Minnesota Regions Prone to Surface Karst Feature Development

Series GW-01

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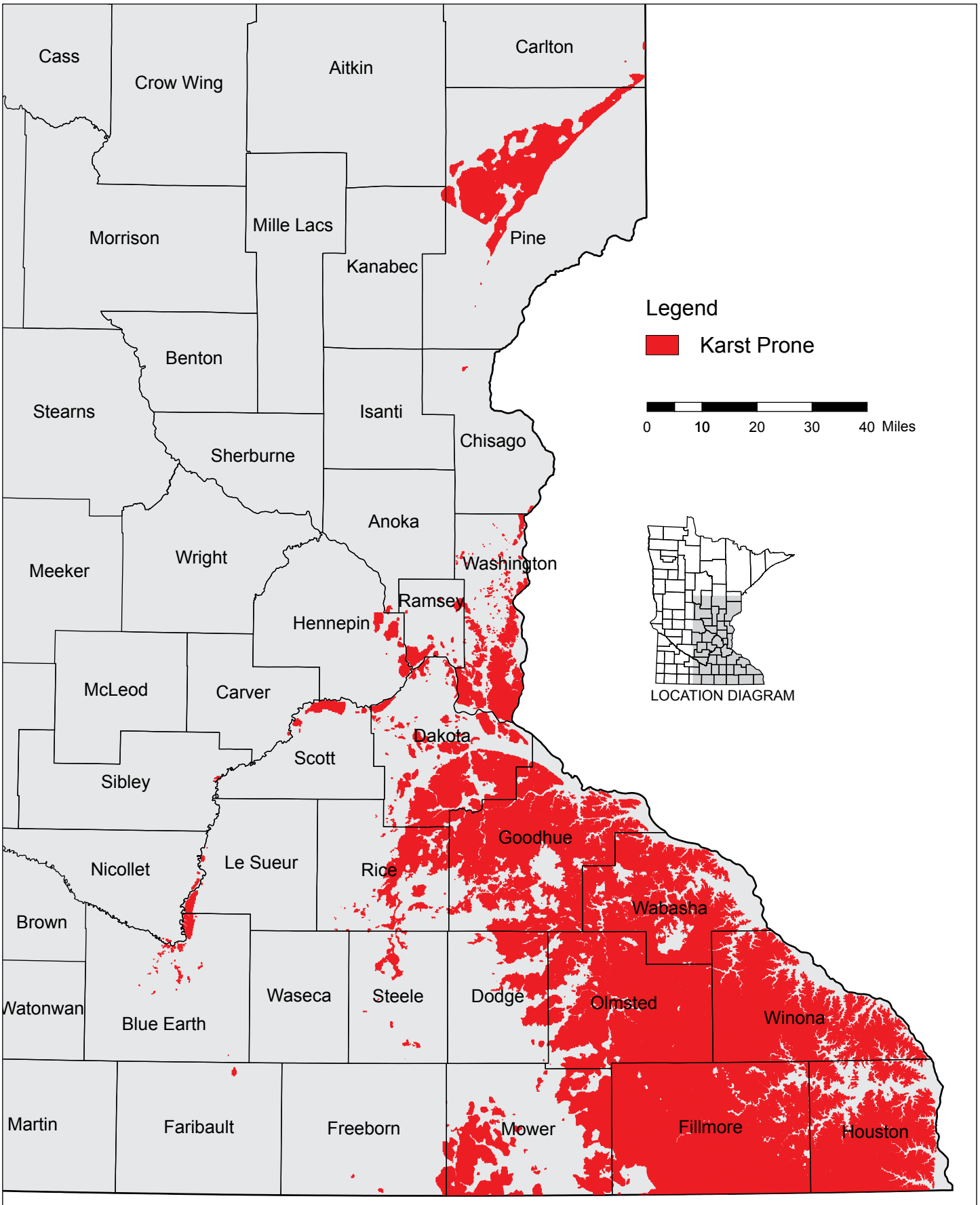

Figure 1. Minnesota Regions Prone to Surface Karst Feature Development: Series GW-01

See the County Geologic Atlas Karst and Springs webpage for additional information:
http://www.dnr.state.mn.us/waters/groundwater_section/mapping/springs.html

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Introduction

This map and associated dataset is a re-creation of active karst shown in the *Minnesota Karst Lands* map (Alexander and others, 2006). It depicts areas of the state prone to the development of surficial karst features and was developed as part of ongoing work for the Minnesota Hydrogeology Atlas (MHA) series.

