Evolving Geographic Information Systems Capabilities for Management of Cave and Karst Resources

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Abstract

Geographic Information Systems (GIS) software and the increasing power of desktop computers have created powerful tools for the management of cave and karst resources. This includes tools for:
1) the bookkeeping of large, complex spatial data sets,
2) analysis and quantitative modeling of karst processes, and
3) visualization of both spatially and temporally complex data.

Over the last four years, the advent of Environmental Systems Research Institute's (ESRI) ArcView package has made Geographic Information Systems more accessible to users in the karst science and management community. More recently, the ArcView extensions, 3D Analyst, Spatial Analyst, and CaveTools, have added particular utility for karst applications. Using these tools, we are developing methods to manage karst resources more effectively as well as moving toward a deeper understanding of karst systems' fundamental behavior and organization.

On the western boundary of Mammoth Cave National Park, potential threats to water quality from oil drilling adjacent to the park are being cataloged for emergency response teams using Geographic Information Systems. Regional water quality impacts to the aquatic ecosystem within the Mammoth Cave Karst Aquifer are also being studied through land use inventories within the aquifer's 350-square-kilometer recharge area. The long-term goal of this "bookkeeping" project is to develop numerical models relating land use changes to potential water quality impacts. Other research is working toward understanding the basic organization of karst flow networks utilizing cave survey data and ArcView's three-dimensional analytical capabilities applying morphometric concepts that have been developed for traditional surface flow networks.