Landscape Metrics Arranged by Hydrological Proximity to Sites on Mississippi, Missouri, and Ohio Rivers

Figure 1. Study area in the Upper Mississippi, the Missouri and the Ohio River basins and 447 sampling sites.

Scientists and GIS specialists at the EPA Mid-Continent Ecology Division created a spatial framework for testing multiple landscape scales of influence upon the water quality and biology sampled at 447 sites along the Upper Mississippi, the Missouri and the Ohio Rivers (Figure 1). Project objectives were to define landscape areas that could deliver stressors to the Great Rivers, and subsequently relate landscape characteristics to the ecological integrity of fish, invertebrate and plankton communities in the rivers. The National Hydrologic Database (NHDPlus) provided a uniform and comprehensive database covering the entire study area. Hydrologically-defined catchments from NHDPlus were aggregated to create sets of spatially-nested contributing units expected to be meaningful to river ecology.

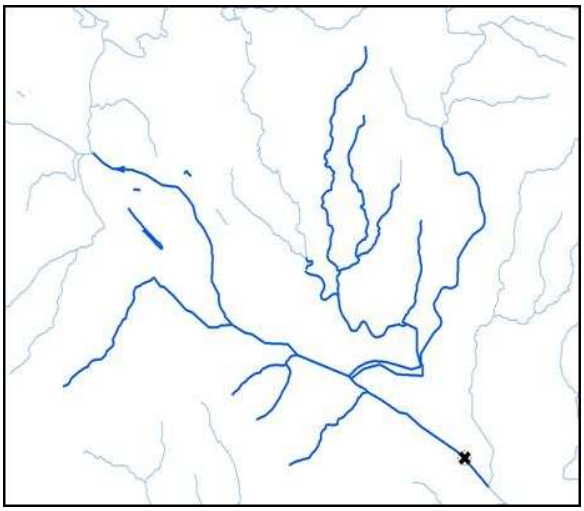

Figure 2. Flow lines within 10-km hydrological proximity to a site as selected by upstream navigation along the NHDPlus network.

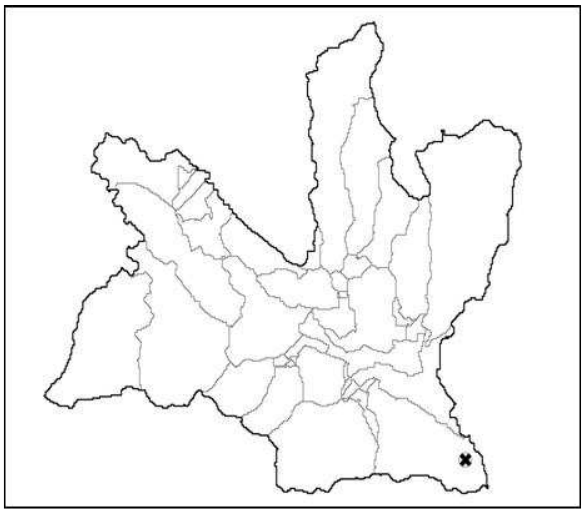

Figure 3. Assemblage of NHDPlus catchments associated with the flow lines selected within 10-km hydrological proximity to a site.

NHDPlus navigation tools and custom scripts helped to select consecutive upstream flow lines (Figure 2) and the associated catchments (Figure 3). Navigation was limited by user-specified distances (10, 50 and 100 km) measured along the flow lines of the main channel and contributing tributaries. In addition we analyzed flooding models and landforms (i.e. slope, elevation) and delineated nominal valley-full catchments (Figure 4). We also delineated sets of main channel and tributary riparian buffers nested within the assembled contributing areas (Figure 5).

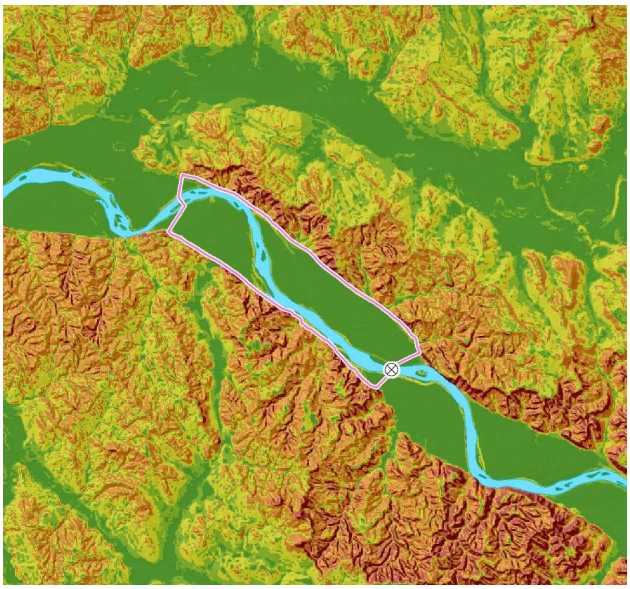

Figure 4. Valley-full contributing area extending 10 km upriver from a site.

