How Has the Biodiversity Of Different Species Of Oak Trees in NYC Changed Over Time?

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ABSTRACT:

This Urban Barcoding Project investigates the biodiversity of oak tree species in New York City (NYC) over time. Focusing primarily on Central Park and extending to all five boroughs, the study intends to explore how the oak tree population has evolved and adapted in response to changing environmental conditions. With a backdrop of NYC's diverse urban landscape, the project utilizes DNA barcoding to identify and classify different oak tree species, linking genetic information with their habitat. The specific aims include understanding the impact of urbanization on oak tree populations, uncovering genomic changes, and exploring temporal dynamics to predict future trends. By examining the intersection of genetics and environment, the study seeks to provide valuable insights into the effects of climate change, human activities, and urban development on the biodiversity of oak trees in NYC, contributing to the preservation of crucial urban ecosystems.

INTRODUCTION:

New York City is home to many different species of trees. According to the MillionTreesNYC website, there are about 5.2 million trees with 168 different species of them across New York City. Some of these trees in fact aren't native to NYC at all, only 55% of NYC's trees are native. Most of the non-native species of trees in NYC have either adapted to New York City's climate or have moved from their original habitat. This Urban Barcoding Project strives to find out these reasons as to why NYC's tree population is as diverse as it is today. We are primarily focusing on the oak tree specimens within NYC, as there are both native and non-native species of oak trees in NYC.

Oak trees are one of the most common species of trees in the world. Overtime they have grown to roughly 435 species across the Americas, Asia, Europe, and Africa according to the U.S National Park Service. We seek to find out how the biodiversity of oak trees in NYC evolved by comparing the biodiversity of oak trees in Central Park right now and all 5 boroughs next year. By finding out how exactly oak tree biodiversity has changed over time in NYC, we could determine the factors that help nurture an oak tree growth and ones that hurt it, which will allow us to eliminate those bad factors. The Oak trees that we will be looking for in Central park are: The White Oak, the Laurel Oak, the Swamp White Oak, the Black Oak, the Red Oak, and finally, the Pin Oak. We will be searching for the biodiversity of these trees by noting them while walking through Central park.

NY's climate has been changing over the years. According to the New York department of environmental conservation, since the 1970s, NY's overall temperature has increased by 3˚F(0.6˚F each decade). Despite this seeming like a small change, it most definitely affected the environment of NY, specifically NYC's oak trees. Finding out this difference in biodiversity of the oak trees would bring light into the major problem of climate change in NY, as most of the change in our environment has come from the rise of global warming and pollution. With oak trees being one of our oldest species of native trees in the US, it would really give the public a rude awakening to find out if oak trees have been slowly dying out

RESULTS:

In our received data, we determined that each oak tree was not completely the same. In fact, the oak tree that was most similar to its pair was composed of 5 different types of oak tree. The only oak trees that matched were WGJ-016, and WGJ-021. The Bur Oak and the Dwarf Post Oak. These oaks were in northern central park, whereas the data received from 002-006 was in southern central park. Northern central park has less tall buildings which allows for more types of trees due to more pollen, and in southern central park, there are more tall buildings which mean less population of trees due to buildings blocking out the needed pollen. Additionally, the trees observed in southern central park were not as large as the ones in northern central park, which towered over buildings. These led us to determine how the scarcity of sunlight and pollen in southern central park lead to more frail trees, and the abundance of sunlight and pollen due to smaller buildings in northern central park lead to larger, stronger trees. In the future, these results led us to believe that while northern central park will continue to flourish, the southern will not. While central park can be saved, it must take the abolishment of large buildings which leave plants thirsting for sunlight, time to allow plants and young trees to grow, and a community which understands the implications of their actions in nature.

