

- Lite Metadata -

- [Get Data](#) -

- View Attribute
Table -

- View Sample -

University of Minnesota, Department of Geology and Geophysics; Minnesota DNR - Division of Waters

Karst Feature Inventory Database

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Go to Section:

[1. Identification Information](#)

[2. Data Quality Information](#)

[3. Spatial Data Organization Information](#)

[4. Spatial Reference Information](#)

[5. Entity and Attribute Information](#)

[6. Distribution Information](#)

[7. Metadata Reference Information](#)

[8. References](#)

Section 1 *Identification Information - - - - - [top](#)*

Originator University of Minnesota, Department of Geology and Geophysics;
Minnesota DNR - Division of Waters

Title Karst Feature Inventory Database

System Name krstView.mde

Abstract

Southeastern Minnesota is part of the Upper Mississippi Valley Karst (Hedges and Alexander, 1985) that includes southwestern Wisconsin and northeastern Iowa. Karst lands in Minnesota are developed in Paleozoic carbonate and sandstone bedrock. A significant sandstone karst has developed in Pine County (Shade and others, 2001). Most surficial karst features such as sinkholes are found only in those areas with less than fifty feet of sedimentary cover over bedrock surface (Gao and others, 2002).

Since the early 1980s, the Minnesota Geological Survey and Department of Geology and Geophysics at the University of Minnesota have been mapping karst features and publishing various versions of their results in the form of 1:100,000 scale County Geologic Atlases. In the mid 1990s, the Minnesota Department of Natural Resources was assigned responsibility for the hydrogeology portions of the County Atlases and is now responsible for the karst mapping. Dalglish and Alexander (1984), Alexander and Maki (1988), Witthuhn and Alexander (1995), Green and others (1997), Shade and others (2001), and Tipping and others (2001) published sinkhole distribution maps for Winona, Olmsted, Fillmore Counties, Leroy Township, Pine and Wabasha Counties respectively. Published Atlases of Washington, Dakota, and the counties of the Twin Cities Metro area contain limited information on sinkhole occurrences.

A karst feature database of Southeastern Minnesota has been developed that allows sinkhole and other karst feature distributions to be displayed and analyzed across existing county boundaries in a GIS environment. The central DBMS is a relational GIS-based system interacting with three modules: spatial operation, spatial analysis, and hydrogeological modules. Data tables are stored in a Microsoft ACCESS 2000 DBMS and linked to corresponding ArcView shape files. The current Karst Feature Database of Southeastern Minnesota was put on a Citrix Window 2000 server accessible to researchers and planners through networked interfaces.

The karst inventory points were point features such as sinkholes, springs, and stream sinks extracted from the karst feature database of Southeastern Minnesota. Both inventory points and karst feature database are updated on regular basis. This research was supported with funding from the Minnesota Department of Health.

Purpose

1) to look for large-scale patterns in the sinkhole distribution; 2) to conduct statistical tests of hypotheses about the formation of sinkholes; 3) to create web-accessible management tools for land-use managers and planners; and 4) to deliver geomorphic and hydrogeological criteria for making scientifically valid land-use policies and decisions in karst areas of southeastern Minnesota.

*Time Period of
Content Date*

Unknown

Currentness Reference The databases used in this research have been built over the past 20+ years with support from The Legislative Commission on Minnesota Resources, Minnesota Department of Natural Resources and several counties.

Progress in work

Maintenance and Update Frequency Continually

Spatial Extent of Data Statewide

Bounding Coordinates E = -89
W = -97.5
N = 49.5
S = 43

Place Keywords Minnesota

Theme Keywords Karst Feature Database, Sinkhole, Spring, Stream Sink

Theme Keyword Thesaurus None

Access Constraints None

Use Constraints None

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Browse Graphic File Name [karstfeature](#), [mnkarst](#), [pinekarst](#)

Browse Graphic File Description [karstfeature](#) shows all the major karst features stored in the karst feature database of southeastern Minnesota.

[mnkarst](#) overlays the areas with < 50 feet, 50 to 100 feet, and > 100 feet of surficial cover over the areas underlain by carbonate bedrock. This map emphasizes the patchy nature of the thick sediment cover and the importance of site-specific information for land-use decisions.

[pinekarst](#) illustrates sinkhole distributions in the sandstone karst areas of Pine

county.

Associated Data Sets More Polygon and Line karst features such as outcrops, sub-drained areas, and water-tracing vectors are being developed and processed in selected areas of southeastern Minnesota. Depth to bedrock and bedrock geology information are available in the karst areas of southeastern Minnesota.

Section 2 *Data Quality Information - - - - - [top](#)*

Attribute Accuracy Statistically valid attribute accuracy information is not available for these data. Attribute accuracy was tested by comparison of the source with hard copy printouts and investigation using interfaces developed in ArcView and Microsoft Access platforms.

Logical Consistency Data are topologically correct.

Completeness The karst feature database is still an incomplete database. Only sinkholes, springs, and stream sinks are included in the inventory here because information of other karst features is either not available or not verified. Both inventory points and karst feature database are updated on regular basis. More karst features will be available after the database is significantly updated. Sinkhole data in Fillmore, Goodhue, Mower, Olmsted, Pine, Wabasha, and Winona counties are relatively more complete than the rest of the karst areas in southeastern Minnesota.

Horizontal Positional Accuracy Varies depending on the source and method of generating geographic coordinates for the karst features.

Vertical Positional Accuracy Varies depending on the source and method of generating elevations for the karst features.

