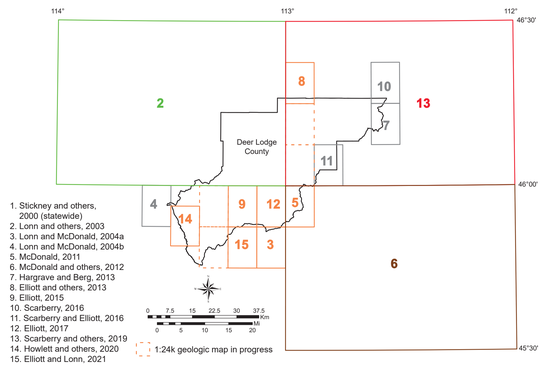


1. Stickney and others, 2000 (statewide)
2. Lonn and others, 2003
3. Lonn and McDonald, 2004a
4. Lonn and McDonald, 2004b
5. McDonald, 2011
6. McDonald and others, 2012
7. Hargrave and Berg, 2013
8. Elliott and others, 2013
9. Elliott, 2015
10. Scarberry, 2016
11. Scarberry and Elliott, 2016
12. Elliott, 2017
13. Scarberry and others, 2019
14. Howlett and others, 2020
15. Elliott and Lonn, 2021

Figure 1. Previous mapping in the study area.



Location of Deer Lodge County, Montana

Scale 1:75,000

Basemap: Lidar hillshade digital elevation model (DEM) overlain with slopeshade (relief).
Lidar data for Deer Lodge County made available by the Montana State Library.

Legend

- Interstate
- Major road
- Railroad
- Town
- Stream
- County boundary
- Historic landslide
- Dormant Young landslide
- Dormant Mature landslide
- Dormant Old landslide

Slope index gradient

Moderate — Steep

Slope index values

25–30° | 30–35° | 35–45° | >45°

This landslide inventory and slope map identifies landslides that demonstrate evidence of gravity-driven movement based on lidar data, geomorphic and topographic analyses, satellite imagery, field checks, and when available, published geologic maps (fig. 1). Landslides are classified based on the relative recency of surface movement. The slope map provides a preliminary tool to identify areas that may be susceptible to failure. Several factors in addition to slope steepness affect the formation of landslides, including the geologic setting, stream erosion, weathering, vegetation, change in precipitation or groundwater levels, and human activities.

Landslides shown on this map are gravity-driven mass movements or mass wasting deposits where soil, sediments, rock, and/or rock debris have failed downslope. Landslides and mass movements include earth flows, debris flows, debris slides, and rock slides. Rock fall areas (not shown) are widespread near oversteepened slopes (see slope index gradient), particularly within glaciated valleys of the Anaconda Range. Mapped landslides are identified from the geomorphic expression of both the source area (i.e., head scarp or scar) and transported material. Landslide identification and location certainty are limited to mappable features in the lidar data at scales less than or equal to 1:5,000. Smaller or poorly preserved landslides may not have been identified.

The lidar slope map displays a colored slope index gradient. Classes of 25–30°, 30–45°, 35–45°, and >45° delineate areas with increasing potential for mass movements. The slope map, combined with occurrence of landslides in a given area and recency of surface movement, provides a set of proxies and tools to identify areas susceptible to mass movements. This map is designed for use as a general planning tool and is appropriate for use at a scale of 1:75,000. Site-specific investigations and more detailed geotechnical information are required for landslide hazard assessments.

Active/Historic landslides represent movements that occurred in the historic record or are associated with anthropogenic activity. Landslides in this category have well-constrained locations with clear scarps or scars, cracks, well-defined boundaries, disrupted vegetation, blockage to drainages, or damaged manmade features, and show little to no erosion.

Dormant young landslides represent movements that occurred during the Latest Quaternary (within the past 15,000 years) that appear relatively fresh and have no existing historical record. Landslides in this category have well- to moderately constrained locations with clear scarps or scars, cracks, well-defined boundaries, disrupted vegetation, or blockage to a stream drainage, and show minor erosion.

Dormant mature landslides represent movements that occurred during the Late Quaternary (within the past 130,000 years) that appear smoothed and/or partly modified by erosion. Landslides in this category have well- to moderately constrained locations with some degree of head scarp rounding, diffuse scars, eroded toe area, partly smoothed boundaries and deposits, relatively uniform vegetation, and some gullies or drainages incised within the landslide features.

