SMALL ARTIFICAL WATER BODIES: A NEGLECTED BUT IMPORTANT FACTOR IN WATER SUPPLY AND ENVIRONMENTAL QUALITY.

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Recent studies[1] have shown that artificial ponds of various types and purposes are ubiquitous features of the landscape in many areas of the US, far outnumbering natural water bodies. Because they are small, mostly on private property, and their numbers and locations vary over time, they are very poorly represented on the digital map products and databases normally used for hydrologic analyses. However, in many areas they are a major factor in controlling the residence time of surface water, in trapping sediment, and in providing a network of biogeochemical reactors that modify loads of nutrients and other solutes. By filtering and slowing the movement of surface water, pond networks have a positive effect on development of surface water supplies in that they trap sediment and may prolong the life of larger supply reservoirs; however, they also tend to reduce net runoff at the expense of evaporation and infiltration. In terms of water quality, particularly in agricultural areas, ponds may provide some of the beneficial effects of riparian zones by intercepting and transforming nutrients and contaminants. Ecologically, the ponds provide habitat diversity and may partly replace diminished wetland inventories, but many are in areas that lacked natural water bodies and thus can serve as homes or pathways for non-native pest or invasive species.

Kansas straddles the North American transition from very high pond densities in the east to much lower densities in the west,[1] and thus provides an ideal mesocosm in which to explore issues of pond detection, inventory, histories, and hydrologic and biogeochemical effects at the landscape scale. A multi-institutional interdisciplinary project[2] is applying a combination of remote sensing, field characterization, and modeling studies to calibrate satellite observations (Landsat TM and ASTER) with multispectral and conventional aerial photography, and to evaluate the potential application of results to a wide range of water resource and environmental studies. Case study efforts focus on Jefferson and Lyon counties, with detailed investigation of the Midland and Allen SE quadrangles.

Results confirm the under-reporting of ponds in available data sources and show similarly high densities in both the Midland (9.3/mi2; 3.5/km$^{2)}$ and Allen SE (8.6/mi2; 3.2/km^2) quads, but historical air photos dating back to the 1940s indicate very different temporal patterns of development in the two case study areas. Spectral analysis of satellite and camera images indicates that the tools are capable of identifying a wide range of pond water quality and ecological conditions, and initial watershed spatial model analyses are being used to test and refine earlier, more general results or assumptions about the effects of ponds on the net evaporation budget, filtration effectiveness for sediment retention, and relationships between pond numbers and types and land use. The presentation will illustrate the results being obtained and their potential importance to water resource and environmental quality issues.

[1]Smith, S. V., Renwick, W. H., Bartley, J. D., and Buddemeier, R. W. 2002. Distribution and significance of small, artificial water bodies across the United States landscape. The Science of the Total Environment 299:21-36.

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