ALASKA DIVISION OF GEOLOGICAL &
GEOPHYSICAL SURVEYS

PRELIMINARY INTERPRETIVE REPORT
Wikstrom Jones and Larsen, 2025-3
SHEET 1 OF 1
Explanatory report accompanies map
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EXPLANATION

This map provides a state-wide overview of areas susceptible to deep-seated landslides in Alaska. We followed a well-tested protocol for modeling deep-seated landslide susceptibility used by state geological surveys in California (Wills and others, 2011) and Wyoming (Wittke and Stafford, 2019). The methodology involves resampling and classification of raster and vector data and assigning a landslide susceptibility value based on combined rock strength and slope angle classes.

METHODOLOGY

The statewide 5-meter Interferometric Synthetic Aperture Radar (U.S. Geological Survey, 2013) digital elevation model was resampled to a 20-meter grid for processing efficacy and minimum landslide detection size. Slope gradients in degrees were derived using a geodesic method and values were grouped into eight slope classes with increasing steepness; class 1: < 3 degrees; class 2: 3 to < 5 degrees; class 3: 5 to < 10 degrees; class 4: 10 to < 15 degrees; class 5: 15 to < 20 degrees; class 6: 20 to < 30 degrees; class 7: 30 to < 40 degrees; and class 8: > 40 degrees (see Slope map below).

We constructed a comprehensive geologic map by compiling data from the Geologic Map of Alaska (Wilson and others, 2015; scale 1:1,584,000), which includes more than 240,000 geologic unit polygons. To reduce complexity, polygons were generalized using the Description and GeoMaterial attributes, resulting in 1,159 distinct geologic units. Rock strength values were subsequently assigned to each unit in accordance with the classification framework of Wills and others (2011). The three rock strength classes are: (1) Strong: crystalline rocks and well-cemented sandstones and limestones; (2) Moderate: weakly cemented sandstones and volcanic rocks; and (3) Weak: pre-existing landslides, mudstone, shales, unconsolidated surficial units (see Rock Strength map below).

The rock strength vector layer was converted to a raster, resampled to 20 m, multiplied by a factor of 10, and then added to the classified slope values to obtain unique two-digit slope weakness identifiers where the first digit represents rock strength, and the second digit represents slope class:

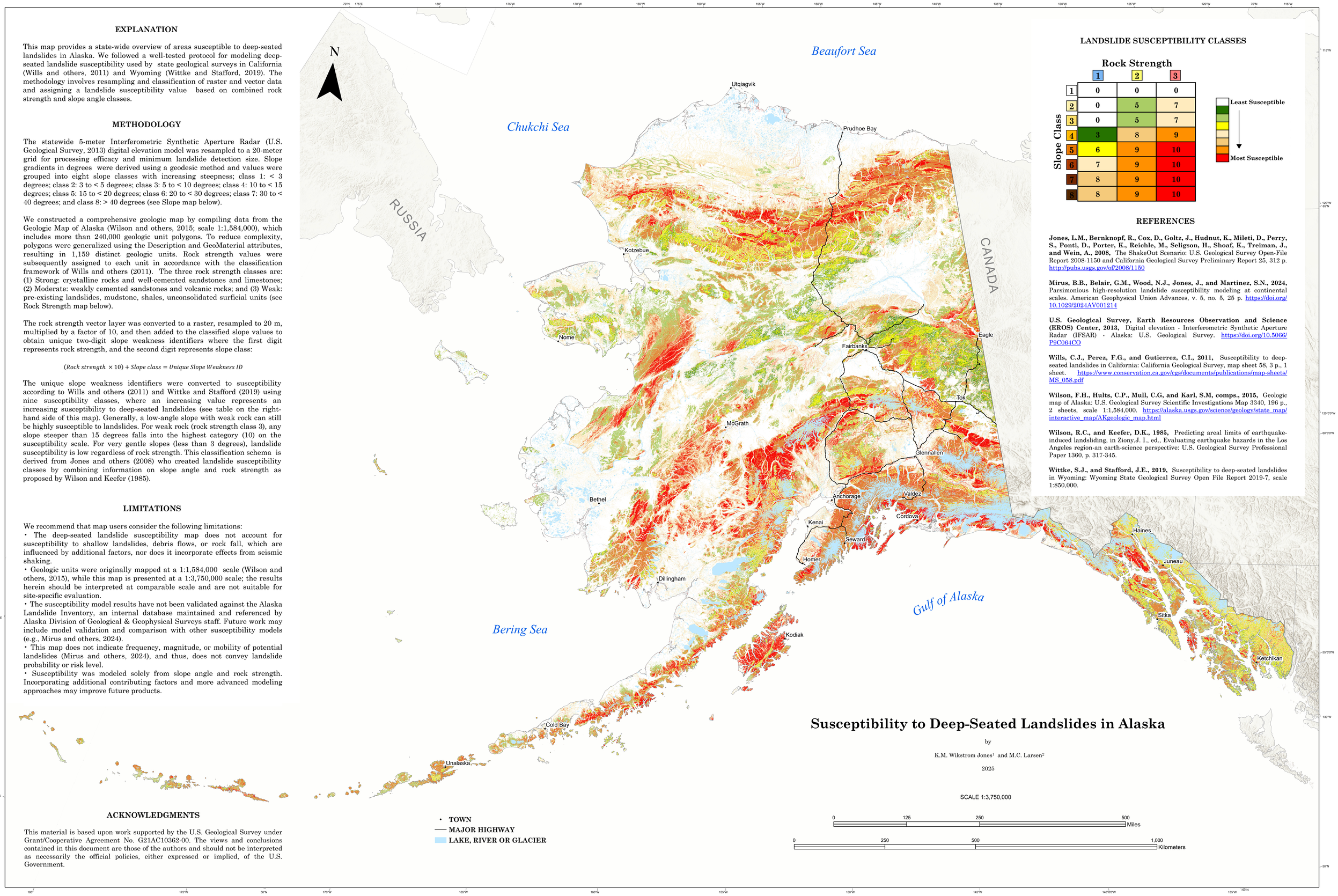
$$(Rock\ strength \times 10) + Slope\ class = Unique\ Slope\ Weakness\ ID$$

