The Effects of Agricultural Runoff on the Kansas River Water Quality

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Introduction

The Kansas River is an important part of northeast Kansas' agricultural infrastructure and provides drinking water to a significant portion of the state's populace. Surrounding this crucial water source are vast expanses of cropland predominantly dedicated to the growing of corn and soybeans. These crops pull water directly from the river and are subjected to various chemical applications, including fertilizers, pesticides, and herbicides. These chemical inputs contain substantial amounts of nitrogen and phosphorus, which strongly influence nearby ecosystems. The overall effect of these agricultural practices on the river's ecosystem is highlighted by the clear link between nearby crop production and changes in water quality, primarily due to nutrient-rich runoff. This prompts investigation into how surrounding land use and landcover affect water quality and the extent of nutrient runoff's influence.

Objective

Our study aims to evaluate the impact of agricultural runoff on the ecological integrity of aquatic systems, with a specific focus on the Kansas River. It also provides insight into the relationship between agricultural practices and aquatic ecosystem health.

Methodology

Using data collected from the USGS and USDA and utilizing Esri ArcGIS Pro we compared land use and land change and what is applied, to water quality samples from the Kansas River to assess the potential correlations and dangers of surface agriculture runoff.

Results

The land surrounding our areas of study was a mix of cropland and urbanized communities. Total cropland across the ten counties showed marginal variation from 2013 to 2021, with the exception being Wyandotte County which experienced a 6.36% reduction in total cropland. Conversely, Jefferson County demonstrated the largest increase in cropland, with a 1.45% change within the same timeframe..

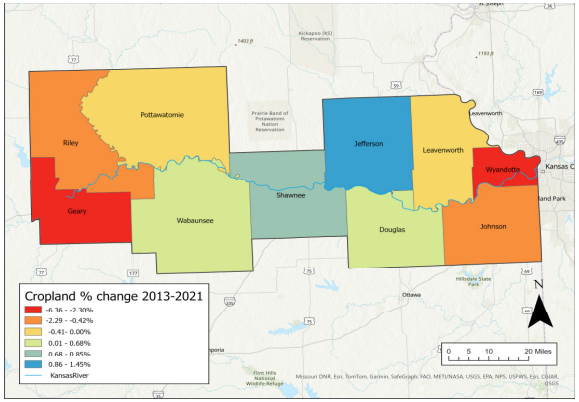

Figure 1:Cropland percentage changes from 2013-2021.

With soybeans as the main crop grown in the ten counties, we found that phosphorus was applied more compared to nitrogen since soybeans have nitrogen fixating bacteria. Other field crops such as corn, wheat, and sorghum can require at least 30lbs N and can use up to 300lbs N depending on cropland size. Nitrogen based fertilizers such as urea, ammonium nitrate and anhydrous ammonia were found commonly used as they provide necessary macronutrient levels for those crops. The water quality data was not significate in comparison from 2013 to 2022, however, 2019 was notably different (see Figure 2). Nitrogen levels in the Kansas River near DeSoto, KS increased by 27% from 2016 to 2019 and decreased by 40% from 2019 to 2022.At the Wamego, KS phosphorus increased by 11% from 2016 to 2019 then decreased by 14.2% from 2019 to 2022 .

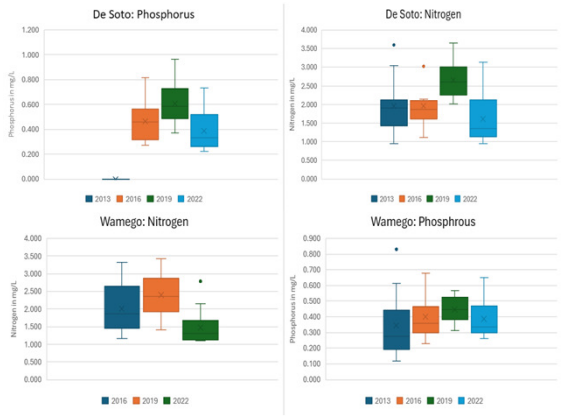

Figure 2: Instantaneous nitrogen and phosphorus taken from the Kansas River demonstrating the fluctuations over 10-years.

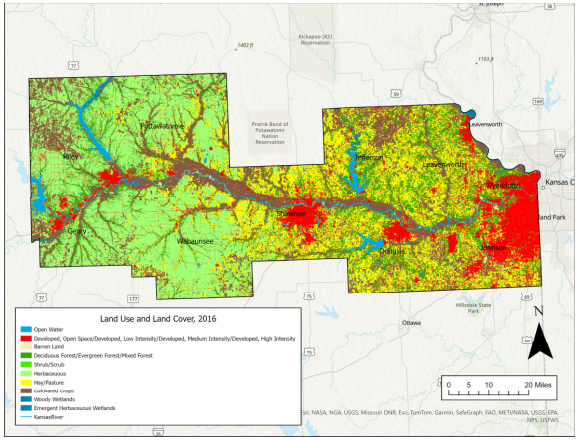

Figure 3: *Land Use and Land Cover for area of study.*

Discussion

1. Land Use and land cover change was insignificant.
2. Agricultural practices contribute as herbicide and fertilizer application rates for cropland vary.
3. Increase in precipitation was a contributing factor