Watershed Parameterization Using Geospatial Modeling and Preliminary Assessment of the Effects of Small Impoundments (Ponds)

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Small watershed impoundments (ponds) have cumulative effects on surface drainage and on the transport of suspended and dissolved materials through and out of the larger watersheds in which they reside. However, they are often small enough to be missed in most mapping and water-body inventory activities, many have lifetimes on the order of a few decades, and they may be "replaced" by new ponds in different locations or periodically "rebuilt" to remove accumulated sediment, increase capacity, and/or enhance runoff catchment area. In areas of relatively high pond density, the hydrologic landscape is, therefore, a shifting mosaic of small sub-watersheds and this may influence the accuracy of runoff, non-point source pollution, and sediment yield modeling efforts.

Determination of the influence of small ponds on runoff and sediment yield for their respective larger watersheds is a laborious and therefore expensive process. It is similarly difficult and time consuming to parameterize the small drainage basins above each small pond to determine factors that affect sediment yield and therefore pond lifespan, which in turn affects the 'shifting mosaic' of small subwatersheds mentioned above. The cumulative importance of these networked impoundments places a premium on the ability to understand and predict pond functions from knowledge of the environment and land use, and on the ability to extrapolate or generalize from case studies, or from limited samples and information. Specifically, there is a need to understand the ecological, biogeochemical, and environmental functions and effects of ponds in an altered landscape, and how they relate to environmental characteristics such as soils, topography, and land use/land cover. This will ultimately lead to a better understanding of how ponds may affect (and be affected by) runoff, sediment yield, and the transport and cycling of nutrients and other constituents (such as carbon).

We have begun to address these issues in four ways. First we have derived the drainage-related topographic parameters needed to apply an existing model (AnnAGNPS) to a small watershed using the computer model TOPAZ (Topographic Parameterization). Second we used spatial analysis techniques in GIS to determine the most likely major sediment producing areas within the drainage basin of a large impoundment (Lyon County State Lake, LCSL) within the selected watershed boundary based on the derived model parameters for slope and soil characteristics. Third, we compared the likely sediment producing areas with the spatial distribution of small ponds through time to help determine the cumulative effects of ponds on runoff and sediment yield from the LCSL watershed. Fourth, we compared derived model parameters to selected small ponds within the LCSL watershed to determine the influence of these parameters on small pond history and current condition.