How do humans influence water quality in streams?

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Introduction

Over one third of rivers in the United States are considered polluted, and surface runoff is a key contributor to this. Every day, substances enter streams due to human activities. Some examples include pesticides, fertilizers, road salt, mine drainage, and even organic matter. Urban areas can have a larger effect on the amount of pollution entering a stream simply because there are more people living in an area compared with rural areas. Fertilizers provide nutrients for algal blooms to form within streams or lakes, which can decrease the amount of oxygen in a stream significantly. Large amounts of salt in streams are toxic to aquatic life. Higher amounts of iron from mine drainage are also toxic to fish and plants in streams. The examples demonstrate how humans impact streams, and how much needs to be done to address these problems.

Methods

To analyze the water quality in streams with an urban area and a rural area, two streams were selected: Crooked Creek which travels through farmland, and Mahoning Creek which comes out of a populated town. These two streams are located where the same storms will hit, so the amount of rainfall in the two areas should be similar. Data was collected from the National Water Information System found on the United State Geological Survey website. The data gathered wasn't complete. There were missing pieces of measurements not collected which cause a few pieces that were measured to be cut off, therefore limiting the length of time the graph shows. Fortunately, it seems that there aren't important pieces that were cut out that would change the appearance of the graphs.

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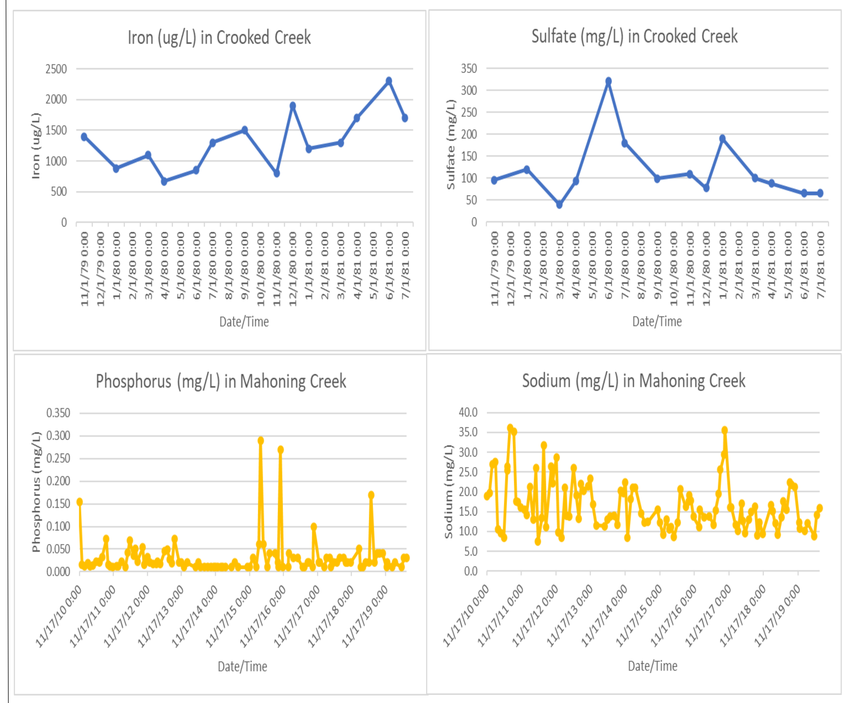
Results



(A) Crooked Creek in Idaho, PA aerial imagery. (B) Crooked Creek base map. (C) Mahoning Creek in Punxsutawney, PA aerial imagery. (D) Mahoning Creek base map.

Discussion and Conclusion

The graphs show changes in iron and sulfate in Crooked Creek from November 1979 to July 1981, and changes in sodium and phosphorus levels in Mahoning Creek from November 2010 to November 2019. Both graphs of each creek show peaks in the same time frame which corresponds to a rain event which increased the amount of runoff in the areas resulting in a spike of the substances measured. Iron is a common metal found in streams and it is often because of groundwater being pumped or drained from mines. Sulfate in water can come from agricultural chemicals such as fertilizers, pesticides, and herbicides. One of the main reason sodium is in streams is because of road salt used in the winter that slowly makes its way into the waters. Phosphorus can enter a stream various ways. Some include organic waste, fertilizers, and industrial effluent. The maps below the graphs show the overhead pictures of the landscape of the streams. In Crooked Creek, it can be seen that it will be plagued more by agricultural practices. On the other hand, Mahoning Creek has a town at the top right of the picture, so it will be receiving runoff from impervious surfaces and water potentially contaminated by industry. From this study, further work needs to be done to find a relation between the two differently located streams. The data suggests that there could be a significance between sulfate and phosphorus since they both come from fertilizer, and it is much lower in the urban stream than in the rural stream.

References

Lintern, A.; Webb, J. A.; Ryu, D.; Liu, S.; Bende-Michl, U.; Waters, D.; Leahy, P.; Wilson, P.; Western, A. W. Key Factors Influencing Differences in Stream Water Quality across Space. Wiley Interdiscip. Rev.: Water 2018, 5 (1), No. e1260

"Water Research Center - Metals in Surfacewater Watershed Projects.' www.water-research.net/index.php/metals-in-the-environment.

"Sulfate in Water - EH: Minnesota Department of Health." www.health.state.mn.us/communities/environment/water/wells/waterquality/sulfate.html.

USGS. "Phosphorus and Water." Usgs.gov, 2011, www.usgs.gov/special-topic/water-science-school/science/phosphorus-and-water?qt-science_center_objects=0#qt-science_center_objects.