

Effects of Urbanization on Microbial Abundance and Diversity in Prince Edward County



Prince Edward County



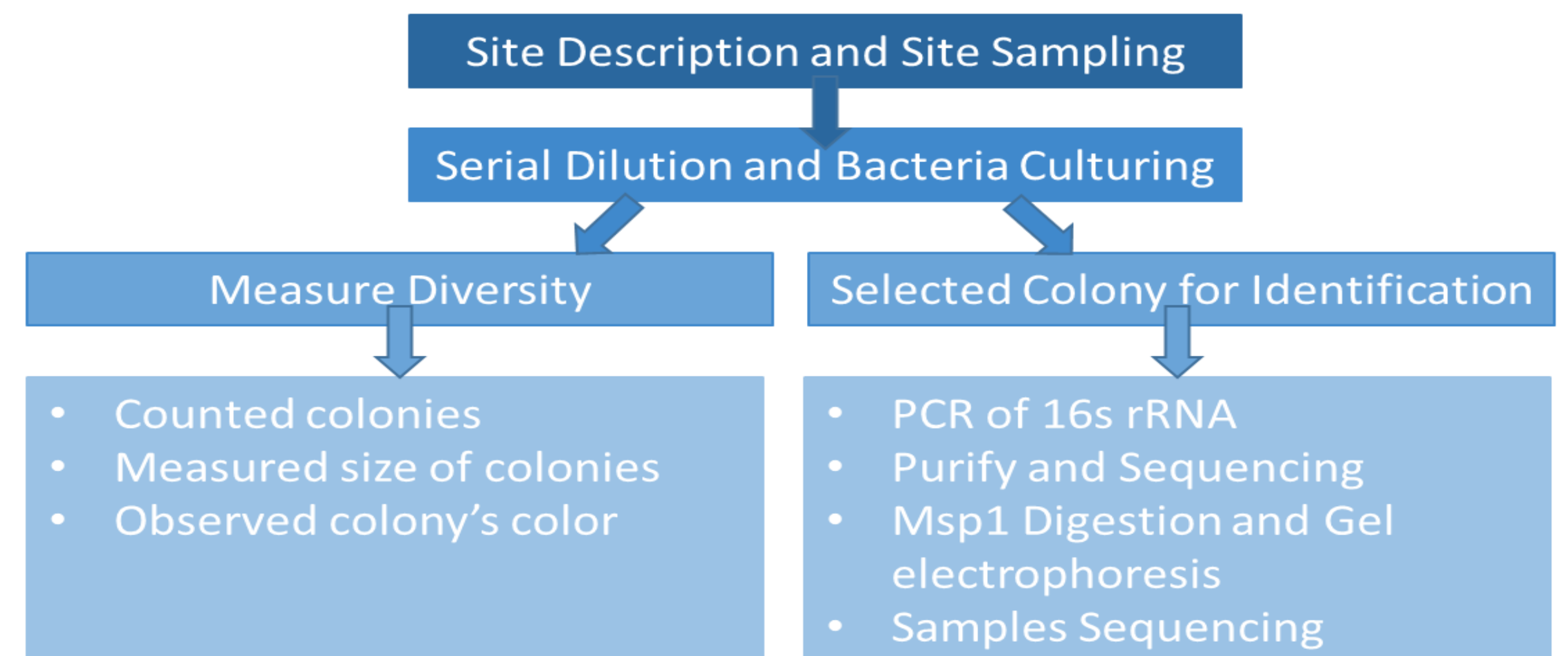
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Biology 250: Introduction to Genetics and Cell Biology
Longwood University

Introduction

- Microbial diversity: the number of different bacterial species at a specific site
- One study found that human interference directly correlates to microbial diversity negatively (Hosen et al. 2017).
- Urban-influenced waterways contained a considerably larger shift (increase) in the microbial diversity richness than the low- to un-impacted waters of Lake Michigan (Newton and McLellan 2015).
- Urbanization is known to have negative impacts on the biological ecosystems that are in close proximity, and that remains true for the aquatic ecosystems as well (Hosen et al. 2017).
- Results from a study conducted in 2011 suggested that urbanization causes an increase in hydrologic disturbance, water temperatures, and contaminants.
 - These can influence the microbial composition. The change in composition has the potential to be harmful to other functional systems such as nitrification (Wang et al. 2011).

