


[Home](#) > [Journal](#) > [Earth & Environmental Sciences](#) > [JGIS](#)
[Indexing](#) | [View Papers](#) | [Aims & Scope](#) | [Editorial Board](#) | [Guideline](#) | [Article Processing Charges](#)
[JGIS](#) > Vol.3 No.4, October 2011



Identifying the Stream Erosion Potential of Cave Levels in Carter Cave State Resort Park, Kentucky, USA

PDF (Size: 1049KB) PP. 323-333 DOI: 10.4236/jgis.2011.34030

Author(s)

B. S. Jacoby, E. W. Peterson, T. Dogwiler

ABSTRACT

Cave levels, passages found at similar elevations and formed during the same constant stream base level event, reveal information about paleoclimates and karst geomorphology. The investigation presented here examines how Stream Power Index (SPI) relates to cave levels. The study area, Carter Caves State Resort Park (CCSRP), is a fluviokarst system in northeastern Kentucky containing multiple cave levels. SPI determines the erosive power overland flow based on the assumption that flow accumulation and slope are proportional to potential for sediment entrainment. Part of this digital terrain analysis requires the creation of a flow accumulation raster from a digital elevation model (DEM). In creating the flow accumulation raster, one has the option to fill depressions (also considered errors) within the DEM. Filling these depressions, or "sinks," creates a well-connected stream network; however it also removes possible sinkholes from the DEM. This paper also investigates the effects a filled and an unfilled DEM have on SPI and what each reveals about erosion potential in the area. The data shows that low elevations within the filled DEM maintain a high SPI value when compared to the unfilled DEM. The filled DEM also created a stream network similar to reality. The unfilled DEM demonstrated similar SPI results between all levels, indicating a well-connected karst system. In order to truly understand the mechanics of this system, a combination of these two DEMs is required.

KEYWORDS

Karst, Erosion, Geomorphology, Speleogenesis, Terrain Analysis

Cite this paper

B. Jacoby, E. Peterson and T. Dogwiler, "Identifying the Stream Erosion Potential of Cave Levels in Carter Cave State Resort Park, Kentucky, USA," *Journal of Geographic Information System*, Vol. 3 No. 4, 2011, pp. 323-333. doi: 10.4236/jgis.2011.34030.

References

- [1] W. Dreybrodt and F. Gabrovsek, "Basic Processes and Mechanisms Governing the Evolution of Karst," *Speleogenesis and Evolution of Karst Aquifers*, Vol. 1, No. 1, 2003, pp. 115-154.
- [2] A. N. Palmer, "Cave Levels and Their Interpretation," *The NSS Bulletin*, Vol. 49, No. 2, 1987, p. 50.
- [3] D. M. Anthony and D. E. Granger, "A Late Tertiary origin for Multilevel Caves along the Western Escarpment of the Cumberland Plateau, Tennessee and Kentucky, Established by Cosmogenic ²⁶Al and ¹⁰Be," *Journal of Cave and Karst Studies*, Vol. 66, No. 2, 2004, p. 46.
- [4] D. E. Granger, D. Fabel and A. N. Palmer, "Pliocene—Pleistocene Incision of the Green River, Kentucky, Determined from Radioactive Decay of Cosmogenic ²⁶Al and ¹⁰Be in Mammoth Cave Sediments," *GSA Bulletin*, Vol. 113, No. 7, 2001, p. 825. doi:10.1130/0016-7606(2001)113<0825:PPIOTG>2.0.CO;2
- [5] B. Jacoby, E. W. Peterson, J. C. Kostelnick and T. Dogwiler, "Approaching Cave Level Identification with GIS: A Case Study of Carter Caves," *Journal of Cave and Karst Studies*, in Review.
- [6] B. S. Jacoby, E. W. Peterson, T. Dogwiler and J. C. Kostelnick, "Estimating Cave Level Development with GIS," *Speleogenesis and Evolution of Karst Aquifers*, in Review.

