The Effects of Road Salt on the Waterways of the Bee Branch

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Abstract

Road salt has a negative effect on bodies of water all around the United States. To see how road salt affects the water in Dubuque's Bee Branch, a study was done by collecting water samples and testing the chloride and salinity/conductivity levels in three points along the Bee Branch. It was discovered that during this winter, the salinity and chloride levels did not change a lot. They increased as the snow melted but did not reach any dangerous levels.

Research Question

Asking Questions

Does melting snow and ice lead to a higher level of salt and chloride in the Bee Branch waterways? This is an important question because levels of salt and chloride that reach too high have a negative effect on the environment and organisms that live in it.

Introduction

In the local Dubuque area, multiple waterways flow through, including the Mississippi River. Heavy use of road salt in the winter negatively impacts the environment due to the increase in salt and chloride in the mixtures used on the roads. This reduces life in water and soil. Not taking action on this issue will leave aquatic life and their environment at dangerous salt and chloride levels along with low oxygen levels. In 40% of urban streams, there are chloride levels that exceed a safe amount (800 ppm) for aquatic animals. This decreases the survival rate for these species and may allow invasive species to take over should they have a chloride tolerance (Stromberg, 2014). Not only does this affect species in the water, but also above the surface. When salt and chloride levels reach too high, soil may become less fertile and more dense. This could lead to a decrease in plant growth and an increase in runoff (MPCA, 2017). Excess levels not only kill trees and shrubs, but also create something new. Salt crystals have formed on the side of roads, attracting deer and causing accidents, which indirectly affects another population (Stromberg, 2014). To battle these issues, some cities are using new methods such as beet juice or running hot water through pipes under roads (Valleau, 2017). None of these new methods are perfect, but they are all steps in the right direction. Getting people involved and working on a solution is the first step. If the negative effect on the environment is not enough to concern people, it might help if they know that this will also affect their drinking water by raising it above safe drinking levels (Valleau, 2017). With this in mind, any research or ideas to combat this issue are an opportunity to improve the way that we treat the environment. The best way to improve at this point is to research and find ways to better live our lives.

In correspondence with this research, a study was done on the Bee Branch waterways to determine the effect of road salt on the water. By testing chloride and conductivity, the quality of the water was determined due to the runoff into the watershed.

Research Methods

Planning Investigations

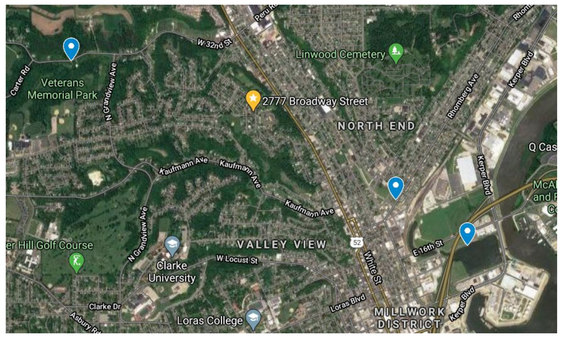
The testing site on 32nd Street (top left corner) is right off of the road. It is in a woody area with houses spread out on either side of the pavement. Snow plows drive on a gravel road above the stream. Snow piles are kept nearby in the winter. The Upper Bee Branch (middle map location) is in the middle of downtown Dubuque. It falls under a bridge on Rhomberg and Lincoln. There are residences nearby along with a sidewalk that follows the path of the water. The final location at the Lower Bee Branch (lower right corner) is on 16th Street. These samples were taken from a pond next to a gas station and a busy street. There is an outcrop into the pond with vegetation around it.

GLOBE Data Used

While gathering the data for this project, the same locations were utilized throughout the data collection period. GLOBE was used to record the locations for each place and give information about what each location looks like and how the local environment could affect it. The data was collected using the same, calibrated equipment. This data was then used to compare each location and time the data was taken to determine if the melting period affected the conductivity of the water.

