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Drainage to Mammoth Cave National Park

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Abstract

Since land use is carefully managed within U.S. national parks, the most significant negative impacts to resources, including impacts to water quality, air quality, and from exotic species, often come from external sources. To identify water quality threats it is critical to define the region that drains to a park, as land use within that area is the principal source of water contamination. Compared to most national parks, determining drainage to Mammoth Cave National Park (MACA) is relatively complicated due to the highly developed karst landscape/aquifer system so integral to MACA.

While in general the area draining to MACA is well known (Meiman, 2005), we present here the most comprehensive single map so far developed of drainage to MACA (Figure 1), that for the first time includes corrections to areas of the catchment boundaries that were influenced by differences between those of the Hydrologic Unit Code (HUC) maps from the US Geological Survey (USGS) National Hydrography Dataset (NHD) and subsurface karst basin boundaries based on the Kentucky Geological Survey (KGS) Karst Atlas Maps (Osterhoudt, 2014).

NHD map catchment boundaries are based on surface topography, which can be misleading where drainage boundaries cross sinkhole plains in karst settings, as in areas of the Green River upstream from MACA (Figure 2). An extensive program of dye tracing over more than four decades (Currens and Ray, 1999) has provided the necessary flow data to make these corrections.

Four principal regions drain to MACA: 1) surface drainage from the Green River valley to the east, 2) surface drainage from the Nolin River valley to the north, 3) subsurface karst flow into the Green River from the south, and 4) subsurface karst flow into the Green River from the North. Green River surface drainage includes the river's floodplain crossing the karst sinkhole plain.

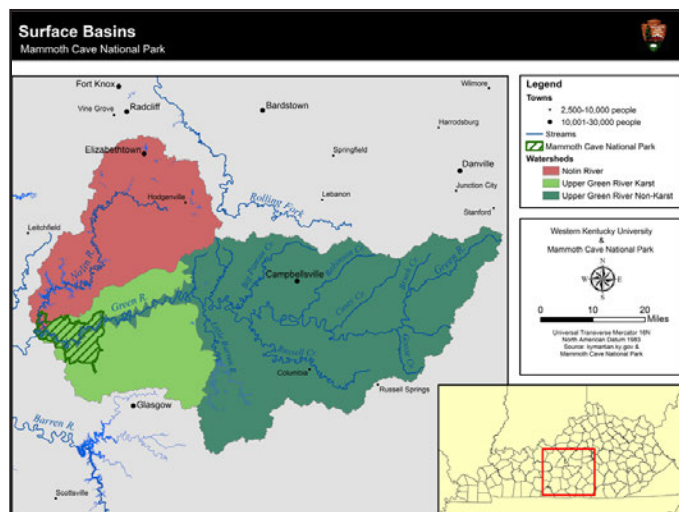


Figure 1: Map showing drainage areas upstream from Mammoth Cave National Park.

While land use in the MACA catchment is dominated by agriculture, it also includes urban areas of Elizabethtown and Campbellsville. One potential use of such a map is to provide a specific, quantifiable basis for the defined extents of the Zone of Cooperation and Outer Transition Zones for the UNESCO Mammoth Cave International Biosphere Reserve.

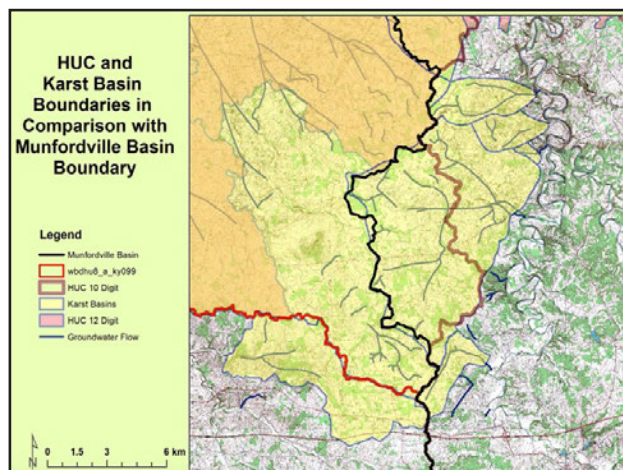


Figure 2: Map showing an example of basin boundary differences for the Green River Basin between those based on the USGS National Hydrography Data Set and those that consider subsurface karst flow as defined by the Kentucky *Karst Atlas Maps* (Currens and Ray, 1999). The brown line shows the basin boundary for the Green River based on the USGS HUC (Hydrologic Unit Code) 10, while the black shows the boundary based on the karst drainage. The area between the two is incorrectly attributed to the Green River on the USGS map, with a difference of nearly five km in places. Small differences between the boundary given by the karst atlas maps (blue) and the newly drawn boundary (black) reflect the slightly generalized nature of the line at the scale of the karst atlas maps.

References

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