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Microbial Diversity of Rural and Urban Soil at Different Depths on Longwood University's Campus

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Background

- Microbial diversity is the study of the variety of microorganisms across a gradient of stress, disturbance, or other biotic or abiotic differences.⁴
- Urban development is one of the leading causes of biodiversity change altering bacteria colonies¹
- Microorganisms in soil are critical to the maintenance of soil function in both disturbed and undisturbed soils²

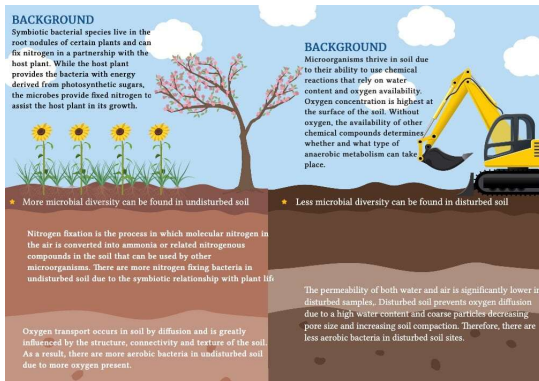


Figure 1: Difference between disturbed and undisturbed soils⁵

Specific Aim

- The aim of the experiment is to determine the complex diversity of bacteria among soil samples at two locations, Main Street and Lancer Park, on Longwood University's Campus.
- We hypothesized that the urban soil would have more microbial diversity than the rural soil.



Figure 2: Sample collection site on Main Street

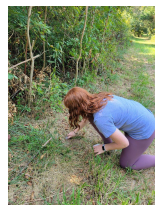
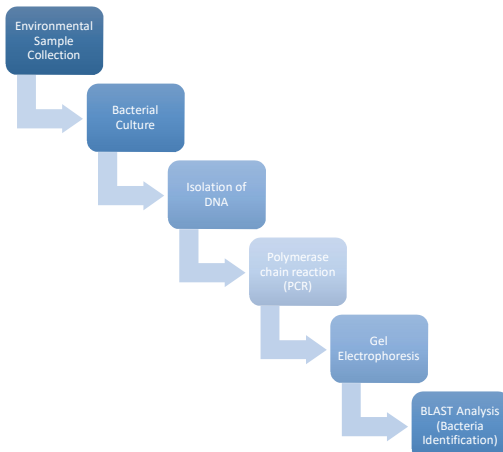


Figure 3: Sample collection site at Lancer Park

Methods



References

1. Chen Y, Martinez A, Cleaver S, Rudolph J, Barberán A. Changes in SOIL microbial communities across an Urbanization Gradient: A LOCAL-SCALE TEMPORAL study in the Arid SOUTHWESTERN USA. MDP. 2021 Jul 9 [accessed 2021 Sep 8]. <https://www.mdpi.com/2076-2607/9/7/1470/html>
2. Garbeva P, van Veen JA, van Elsas JD. Microbial diversity in soil: Selection of microbial populations by plant and soil type and implications for disease suppressiveness. Annual Review of Phytopathology. 2004;42(1):243-270. doi:10.1146/annurev.phyto.42.012604.135455
3. Hu Y, Dou X, Li J, Li F. Impervious surfaces Alter Soil bacterial communities in urban Areas: A case study in Beijing, China. Frontiers in microbiology. 2018 Feb 27 [accessed 2021 Sep 8]. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5839015/>
4. Kirk, J. L., Beaudette, L. A., Hart, M., Moutoglis, P., Klironomos, J. N., Lee, H., & Trevors, J. T. (2004, June 15). *Methods of studying soil microbial diversity*. Journal of Microbiological Methods. Retrieved November 1, 2021, from <https://www.sciencedirect.com/science/article/abs/pii/S0167701204000983>.
5. Undisturbed vs. Disturbed: Soil Microbial Diversity | CURE (brown.edu)

Results

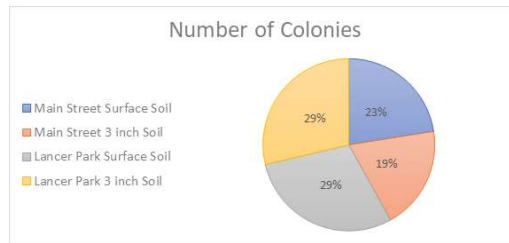


Figure 4: The approximate number/percentage of colonies in each of the sample locations (Main Street or Lancer Park) and the different depths (surface or three-inch-deep).

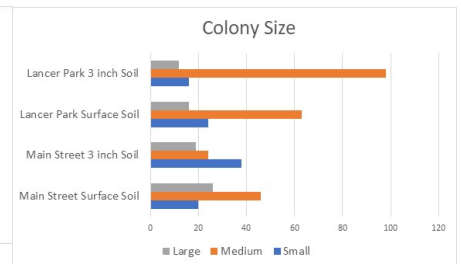


Figure 5: The count of each size difference on the plates and organized by each of the locations and the different depths.

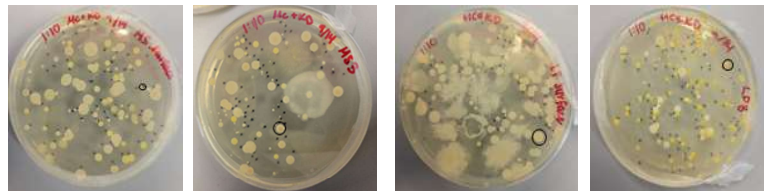


Figure 6: Shown is the 1:10 plates of each of the location. The far-left plate is from the surface level soil on Main Street, then (going to the right) the three-inch-deep soil on Main Street, then the surface soil at Lancer Park, and then the three-inch-deep soil at Lancer Park.

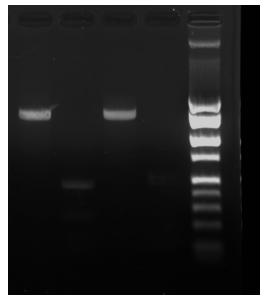


Figure 7: Gel electrophoresis results from all soil samples. The sample order is the same as figure 6.

Location/depth	pH
Main Street Surface soil	6.8
Main Street 3-inch-deep soil	6.8
Lancer Park Surface soil	6.5
Lancer Park 3-inch-deep soil	6.8

Table 1: The pH differences between each soil sample.

Location	Closets BLAST Match	Colony Description	Environment	% Similarity	Gaps
Main Street Surface	<i>Rugamonas rubra</i>	Red pigmented, circular shape	River water	99.68%	2/949
Main Street 3-inch-deep	<i>Flavobacterium aquidurense</i>	Dark orange, circular shape	Hard water creek	99%	5/865
Lancer Park Surface	<i>Bacillus toyonensis</i>	Cream colored, circular shape	Animal Pathogen	100%	0/967

Table 2: Analysis of BLAST search indicating the bacteria, colony description, environment, percent similarity, and the gaps.

Conclusion

- At the conclusion of our experiment, it was determined that there was more microbial diversity in the rural area versus the urban (Figure 6).
- We can conclude that impervious surfaces cause the lack of oxygen availability and water content in urban communities³
- It is determined there is no significant difference in the pH levels between the two locations, urban and rural (Figure 8).
- Both *Rugamonas rubra* and *Flavobacterium aquidurense* has been found in the area of Main Street that correlates with a recent rainfall. The formation of *Bacillus toyonensis* was due to the abundance of wildlife located in the rural environment.
- In the future, we can continue our research by expanding our sampling locations both in more urbanized and rural locations.