Carrying Out Investigations

To gather the samples needed for the tests, water was taken in containers from each of the three locations back to the school to be tested. The three locations were chosen based on where they fall in the Bee Branch and how easy it was to get to the water from the bank. A sample was taken at the beginning of the Bee Branch, and the end, and in the middle. This covered each area fairly well. The testing site on 32nd Street falls next to a dumping area for snow plows. The Lower Bee Branch is at a pond near the end and the Upper Bee Branch flows through a highly residential area. These samples were taken after days of warmer weather caused snow and ice to melt, or after a rainstorm when the water washed the salt into waterways. There ended up being four main times between January 28th and March 10th that samples were taken from the testing sites. The time of day was not important for the conductivity tests, so that was not decided ahead of time. Once the samples were back at the school, the conductivity was tested, by using a conductivity probe and recorded in a data table.



Results

Analyzing Data

The data was taken during the winter after a decent amount of melt occured. This was done so that it could be determined whether or not the salt on the roads had a large negative impact on the water in the Bee Branch. After the data was collected, it was placed in a bar graph to easily see differences in conductivity levels in each testing site. It was decided to put each location as its own set of data to easily determine the level changes right next to each other instead of organizing them by the date they were taken.

Table 1: Changes in Conductivity Throughout the Bee Branch Stream in Dubuque, IA during Winter Snow Melt

	Conductivity (ppm)							
Location	**1/28/20**		**2/16/20**		**3/3/20**		**3/10/20**	
Upper Bee Branch	230	1970	1150	1300	1020	1030	930	930
Lower Bee Branch	430	430	260	260	320	330	870	890
32nd Street	1080	1080	990	970	800	800	900	1060

Figure 1: Changes in Conductivity Throughout the Bee Branch Stream in Dubuque, IA during Winter Snow Melt

The first test on 1/28/20 was during a cold period where nothing was melting so conductivity was low. On 2/16/20, there were a couple of warmer days that caused some runoff before it froze again. The third sample, taken on 3/3/20, dropped in all locations due to a colder spout of weather. There was a lot of rain and warm weather during the days before the fourth and final sample was taken on 3/10/20. This caused a lot of runoff to occur and an increase in conductivity levels.

Discussion

Interpreting Data

After the tests were completed, it was found that the conductivity did not rise drastically through the testing times in all of the areas tested. The conductivity levels rose in two out of the three testing sites. This means that there could have been more runoff in those two areas when compared to the third. The increases in conductivity were found at the upper and lower branches. Both of those locations are closer to traffic and are of easier access to people. The 32nd Street location is a place where snow is dumped during the winter. This is interesting since that location had a decrease in conductivity levels. This does not fully support the hypothesis. Although there were increases in most places, there were also decreases throughout the allotted time. Since the piles of snow were bigger and the warm weather was not as frequent, this could have decreased the amount of salt that entered the water. Slower runoff takes less soil off and this could be the case with the salt. This experiment could only be done to a certain extent due to limitations of a classroom and the allotted time. There was not enough time to make an in-depth plan for deciding when to take samples and gather more data before the experiment. When taking the samples, it could have been done in a more uniform manner by being taken the same amount of time after a warm day or on days specified ahead of time.

Conclusions

Drawing Conclusions & Next Steps

The data for this research experiment was done within a 2 month period. To see more accurate and effective data, tests could be taken all year around to be able to determine the real effect that road salt has on the conductivity of the Bee Branch waterways. This will enable you to see the levels at different times of the year and perhaps be able to determine what else could affect the levels. There is no definite data that shows the road salt had a large negative effect on the waterways of the Bee Branch. There were increases in levels throughout the testing period, but none were high enough to make a huge difference. This could lead to further tests being done to determine if other areas are affected more intensely than the three chosen test sites. Being able to work on this research project has enabled a further understanding of the work that goes into determining how humans impact the earth and what can be done about it. Being guided in a way that allows personal growth and understanding allows for knowledge to be gained and used for the improvement of the earth.

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