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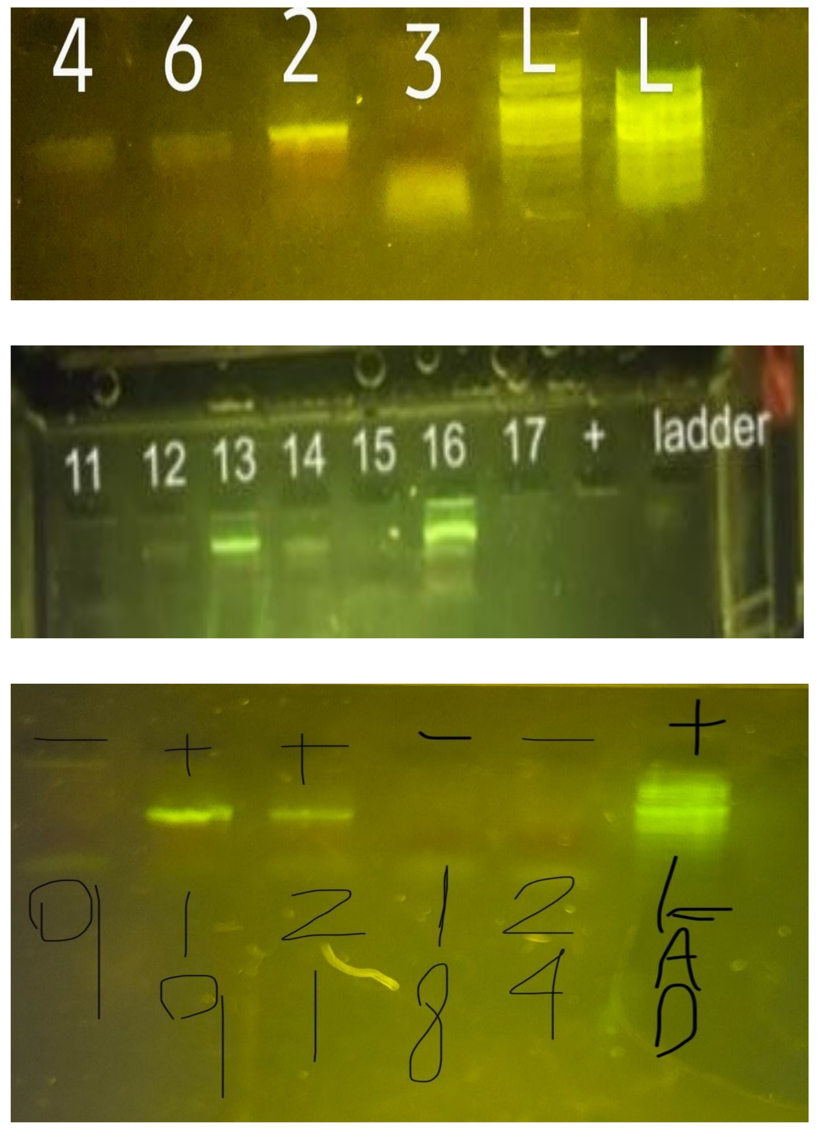
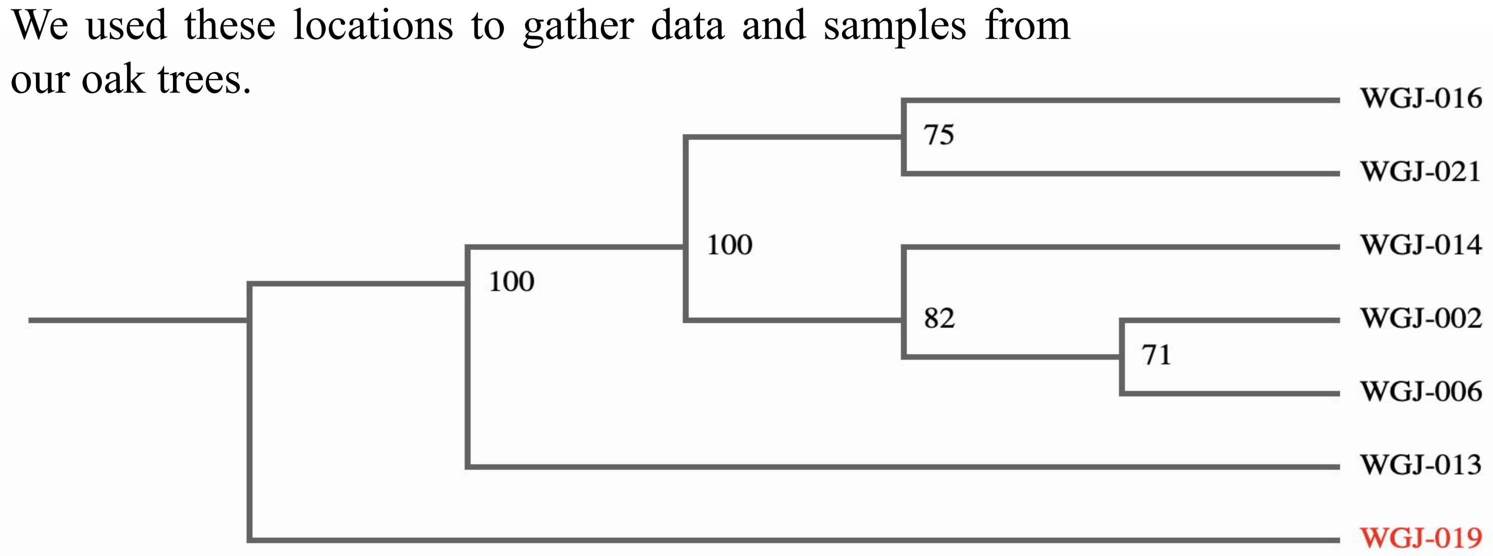
METHODOLOGY:

