NATIONAL CONSORTIUM FOR REMOTE SENSING EDUCATION, RESEARCH, AND APPLICATIONS

KansasView
PROJECT FACT SHEET

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A Comparison of Pond Inventories Using Satellite and Airborne Sensors

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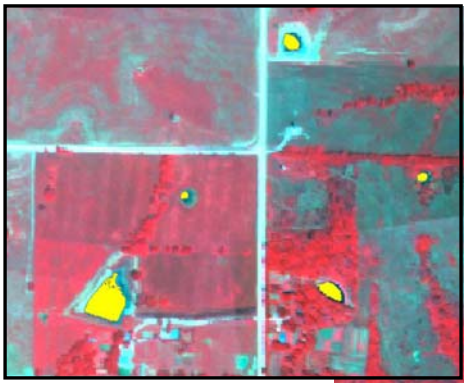
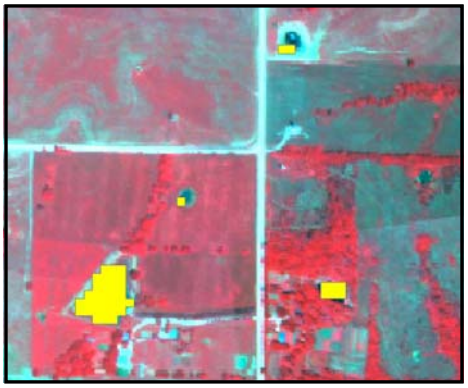
Artificial ponds exist throughout the Kansas landscape, far outnumbering natural water bodies, and therefore play a substantial role in modifying the environment. For example, they trap sediment, thereby affecting biogeochemical cycles, they provide habitat diversity, and they also provide a partial counterbalance to lost wetlands. For a number of reasons, including their small size, their location primarily on private property, and variation in their numbers and locations over time, small artificial ponds are often underrepresented on the digital map products and databases normally used for hydrologic analyses that are created using satellite imagery. An assessment of how many ponds exist in the landscape and their total surface area is being calculated to help determine the impact they have in modifying the environment

Use of Remote Sensing

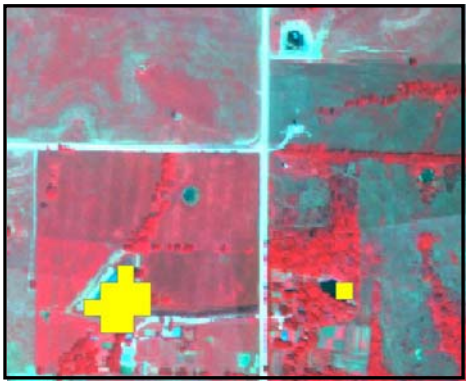
To address the issue of the underestimation of ponds, images from three different satellite and airborne sensors were used to see how accurately they could locate and inventory ponds in a study area in eastern Kansas. DuncanTech 1 meter aerial photography was used to map all impounded water bodies in addition to calculating total surface area - it served as the ground truth for comparison to the satellite imagery. Terra ASTER imagery, with 15 meter spatial resolution, was then used to map and estimate total surface area of all water bodies in the same area using digital image analysis techniques and compared back to the inventory created using 1 meter aerial photography. In the same manner, Landsat Enhanced Thematic Mapper (ETM+) multispectral imagery, with 30 meter spatial resolution, was used to map all water bodies using the same methods. ASTER imagery mapped 93% of the total water bodies, while ETM+ mapped 60% of the total water bodies. Interestingly, the surface area was overestimated by both ETM+ and ASTER, most likely due to the larger pixel sizes of the sensors.



a. DuncanTech: 1 meter



b. ASTER: 15 meters



c. Landsat: 30 meters

Highlighted in yellow are water bodies mapped using each image type. (a) DuncanTech, with 1 meter spatial resolution, served as the ground truth and mapped 97 ponds in the subset area in eastern Kansas. (b) ASTER, with 15 meter spatial resolution, recorded 83 ponds; and (c) Landsat ETM+, with 30 meter spatial resolution, mapped 58 ponds.

	Number of Ponds	Surface Area
ETM+	58	231,425 m^2
ASTER	83	201,994 m^2
Duncan Tech	97	179,889 m^2

Benefits

Our objective was to determine by how much we underestimate the number of ponds in the Kansas landscape using satellite imagery. Due to cost and time considerations it is generally impractical to manually map small ponds from detailed imagery. Remote sensing techniques provide an avenue for mapping and thereby creating a state inventory of water bodies quickly and cost-effectively. However, ETM+ and ASTER imagery do not offer the detailed spatial resolution 1 meter aerial photography offers; this pilot project allowed us to reasonably estimate the number and size of water bodies that are being omitted and therefore to calibrate our estimates of the total number of water bodies.

Kansas Geological Survey

KARS Kansas Applied Remote Sensing Program

EMPORIA STATE UNIVERSITY

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