The Effects of Urbanization on Plant Biodiversity in Southeastern Virginia

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The effects of urbanization on plant biodiversity in Southeastern Virginia

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Research conducted through Dr. Wallace’s Botany Course, Fall 2020

ABSTRACT
This research project investigated the impacts of urbanization on plant species biodiversity within Southeastern Virginia. The hypothesized results of this research were if there was an increase in urbanization, then plant diversity would decrease. Plant biodiversity can increase the decomposition rates, pollination success, and biomass production of the area. Decreasing in plant biodiversity can increase the spread of pathogens through plant populations and increase herbivore damage. There was data compiled from SERNEC herbarium records of four counties, Accomack, Northampton, Norfolk, and Virginia Beach. Virginia Beach had the highest recorded population increase, which was considered the measurement for urbanization in this study. Virginia Beach’s population increased from 8,091 in 1960 to 449,974 in 2019. Northampton had the smallest recorded population for both time periods, however, it had similar plant species population as Virginia Beach. The research supported that there was no clear association between the increasing urbanization and the change in plant biodiversity: The results supported that there was a loss of plant diversity in Norfolk, which was the only human population that experienced a decrease in population from the time periods of 1960 to 2019. The county with the most plant species biodiversity was Accomack County, which had the second lowest recorded population. Norfolk county had the second highest population with the lowest plant species diversity in 2020. Prior to 1960, Norfolk had the largest species diversity, with the largest population.

INTRODUCTION
Plant species biodiversity increases decomposition rates, pollination success, and biomass production (van der Plas 2019). Plant biodiversity also has been reported to increase pathogen spreading throughout plants and more herbivore damage (van der Plas 2019). Past herbaria data showed there was a negative impact of urbanization on plant habitats, with increased spread of pathogens, an overabundance of nitrogen and carbon dioxide, and a decrease in available habitat (Lang et al. 2019). Changes in plant biodiversity in Virginia include an increase in non-native species, increased pathogens, and increased need for conservation of rare species (Fleming 2012). This research will investigated how urbanization impacts plant biodiversity in Southeastern Virginia.

HYPOTHESIS AND PREDICTIONS
The hypothesis tested in this research is that if urbanization increases then there will be a decrease in plant species diversity. The expected results of this research is there will be a direct correlation between plant species diversity and the population size within the counties.

METHODS AND MATERIALS
• Data sets were generated for four counties using records from the SERNEC database, which is a digitized herbarium record.
• Students were given a subset of a county and deleted duplicate herbarium records from the raw data set.
• The lists were compiled to create a unique species list for each county and time period (pre-1965 and post-1965).
• The data from all counties were then compiled into one document, considering the difference of repetition deleted by various students.
• Rarefaction was applied to the datasets when estimating species richness because of unequal numbers of collections among counties.
• Sorensen’s index was calculated to compare the similarities in species composition across the two time periods.

RESULTS
The largest populations in 1960 was Norfolk County, and the smallest population was Virginia Beach. The largest population in 2020, according to the United States Census, was Virginia Beach County, and the smallest population was Northampton County.

Despite the difference of the populations being 438,264, the difference in species biodiversity in time period of 1960-2020, was only four more recorded species in Virginia Beach than Northampton. The county with the most plant species biodiversity in 2020 was Accomack County, which had the second lowest recorded population. Norfolk county had the second highest population with the lowest plant species diversity in 2020. Prior to 1960, Norfolk had the largest species diversity, with the largest population.

CONCLUSIONS
The results of this research did not show a direct association between the species biodiversity and the level of urbanization. The results supported that overall there was an increase in species biodiversity in all counties. These results may have been influenced by research bias, by collected samples in most urbanized counties, may have only occurred in protect areas. The results may have also been impacted by the changing in size of the different counties. The results may have also been impacted by not considering shifts in native and non-native plant species diversity. Further research should investigate whether the species biodiversity is impacted in native and non-native plants with urbanization. An explanation for the study’s result not showing a significant difference, is that with urbanization there may be a decrease in native plant biodiversity and an increase of non-native plant species within the Southeastern Virginia counties.

REFERENCES