Karst is defined as terrain with distinctive landforms and hydrology created primarily from the dissolution of soluble rocks. It is characterized by sinkholes, caves, springs, and underground drainage dominated by rapid conduit flow. Karst allows a direct, very rapid exchange between surface water and groundwater and significantly increases groundwater contamination risk from surface pollutants.

A field-verified karst feature, such as a sinkhole, is direct evidence that karst processes are active both on the surface and in a karst aquifer in the subsurface. However, the absence of karst features on the land surface does not imply the absence of karst processes on the land surface or karst hydrology in the subsurface.

In Minnesota surface karst features primarily occur where 50 feet or less of unconsolidated sediment overlies Paleozoic carbonate bedrock, the St. Peter Sandstone, or the Hinckley Sandstone. This coverage outlines areas where karst features can form on the land surface and where karst conditions are present in the subsurface (Figure 1).

Subsurface karst conditions also occur in carbonate rock in areas where there is more than 50 feet of unconsolidated material over bedrock, but those conditions rarely lead to surficial karst feature development in Minnesota. Therefore, karst conduit flow may exist in areas not shown in this coverage.

This information can be used in conjunction with the *Minnesota Karst Features Database* (See Digital Resources). When combined, this GIS coverage can be used to document the occurrence and distribution of sinkholes and other surface karst features for planning, environmental and risk management, hazard mitigation, scientific, and other purposes.

Dataset Description

This dataset updates the *Minnesota Karst Lands* map developed by Alexander and others (2006) which defined active karst as areas underlain by carbonate bedrock with less than 50 feet of sediment cover. The primary inputs used to develop the dataset were developed by the Minnesota Geological Survey (MGS), with verification using the *Karst Features Database* (Gao and others, 2002). MGS products used to develop this dataset are summarized within the GIS metadata.

This dataset includes a geodatabase that consists of two feature classes:

- The feature class *surfacekarst_carbonate_sandstone* contains the carbonate units shown in Alexander and others (2006), but also includes the siliceous Hinckley Sandstone (Shade and others, 2002) and the St. Peter Sandstone (Alexander and Maki, 1988; Alexander and others, 2011). The Hinckley and St. Peter sandstones are included because University of Minnesota and DNR karst geologists have field-located numerous karst features in these units.
- The feature class *surfacekarst_carbonateonly* contains carbonate units within 50 feet of the land surface. This feature class is similar to the original distribution of *Minnesota Karst Lands* within 50 feet of the surface (Alexander and others, 2006). Subtle differences in the area shown on the original map and this product are due to changes in mapping resolution from updated bedrock geologic mapping.

The St. Lawrence Formation is not included in this dataset. However, in southeastern Minnesota, numerous surface streams have been shown to sink into the St. Lawrence Formation (Green and others, 2008, 2012). Site specific investigations should consider the possibility of surface water interaction and rapid groundwater transport in this setting.

MGS map resolution varies between products. Several that were used to develop this dataset have insufficient resolution to differentiate lithostratigraphic units. For example, the Platteville and Glenwood formations are mapped together in several of the products, as opposed to two separate formations. Additional grouping of lithostratigraphic units occurs elsewhere in the dataset within the Ordovician and Devonian systems.

The *Lineage* section of the GIS metadata lists the MGS map products used, the MGS filename, the map unit labels, and the map unit descriptions.

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Digital Resources

The web page containing links to this report and accompanying dataset: http://www.dnr.state.mn.us/waters/groundwater_section/mapping/springs.html

DNR Related information – Minnesota County Geologic Atlas, Minnesota Hydrogeology Atlas, Karst and Springs: mndnr.gov/groundwatermapping.

Minnesota Karst Features Database: https://gisdata.mn.gov/dataset/geos-karst-feature-inventory-pts.

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