USING GIS TO SELECT DRAINAGE BASINS FOR SAMPLING: AN EXAMPLE FROM A COSMOGENIC 10BE STUDY OF EROSION RATES WITHIN THE SUSQUEHANNA RIVER BASIN

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We used GIS analysis to effectively select a series of sub-basins within the > 70,000 square km Susquehanna River Basin for fluvial sediment sampling. Measuring cosmogenic 10-Be from these samples allowed us to develop a better understanding of erosion rates and patterns within the Susquehanna Basin and to investigate relationships between erosion rates and basin-scale characteristics. We began the analysis by obtaining regional datasets of topography, bedrock geology, glacial extent, precipitation, land cover, and physiographic province, all of which are freely available. After delineating boundaries of thousands of sub-basins at a range of scales, we summarized the landscape characteristics within the basin boundaries. We plotted the summarized characteristics to gain insight regarding the types and quantities of basins available for sampling. Guided by what we learned, we decided to base the sampling strategy on the following factors: basin scale (3–10 square km), position south of the glacial margin, physiographic province, lithology, and mean basin slope. Finally, we used a series of queries to display basins with the desired characteristics. Because the pool of remaining candidate basins was small, we manually selected basins at this point, examining the digital topographic maps to screen for excessive disturbance (such as strip mines) and difficulty of access. Our results demonstrate the effectiveness of using GIS to aid in developing a sampling strategy. Using the 10-Be data generated from 60 sampled basins, we identified positive correlations between slope and inferred erosion rates, though the erosion rates for the sampled lithologies (sandstone, shale, and schist) are indistinguishable from each other after accounting for slope. Rates extrapolated from the small basins, based on the identified relationships, are close to rates measured for larger basins. This systematic approach to basin selection can be applied to any research that requires sampling of a small subset of basins from a large group of possibilities.

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