Dormant old landslides represent movements that likely occurred during the Quaternary (within the past 2.6 million years) that have been greatly smoothed and modified by erosion. Landslides in this category have moderately constrained to inferred locations, with a strong degree of head scarp rounding or eroded head scarp, no clear scars, toe area not preserved, smoothed boundaries and deposits, fully revegetated, and well-defined gullies or drainages incised within the landslide features.

Acknowledgments
This material is based upon work supported by the Federal Emergency Management Agency (FEMA) and the Montana Disaster and Emergency Services (MT DES), under agreement EMD-2020-CA-00039-S01. Andrew Maendel provided assistance for a preliminary landslide inventory database. Thoughtful and constructive reviews from Colleen Elliott, Michael Stickney, Katie McDonald, and Steve Quane helped improve this map.

References

Elliott, C.G., 2015, Geologic map of the Lower Seymour Lake 7.5' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 664, 11 p., 1 sheet, scale 1:24,000.
Elliott, C.G., 2017, Geologic map of the Lincoln Gulch 7.5' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Geologic Map 70, 1 sheet, scale 1:24,000.
Elliott, C.G., and Lonn, J.D., 2021, Geologic map of the Foolhen Mountain 7.5' quadrangle, Beaverhead County, Montana: Montana Bureau of Mines and Geology Geologic Map 79, 1 sheet, scale 1:24,000.
Elliott, C.G., Smith, L.N., and Lonn, J.D., 2013, Geologic map of the Mount Powell 7.5' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 635, 22 p., 1 sheet, scale 1:24,000.
Hargrave, P.A., and Berg, R.B., 2013, Geologic map of the Lockhart Meadows 7.5' quadrangle, west central Montana: Montana Bureau of Mines and Geology Open-File Report 629, 1 sheet, scale 1:24,000.
Howlett, C.J., Reynolds, A.N., and Laskowski, A.K., 2020, Geologic map of the northern half of the Pintler Lake 7.5' quadrangle and the southern half of the Warren Peak 7.5' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology EDMAP portion of the National Geologic Mapping Program 13, 1 sheet, scale 1:24,000.
Lonn, J.D., and McDonald, C., 2004a, Geologic map of the Dickie Hills 7.5' quadrangle, southwest Montana: Montana Bureau of Mines and Geology Open-File Report 501, 14 p., 1 sheet, scale 1:24,000.
Lonn, J.D., and McDonald, C., 2004b, Geologic map of the Kelly Lake 7.5' quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 500, 15 p., 1 sheet, scale 1:24,000.
Lonn, J.D., McDonald, C., Lewis, R.S., Kalakay, T.J., O'Neill, J.M., Berg, R.B., and Hargrave, P., 2003, Geologic map of the Philipsburg 30' x 60' quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 483, 1 sheet, scale 1:100,000.
McDonald, C., 2011, Geologic map of the Dickie Peak 7.5' quadrangle, southwest Montana: Montana Bureau of Mines and Geology Open-File Report 601, 1 sheet, scale 1:24,000.
McDonald, C., Elliott, C.G., Vuke, S.M., Lonn, J.D., and Berg, R.B., 2012, Geologic map of the Butte South 30' x 60' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 622, 1 sheet, scale 1:100,000.
Scarberry, K.C., 2016, Geologic map of the Sugarloaf Mountain 7.5' quadrangle, Deer Lodge, Powell, and Jefferson Counties, Montana: Montana Bureau of Mines and Geology Open-File Report 674, 1 sheet, scale 1:24,000.
Scarberry, K.C., and Elliott, C.G., 2016, Geologic map of the Opportunity 7.5' quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 683, 1 sheet, scale 1:24,000.
Scarberry, K.C., Elliott, C.G., and Yakovlev, P.V., 2019, Geology of the Butte North 30' x 60' quadrangle, southwest Montana: Montana Bureau of Mines and Geology Open-File Report 715, 30 p., 1 sheet, scale 1:100,000.
Stickney, M.C., Haller, K.M., and Machette, M.N., 2000, Quaternary faults and seismicity in Western Montana: Montana Bureau of Mines and Geology Special Publication 114, 1 sheet, scale 1:750,000.

Geologic Map 104

Landslide Inventory and Slope Map of Deer Lodge County, Southwest Montana

Yann G. Gavillot

2025

Maps may be obtained from:
Publications Office
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
Phone: (406) 496-4174
https://mbmg.mtech.edu

GIS production: Yann Gavillot, MBMG. Map layout: Susan Smith, MBMG. Editing: Susan Barth, MBMG.