Karst feature data sources

source data	source data scale	source data date	contact person
karst zip files	1:24000	1995	Robert Tipping
Winona Co. sinkholes	1:24000	1995	Sue Magdalene
Mower Co. karst features	1:24000 or GPS	1997	Jeff Green
Goodhue Co. karst features	1:24000 or GPS	2000	Calvin Alexander
Wabasha Co. karst features	1:24000 or GPS	2001	Robert Tipping
Pine Co. karst features	1:24000 or GPS	2002	Bev Shade
Dodge Co. karst features	1:24000 or GPS	2002	Scott Alexander
Field notes and other sources	various	various	various

Processing steps to develop karst feature database and generate inventory points:

- 1>. Jan. 2000 - Mar. 2000, Investigate existing documentation concerning the application of the database and study the current operating environment and planned use of the information.
- 2>. Apr. 2000 - Sept. 2000, Assemble datasets and develop a karst feature database for Winona County.
- 3>. Oct. 2001 - Dec. 2001, Revise entities, attributes, domains, and keys, relationships, and referential integrities for the karst feature database.
- 4>. Jan. 2001 - June 2001, Load existing archived karst feature files into the karst feature database and build applications for the karst feature database.
- 5>. July 2001 - Dec. 2001, Verify database consistency and security and test applications.
- 6>. Jan. 2002 - June. 2002, Conduct user test to verify attributes and

locations of karst features in the database by using applications built for the database. Modify some of the applications and table structures if necessary.

7>. July 2002 - present, Load and convert more data into the database and verify its overall consistency and security. Generate web-accessible karst feature inventory points.

Source Scale 24000 or 0 (GPS).
Denominator

Section 3 *Spatial Data Organization Information* - - - - - [top](#)

Native Data Set Microsoft Access 2000, ArcView GIS 3.2
Environment

Geographic Not Applicable
Reference for

Tabular Data

Spatial Object Type Vector

Vendor Specific Object Types Point

Tiling Scheme counties

Section 4 *Spatial Reference Information - - - - - [top](#)*

Horizontal Coordinate Scheme UTM

Ellipsoid GRS1980

Horizontal Datum NAD83

Horizontal Units meters

Distance Resolution meters

Altitude Datum n/a

Altitude Units n/a

Depth Datum n/a

Depth Units n/a

Cell Width n/a

Cell Height n/a

Latitude Resolution n/a

Longitude Resolution n/a

UTM Zone Number 15

SPCS Zone Identifier n/a

County Coordinate Zone Identifier n/a

*Coordinate
Offsets or
Adjustments* n/a

*Map Projection
Name* n/a

*Map Projection
Parameters* n/a

*Other Coordinate
System's
Definition* n/a

Section 5 *Entity and Attribute Information - - - - - [top](#)*

*Entity and
Attribute
Overview* Relate ID number, relateid; feature's label, feat_label; feature type, feature; method to generate geographic coordinates, gcm_code; sources of geographic coordinates generation, geoc_src; date on which geographic coordinates were generated, geoc_date; UTM easting coordinate, utme; UTM northing coordinate, utmn; UTM zone, utm_zone; datum of geographic coordinates, datum; MGS quadrangle code, mgsquad_c.

*Entity and
Attribute Detailed
Citation* [Entity and Attribute Table](#)

Section 6 *Distribution Information - - - - - [top](#)*

Publisher Minnesota DNR - MIS Bureau

Publication Date 11/05/2002

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*Distributor's
Data Set
Identifier* krstindx

Distribution Liability None stated
Transfer Format Name ArcView shape files
Transfer Format Version Number ArcView 3.2
Transfer Size 1.6 megabytes
Ordering Instructions Contact above Person
Online Linkage [DNR Data Deli](#)

Section 7 *Metadata Reference Information - - - - -* [top](#)

Metadata Date 10/31/2002

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Metadata Standard Name Minnesota Geographic Metadata Guidelines

Metadata Standard Version 1.1

Metadata Standard Online Linkage <http://www.lmic.state.mn.us/gc/stds/metadata.htm>

Section 8 *References - - - - -* [top](#)

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Probability: Geologic Atlas of Olmsted County, Minnesota, County Atlas Series C-3, Minnesota Geological Survey, St. Paul, Minnesota, Plate 7.

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Gao, Y., Alexander, E.C. Jr., and Tipping, R.G., 2002, The Development of a Karst Feature Database for Southeastern Minnesota, Journal of Cave and Karst Studies, v. 64, no. 1, p.51-57.

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Green, J.A., 2003, Karst Features: Geologic Atlas of Mower County, Minnesota, County Atlas Series C-11, Part B, Minnesota Department of Natural Resources, St. Paul.

Hedges, J., and Alexander, E.C., Jr., 1985, Karst-related features of the Upper Mississippi Valley Region: Studies in Speleology, v.6, p. 41-49.

Shade, B.L., Alexander, S.C., Alexander, E.C., Jr., and Martin, S., 2001, Sinkhole distribution, Depth to bedrock, and Bedrock topography: Geologic Atlas of Pine County, Minnesota, County Atlas Series C-13, Minnesota Geological Survey, St. Paul, Minnesota, Plate 6.

Tipping, R.G., Green, J.A., and Alexander, E.C., Jr., 2001, Karst Features: Geologic Atlas of Wabasha County, Minnesota, County Atlas Series C-14, Minnesota Geological Survey, St. Paul, Minnesota, Plate 5.

Witthuhn, M.K. and Alexander, E. C., Jr., 1995, Sinkholes and Sinkhole Probability: Geologic Atlas of Fillmore County, Minnesota, County Atlas Series C-8, Minnesota Geological Survey, St. Paul, Minnesota, Plate 8.