

Assessing Temporal Changes in Ponds and Pond Numbers Using Historical Air Photos: A Comparison Between the Midland and Allen SE Quadrangles

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Recent work has demonstrated the importance of the cumulative effects of small artificial impoundments (ponds) on landscape-scale cycles of water, sediment, and carbon at scales ranging from local to continental. Initial analyses of data currently available for the contiguous 48 United States indicate that commonly-used available maps and electronic coverages under-represent the number and areal density of small pond features by up to two orders of magnitude. They also do not provide a clear picture of the temporal changes in ponds and pond numbers that have occurred over the past 60 years. There are four basic questions that need to be addressed. How do we accurately detect and count small artificial water bodies (ponds)? 2) How many ponds have been built? 3) How have the numbers and spatial distribution of ponds changed during the last 60+ years? 4) What are the ecological, biogeochemical, and environmental functions and effects of ponds in an altered landscape?

This research addresses the first three perceived needs by studying ponds using historical air photos for two topographic quadrangles in eastern Kansas. Eastern Kansas contains a high density of ponds within a variety of topographic and land use settings, making it an ideal site to evaluate detection and classification techniques for ponds as well as their environmental effects. Air photo coverage begins in the 1940s for both quadrangles and at least 6 sets of air photos from different time intervals are available for both areas. By digitizing ponds using digital imagery in a GIS format, temporal changes in the numbers of ponds, their variations in size, and their life expectancy in different topographic, land use, and geological settings can be assessed.

Results indicate that more ponds were built earlier (1940s) in areas dominated by cattle grazing (Allen SE quad, Lyon County). Pond numbers in the Midland quad (Jefferson County) have increased through time at a rate of about 10 per year from 24 in 1941 to 642 in 2002. The functional intention of ponds within the Allen SE quad appears to still be water for cattle while many of the new ponds in the Midland quad appear to be used for other purposes. Ponds also appear to be temporal features in that some appear to fill in and disappear from the landscape thereby complicating their detection in relatively short periods of time (≤ 40 years) while others are apparently more permanent.