Methods



Specific Aim

- **Research Question:** The goal of this project was to discover whether urbanized or un-urbanized bodies of water were more diverse and abundant in the bacteria that inhabit it and identify bacterial genus species.
- **Hypothesis:** The retention pond will contain more microbial diversity than the flowing water of Buffalo Creek because of its urbanized water from run off.

Results

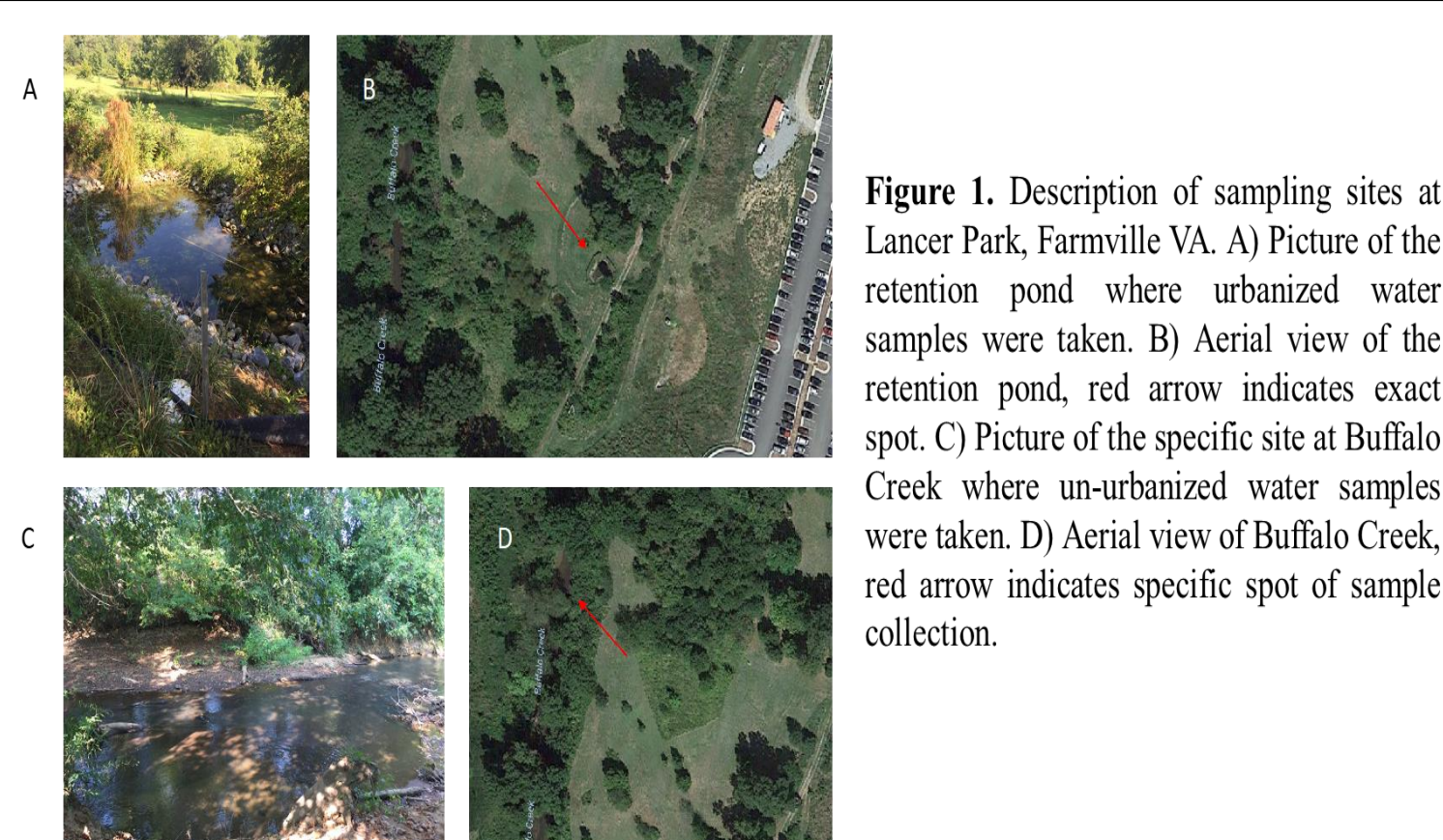


Figure 1. Description of sampling sites at Lancer Park, Farmville VA. A) Picture of the retention pond where urbanized water samples were taken. B) Aerial view of the retention pond, red arrow indicates exact spot. C) Picture of the specific site at Buffalo Creek where un-urbanized water samples were taken. D) Aerial view of Buffalo Creek, red arrow indicates specific spot of sample collection.