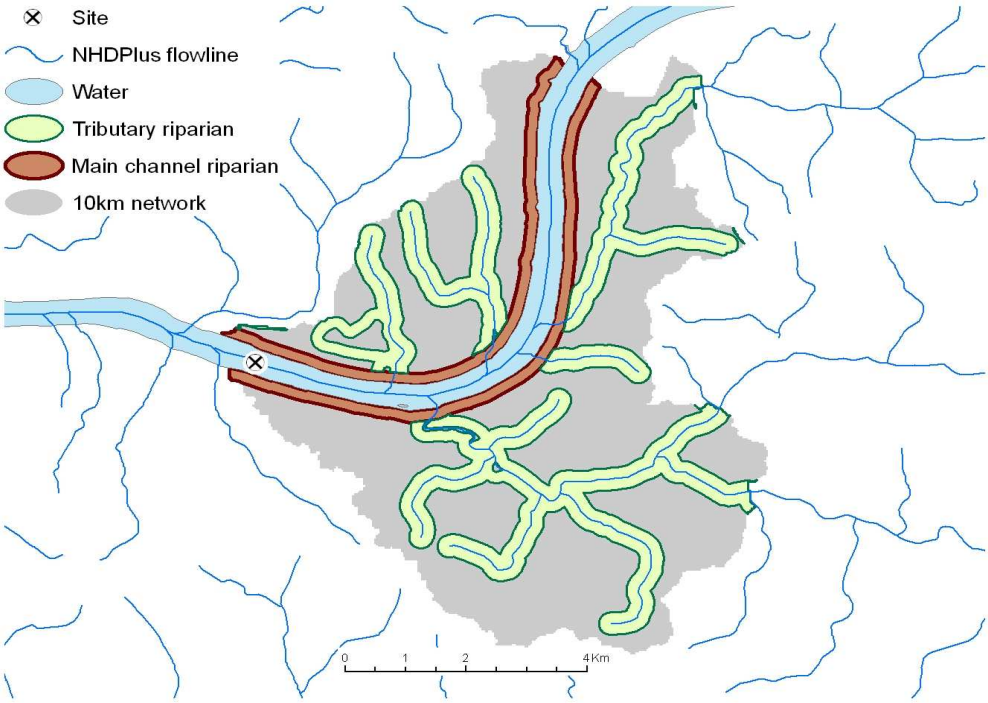

Figure 5. Main channel and tributary riparian buffers nested within 10-km network watershed as navigated by hydrological proximity to a site using NHDPlus.

Landscape metrics in contributing units of various scales are being tested for their importance to water quality and aquatic habitats within large floodplain river systems. The metrics including land cover, elevation, slope, imperviousness, and tree canopy were extracted from the 2001 National Land Cover (NLCD) and the National Elevation (NED) databases for all sets of nested landscape units contributing to each sample site (Figure 6). These basic metrics were transformed into arrays of landscape variables arranged by hydrological proximity to each site. The geoprocessing output provided information for consistent analysis and comparison of stressors and responses at various spatial scales of terrestrial influence on aquatic habitats sampled along the rivers.

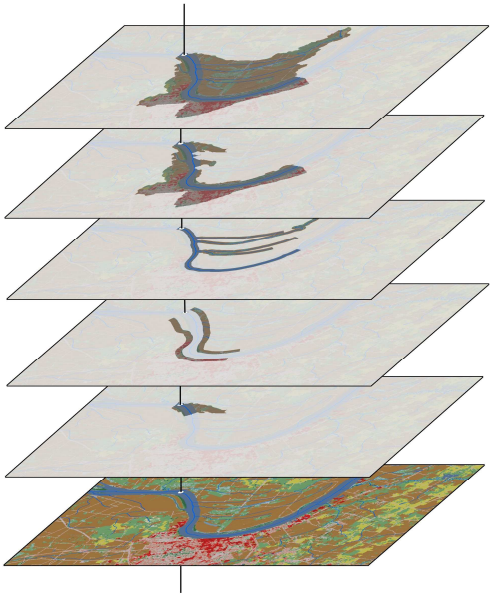

Figure 6. Examples of nested landscape units contributing to a site for which landscape metrics were determined.

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