The unique slope weakness identifiers were converted to susceptibility according to Wills and others (2011) and Wittke and Stafford (2019) using nine susceptibility classes, where an increasing value represents an increasing susceptibility to deep-seated landslides (see table on the right-hand side of this map). Generally, a low-angle slope with weak rock can still be highly susceptible to landslides. For weak rock (rock strength class 3), any slope steeper than 15 degrees falls into the highest category (10) on the susceptibility scale. For very gentle slopes (less than 3 degrees), landslide susceptibility is low regardless of rock strength. This classification schema is derived from Jones and others (2008) who created landslide susceptibility classes by combining information on slope angle and rock strength as proposed by Wilson and Keefer (1985).

LIMITATIONS

We recommend that map users consider the following limitations:

- The deep-seated landslide susceptibility map does not account for susceptibility to shallow landslides, debris flows, or rock fall, which are influenced by additional factors, nor does it incorporate effects from seismic shaking.
- Geologic units were originally mapped at a 1:1,584,000 scale (Wilson and others, 2015), while this map is presented at a 1:3,750,000 scale; the results herein should be interpreted at comparable scale and are not suitable for site-specific evaluation.
- The susceptibility model results have not been validated against the Alaska Landslide Inventory, an internal database maintained and referenced by Alaska Division of Geological & Geophysical Surveys staff. Future work may include model validation and comparison with other susceptibility models (e.g., Mirus and others, 2024).
- This map does not indicate frequency, magnitude, or mobility of potential landslides (Mirus and others, 2024), and thus, does not convey landslide probability or risk level.
- Susceptibility was modeled solely from slope angle and rock strength. Incorporating additional contributing factors and more advanced modeling approaches may improve future products.



LANDSLIDE SUSCEPTIBILITY CLASSES

Rock Strength

Slope Class	Rock Strength 1	2	3
1	0	0	0
2	0	5	7
3	0	5	7
4	3	8	9
5	6	9	10
6	7	9	10
7	8	9	10
8	8	9	10

Least Susceptible → Most Susceptible

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- TOWN
- MAJOR HIGHWAY
- LAKE, RIVER OR GLACIER

Susceptibility to Deep-Seated Landslides in Alaska

by

K.M. Wikstrom Jones[1] and M.C. Larsen[2]

2025

SCALE 1:3,750,000

0 125 250 500 Miles

0 250 500 1,000 Kilometers

Base map:
ArcGIS Map Service Elevation/World Hillshade
Projection:
Alaska Albers Equal Area Conic
Datum:
North American Datum of 1983

Geologic interpretation by:
M.C. Larsen[2]
GIS Analysis and Cartography by:
K.M. Wikstrom Jones[1]
Cartographic review by:
A.E. Macpherson[1]

Affiliations:
[1] Alaska Division of Geological & Geophysical Surveys
3354 College Rd, Fairbanks, AK 99709
[2] Formerly Alaska Division of Geological & Geophysical Surveys
3354 College Rd, Fairbanks, AK 99709

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
3354 College Road ♦ Fairbanks, Alaska 99709-3707
Phone 907-451-5010 ♦ Fax 907-451-5050
email: dggspubs@alaska.gov ♦ website: dggs.alaska.gov