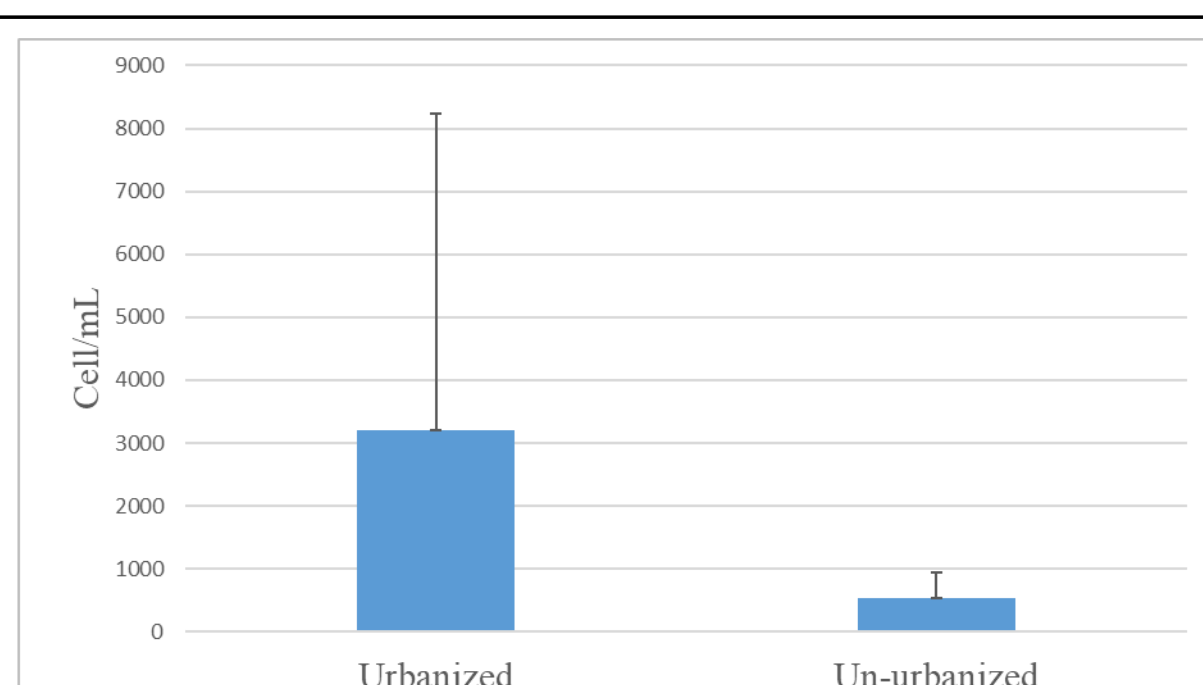


Figure 2. Bacterial abundance from water samples at retention pond (urbanized) and Buffalo Creek (un-urbanized). Averages were taken from the cell/mL data for retention pond and Buffalo Creek.

