The effect of land use, socioeconomics, and racial demographics on water quality of Deer Creek in Saint Louis, Missouri

Sequence: 1018

Introduction

Streams are critical to urban environments because they reduce contamination of areas exposed to humans and wildlife, provide habitats for many types of wildlife, and improve humans' quality of life. However, disruptive land use and urban development impact water quality, as well as racism and classism, for governments are more likely to build harmful factories and less likely to restore streams in neighborhoods that are less privileged. Thus, contaminated streams disproportionately affect the health of people of color and those living in poverty. In this experiment, three different locations in Saint Louis, Missouri were examined, all of which are a part of Deer Creek. For each of the three sites, the following parameters were tested: dissolved oxygen, nitrates, coliform microbes (indicative of sewage), and pollution. The hypothesis was that Rock Hill would have the worst water quality due to its proximity to a busy road and school and less privileged populations and that Ladue would have the best water quality considering its demographics are opposite those of Rock Hill.

Sites

Maplewood: 9% people of color; $91k median income; secluded in short trails and trees, near a park in a residential area.
Rock Hill: 39% people of color; $72k median income; near a school and busy road, lots of human traffic.
Ladue: 14% people of color; $132k median income; most secluded site in green space and trees in a residential area.
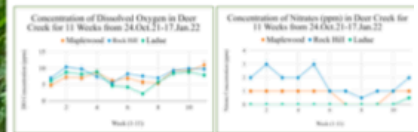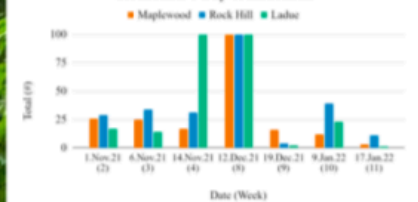
Methods

For 11 weeks from 24.Oct.21-17.Jan.22, data was recorded for each of the sites. LaMotte dissolved oxygen iodometric titration, nitrate, and coliform microbe test kits were used, and pH and salinity were also measured. The self-contained coliform BioPaddles were incubated for about 31 hours and data was recorded via photo to dispose of them quickly with bleach. The presence of pollution at each site was also recorded. Gloves and goggles were worn at all times in the presence of creek water, chemicals, and microbes.

Racial demographics in 2021 by percent (STL EcoUrban Assessment)

Socioeconomic demographics in 2021 by median income (STL EcoUrban Assessment)

Racial and socioeconomic demographics (layered) of Saint Louis

Do socioeconomic and racial demographics affect water quality?

Central picture: Maplewood site 18.Sep.21

Map of Deer Creek watershed and collection sites

Construction to improve Deer Creek quality near Maplewood site 17.Jan.22

Data

Total Number of Coliform Colonies on BioPaddles from Deer Creek After 1 Day of Incubation

Average DO concentration
Maplewood: 7.4 ppm
Rock Hill: 8.4 ppm
Ladue: 6.7 ppm

Average nitrate concentration
Maplewood: 0.7 ppm
Rock Hill: 1.7 ppm
Ladue: 0.0 ppm

Data Analysis

Accounting for 10% error, the difference between Ladue and Rock Hill's DO concentrations were statistically significant. Therefore, the data indicates that Rock Hill provides the best conditions in terms of dissolved oxygen for degrading harmful pollutants and is closest to the ideal 8 ppm. Nitrate concentration showed similar data to DO concentration. However, out of the seven weeks of coliform data, Rock Hill usually had the most microbe colonies. Because coliform microbes can cause serious illness in humans and indicates the presence of human and animal waste, this is perhaps the most important data point and provides evidence that Rock Hill's water is the most harmful. Rock Hill also had the most pollution and Ladue had the least.

Discussion

The coliform microbes data and pollution support the hypothesis that Rock Hill would have the worst water quality; though there were statistically significant differences in dissolved oxygen and nitrate concentrations, they were still rather small and all fell within the range of healthy conditions. However, the combination of land use and racial and socioeconomic demographics makes it difficult to discern the reasoning behind the differences in water quality, particularly when it comes to coliform microbes and pollution. It is impossible to entirely separate the different sites' conditions, but it is likely that this had the greatest impact on water quality. It would be interesting to observe water quality over time, in different neighborhoods, and the presence of microplastics. This project was just beginning to examine environmental injustice regarding water quality in Saint Louis, and many more studies are needed using different parameters, sites, and neighborhoods.