Stormwater Pollution as a function of Increasing Urbanization

Midterm Project Proposal and Outline

By Jason Curtis

# Topic – The effect of Changing Urbanization on the surrounding environment

As cities and towns expand, they necessarily have an impact on the environment. Everything from the physical use of the land to the transport of materials has some impact on the environment at some level of significance. Urbanizing land whether for commercial, residential, or other use changes the environmental niche that that land fills in complex and unpredictable ways. Analysis of this land is critical for the development of both reactionary and preventative plans to ensure that urbanization is carefully considered and environmental impact is minimized.

Investigating the relationship between these complex networks is a significant challenge that requires the synthesis of several datasets related to a variety of factors. Given that investigating the whole perspective would be a project of years for an government agency, I have decided to narrow my focus significantly and focus on a portion of a single watershed over a relatively small timescale. This will limit the topic in scope, complexity, and focus such that it should be manageable within the remainder of the semester.

# Data

Investigation of this topic requires a broad array of datasets. The following areas will be investigated in the first stage of this project to gather more information about the geographical construction of the area in question and how best to narrow the focus to a manageably small yet impactful region:

1. Land Use
   1. Understand the distribution of land use from 1999-2016 to determine patterns of increasing urban development
2. Stormwater Infrastructure
   1. investigate the development of stormwater infrastructure in the watershed to investigate the relationship between increased stormwater infrastructure, increased urbanization, and mitigation of stormwater pollution
3. Water Quality
   1. Investigate the quality of stormwater runoff and identify relevant pollutants in the water quality of the river to determine the change in water quality over the period of interest
4. Meteorological Data
   1. Analyze precipitation patterns and effects on stormwater runoff
5. Topographic and Hydrological Data
   1. Understand the physical characteristics of the watershed and how they interact with urbanization

By synthesizing datasets in the following areas I can create useful views for analysis of a region within the greater watershed and how its urbanization over the period of roughly two decades. Datasets will be taken from a number of sources and map layers including:

1. MassGIS Bureau of Geographical Information
2. New Hampshire Department of Environmental Services
3. EPA Watershed Assessment, Tracking & Environmental Results System (WATERS)
4. United States Geological Survey
5. National Ocean and Atmospheric Administration
6. New Hampshire Geographically Referenced Analysis and Information Transfer System (GRANIT)

# Research Question

Using some initial exploration of datasets as well as general knowledge about the area, I have generated the following research question:

1. How has increasing urbanization in the Merrimack River watershed affected the quality of stormwater runoff over the past 5 decades?

The Merrimack River watershed is heavily involved in the function of large portions of New England and is a critical structure for the protection of a number of urbanized areas. I believe the southern portion of the watershed closest to the mouth of the river will be useful for investigation due to the increased development of the greater Boston area. Additionally, this region should provide interesting trends and insights into seasonal changes in the pollution levels as well as into changing and increasingly chaotic weather patterns. The combination of increasing urbanization with changing atmospheric weather patterns should provide information about the resilience and efficacy of the watershed.

# Preliminary Analysis Strategy

For preliminary analysis I plan to modify gathered datasets into several map views to cover a southern portion of the watershed. Land use will be the first target of analysis to see what development has happened between 2000 and the present day focused on the region of interest within the Merrimack River watershed. Additionally, I will investigate the characteristics of the watershed to identify any areas of heightened load or particular influence on the character of the water.

Once initial investigation is done I intend to analyze trends in the change of water quality over the same period. This will help determine if there is any correlation between changes in land use and the overall health of the watershed.

Additionally I would like to investigate the relationship between change in land use and instances of sewer outfalls in the region of interest to find any relationships between the occurrences of sewer load and stormwater quality and the role changing weather patterns play in this complex relationship.

# Conclusion

With the proposed plan above I hope to be able to show a meaningful relationship between increasing urbanization, changing weather patterns, stormwater quality, and the health of the Merrimack River watershed. This will provide important insights for making plans to better protect the watershed and ensure its longevity as an important piece of environmental protection in New England.