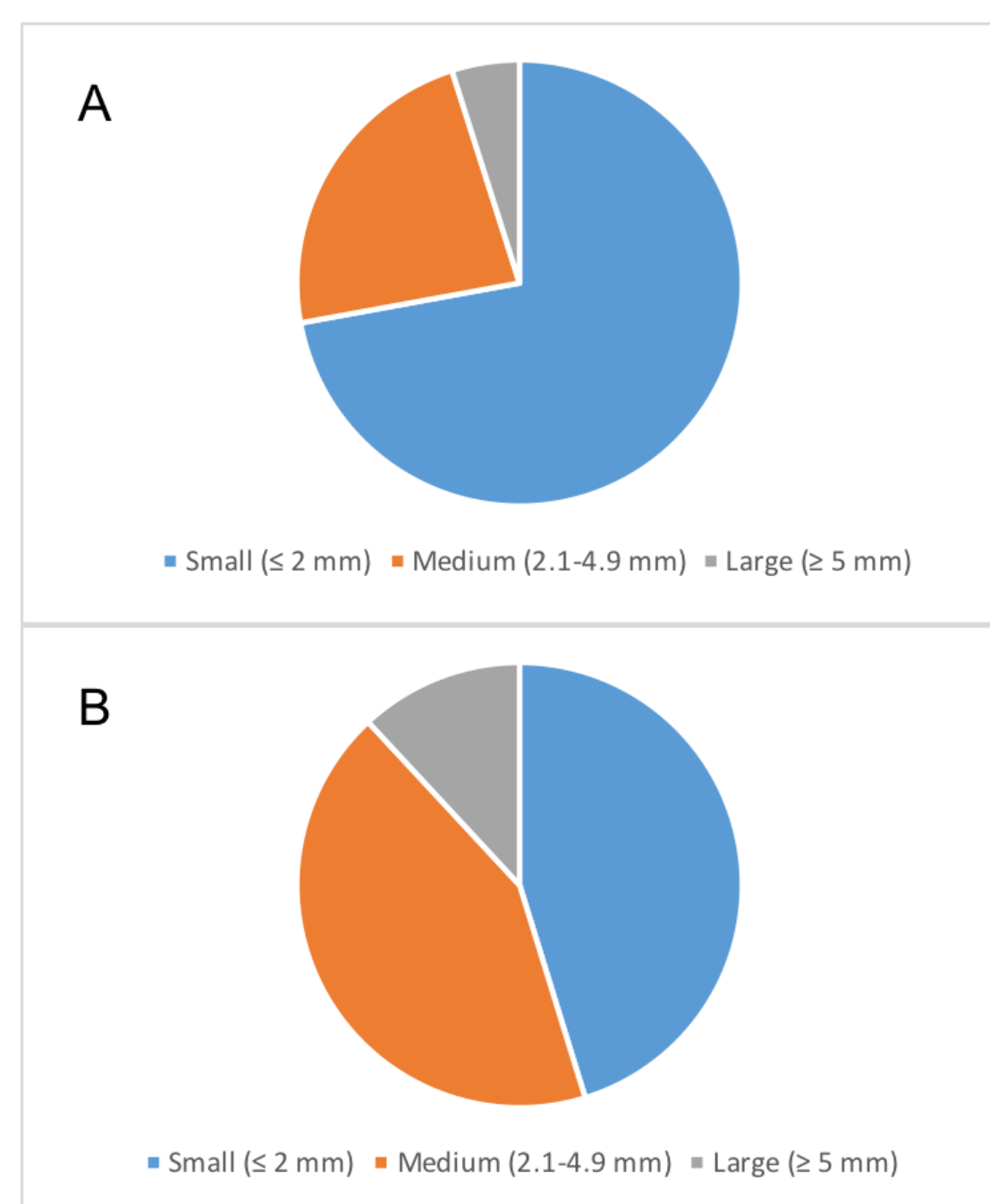


Figure 3. Diversity of bacterial colonies shown by size. (A) Different sizes of the colonies from retention pond. (B) Different sizes of the colonies from Buffalo Creek.

