory: Mapping Active Landslides in the Belfield 1:100,000 Quadrangle

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## **Abstract**

The first North Dakota Geological Survey landslide inventory map (about 300 1:24,000 scale quadrangle maps) was published in 2003 during Phase I of the North Dakota Geological Survey's landslide mapping program. The landslides were delineated by hand using stereo projection of black and white 1:20,000 scale aerial photographs taken during the 1950s and 1960s. Phase II started around 2017 with the goal of mapping landslides for the entire state using LiDAR, and now Phase III is mapping active landslides utilizing repeat LiDAR coverages. Geologists at the North Dakota Geological Survey calculate the difference between the two LiDAR collects to locate movement and, once determined to be a landslide, delineate the feature. This award would fund Phase III in the Belfield 1:100,000 quadrangle in western North Dakota. This area contains extensive critical energy infrastructure (oil well pads and pipelines) and encompasses a region that is very landslide dense. Mapping active landslides provides a dataset that the public, government, and industry leaders can use to make informed decisions concerning private and industry infrastructure installation. Alongside commercial applications, further development of our statewide active landslide dataset creates an invaluable asset for studying the nature of landslide occurrence. The Belfield 1:100,000 area now has multiple LiDAR datasets, one of which is 3DEP.

## **Goals and Objectives**

The goal of this grant is to complete Phase III of our NDGS landslide mapping program for the Belfield 1:100,000 quadrangle. Successfully completing this goal results in all active landslides mapped that have occurred between the two LiDAR collects (flown between 2015 and 2021).

## **Risk Reduction Priority Areas Funded**

Risk Reduction Priority Area: P1 Landslide Inventory (Hazard Mapping)

## **Accomplishments**

Phase III mapping of our NDGS landslide mapping program for the Belfield 1:100,000 quadrangle was completed on time. This grant funded the mapping of 322 active landslides across thirty-two 1:24,000 scale maps. These slides were identified from the difference raster created from the difference between two LiDAR collects.

## **Unmet Results**

This project had no unmet results.

## **Summary**

Mapping 322 active landslides in the Belfield 1:100,000 quadrangle added to our statewide landslide inventory. This contributes to the Risk Reduction Priority Area concerning hazard mapping. The North Dakota statewide landslide mapping program is a multi-year project, and the grant money helped fund a portion of the state's program. In addition to adding to the statewide dataset, the maps produced through this grant are also published on our online download portal:

<https://www.dmr.nd.gov/ndgs/landslides/>

From the grant money, thirty-two 1:24,000 scale maps and one 1:100,000 scale map were produced. The maps also show existing landslides that were not active during the 2015-2021 window. The maps and resulting shapefiles will be a great addition of data to end-user utilizing the landslide data.

## Bibliography

Maike, C.A. and York, B.C., 2025, Areas of Landslides Daglum NW Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Dglm NW - I3.

Maike, C.A. and York, B.C., 2025, Areas of Landslides Daglum SE Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Dglm SE – I3.

Maike, C.A. and York, B.C., 2025, Areas of Landslides Daglum SW Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Dglm SW - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Bullion Butte Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. BlnB - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Cliffs Plateau Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. ClfP - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Deep Creek North Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. DepC N - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Dry Bullion Creek Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. DrBC - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Juniper Spur Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. JnSr - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Square Butte Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. SqrB - I3.

Maike, C.A., York, B.C. and Anderson, F.J., 2025, Areas of Landslides Three V Crossing Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. TrVC - I3.

Maike, C.A., York, B.C. and Moxness, L.D., 2025, Areas of Landslides Alpha Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Alpa - I3.

Maike, C.A., York, B.C. and Moxness, L.D., 2025, Areas of Landslides Golva Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Glva - I3.

Maike, C.A., York, B.C. and Moxness, L.D., 2025, Areas of Landslides Rocky Ridge North Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. RkyR N - I3.

Maike, C.A., York, B.C. and Moxness, L.D., 2025, Areas of Landslides Williams Lake Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. WlmL - I3.

Maike, C.A., York, B.C. and Moxness, L.D., 2025, Areas of Landslides Belfield SE Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Blfd SE - I3.

Maike, C.A., York, B.C. and Moxness, L.D., 2025, Areas of Landslides Daglum Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Dglm - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Beach East Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. BchE - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Belfield Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Blfd - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Belfield NE Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Blfd NE - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Buffalo Gap Campground Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. BfGC - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Chimney Butte Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. ChmB - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Fryburg NE Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Frbg NE - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Fryburg NW Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Frbg NW - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Medora Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Mdra - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Sentinel Butte Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. SntB - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Sentinel Butte SE Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. SntB SE - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Spring Creek Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. SprC - I3.

York, B.C. and Anderson, F.J., 2025, Areas of Landslides Tracy Mountain Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. TrcM - I3.

York, B.C. and Maike, C.A., 2025, Areas of Landslides Belfield SW Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Blfd SW - I3.

York, B.C. and Moxness, L.D., 2025, Areas of Landslides Fryburg Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Frbg - I3.

York, B.C. and Moxness, L.D., 2025, Areas of Landslides Thelan Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. Thln - I3.

York, B.C., Maike, C.A. and Moxness, L.D., 2025, Areas of Landslides Rocky Ridge South Quadrangle, ND Quadrangle: North Dakota Geological Survey 24K Map Series No. RkyR S - I3.