[JGIS Subscription](#)
[Most popular papers in JGIS](#)
[About JGIS News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads:	128,257
------------	---------

Visits:	272,968
---------	---------

[Sponsors, Associates, and Links >>](#)

- [7] J. P. Wilson and J. C. Gallant, " Digital Terrain Analysis," In: J. P. Wilson and J. C. Gallant, Eds., *Terrain Analysis: Principles and Applications*, John Wiley and Sons, Inc, New York, 2000, pp. 1-27.
- [8] I. D. Moore, R. B. Grayson and A. R. Ladson, " Digital Terrain Modeling: A Review of Hydrological, Geomorphological, and Biological Application," *Hydrological Processes*, Vol. 5, No. 1, 1991, p. 3. doi:10.1002/hyp.3360050103
- [9] T. Dogwiler, D. Docker and D. Omoth, " Rush-Pine Creek Watershed Digital Terrain Analysis Overview and Procedure Guidelines: WRC Report 2010-02," Southeastern Minnesota Water Resource Center, Winona State University, Winona, 2010.
- [10] A. C. Pike, T. G. Mueller, A. Schrgendorfer, S. A. Shearer and A. D. Karathanasis, " Erosion Index Derived from Terrain Attributes Using Logistic Regression and Neural Networks," *Agronomy Journal*, Vol. 101, No. 5, 2009, p. 1068. doi:10.2134/agronj2008.0207x
- [11] S. D. Warren, V. E. Diersing, P. J. Thompson and W. D. Goran, " An Erosion-Based Land Classification System for Military Installations," *Environmental Management*, Vol. 13, No. 2, 1989, p. 251. doi:10.1007/BF01868372
- [12] L. Mitas and H. Mitasova, " Distributed Soil Erosion Simulation for Effective Erosion Prevention," *Water Resources Research*, Vol. 34, No. 3, 1998, p. 505. doi:10.1029/97WR03347
- [13] J. Galzki, D. Mulla, N. Joel and S. Wing, " Targeting Best Management Practices (BMPs) to Critical Portions of the Landscape: Using Selected Terrain Analysis Attributes to Identify High-Contributing Areas Relative to Nonpoint Source Pollution," Minnesota Department of Agriculture, 2008.
- [14] A. S. Engel and S. A. Engel, " A Field Guide for the Karst of Carter Caves State Resort Park and the Surrounding Area, Northeastern Kentucky," In: A. S. Engel, Ed., *Field Guide to Cave and Karst Lands of the United States*, Karst Waters Institute Special Publication 15, Karst Waters Institute, Leesburg, 2009, pp. 154-171.
- [15] G. D. Ochsenbein, " Origin of Caves in Carter Caves State Park, Carter County, Kentucky," Bowling Green State University, Bowling Green, 1974.
- [16] N. Arnold, " A New Approach for Dealing with Depressions in Digital Elevation Models When Calculating Flow Accumulation Values," *Progress in Physical Geography*, Vol. 34, No. 6, 2010, p. 781. doi:10.1177/0309133310384542
- [17] T. Blak, " DEM Quality Assessment," In: D. F. Maune, Ed., *Digital Elevation Model Technologies and Applications: The DEM Users Manual*, American Society for Photogrammetry and Remote Sensing, Bethesda, 2007, pp. 425- 448.
- [18] C. G. Groves and A. D. Howard, " Early Development of Karst Systems: 1, Preferential Flow Path Enlargement under Laminar Flow," *Water Resources Research*, Vol. 30, No. 10, 1994, p. 2837. doi:10.1029/94WR01303
- [19] J. C. Gallant, M. F. Hutchinson and J. P. Wilson, " Future Directions for Terrain Analysis," In: J. P. Wilson and J. C. Gallant, Eds., *Terrain Analysis: Principles and Applications*, John Wiley and Sons, Inc, New York, 2000, pp. 423-427.