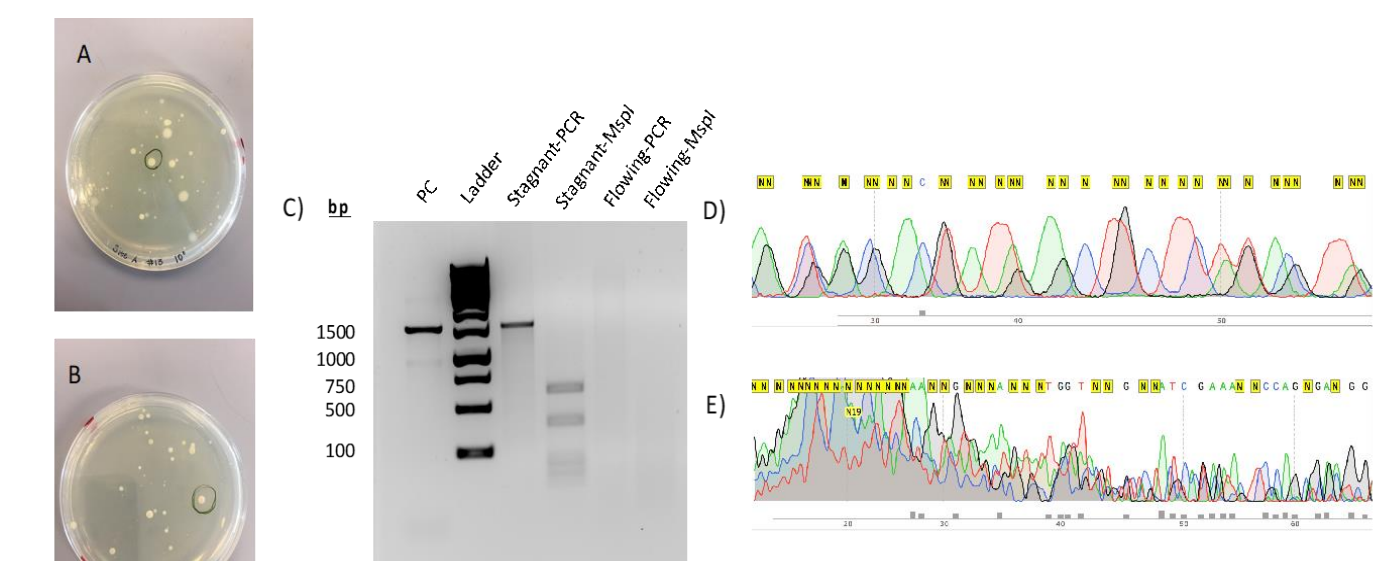


Figure 5. A) Pictures of colonies selected for identification. Colony chosen from retention pond (urbanized). B) Colony chosen from Buffalo Creek (un-urbanized). C) Gel electrophoresis of 16s rRNA PCR product and MspI digestion. The base pair (bp) size of the bands are listed down the side of the image. PC stands for positive control. Results from retention pond (urbanized) and Buffalo Creek (un-urbanized) are shown in lanes 2-4. D) Chromatogram results from DNA sequencing. Displays DNA sequence for microbial colony obtained from urbanized water. E) Displays DNA sequence for microbial colony obtained from un-urbanized water.

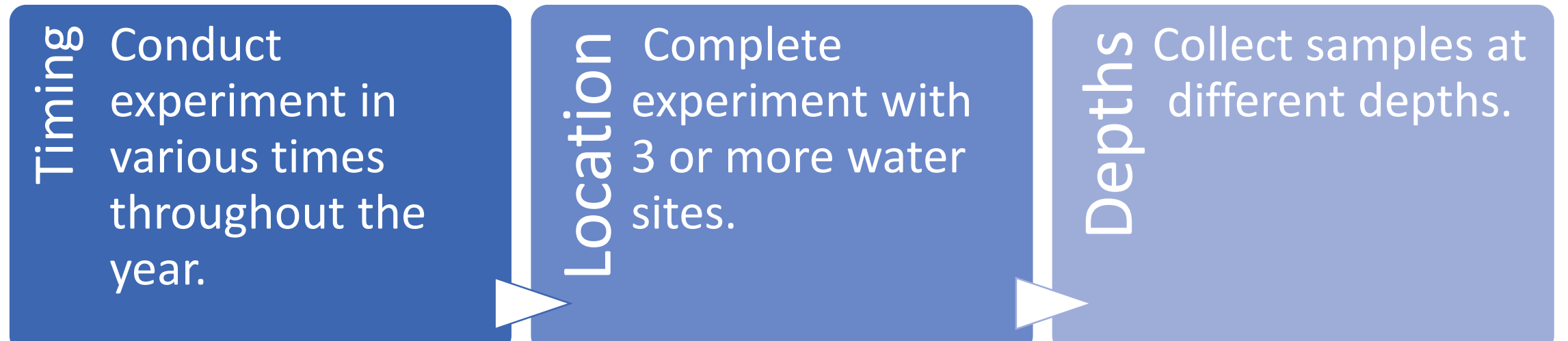
	ng/ μ L	260/280
Urbanized	18.3	2.07
Un-urbanized	9.9	2.04

Table 2. Nanodrop results for urbanized and un-urbanized water samples.

Conclusions

- Hypothesis was rejected because Buffalo Creek produced more microbial diversity than the retention pond.
- Retention pond contained more microbial colonies than Buffalo Creek.
- Uninterpretable data resulted in the inability to identify a bacterial genus species.
 - Due to human error:
 - Accidental selection of two colonies for identification
 - Accidental selection of a yeast colony

Future Directions



References

- Hosen, J.D., Febria, C. M., Crump, B.C. and Palmer, M.A. 2017. Watershed urbanization linked to differences in stream bacterial community composition. *Frontiers in Microbiology*, 8:1452.
- Newton, R.J. and McLellan, S.L. 2015. A unique assemblage of cosmopolitan freshwater bacteria and higher community diversity differentiate an urbanized estuary from oligotrophic Lake Michigan. *Frontiers in Microbiology*, 6:1028.
- Wang, S-Y., Sudduth, E.B., Wallenstein, M.D., Wright, J.P. and Bernhardt, E.S. 2011. Watershed urbanization alters the composition and function of stream bacterial communities. *PLoS ONE*, 6(8): e22972.