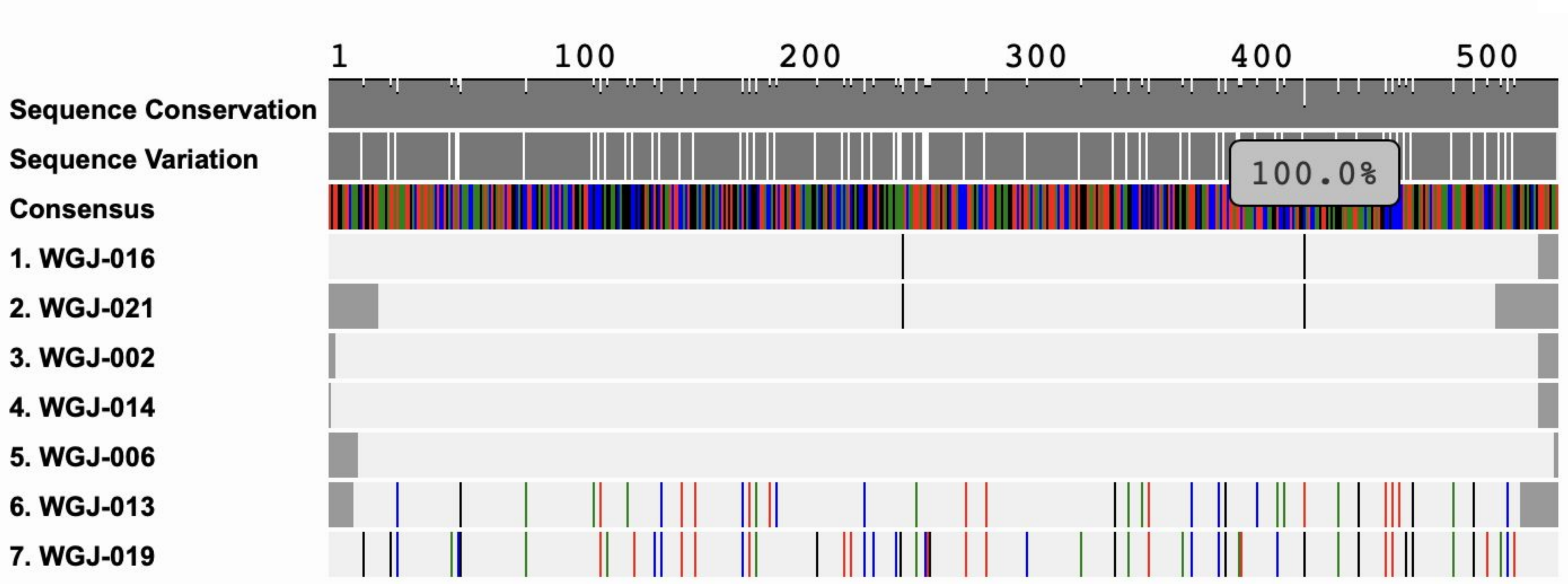
In this case, we studied oak tree species and took samples from the trees themselves. We examined Central park for information on the biodiversity of the oak tree species. After that, we extracted the DNA from the leaf samples following the protocols from "Using DNA Barcodes to Identify and Classify Living Things." And amplified the DNA sequence using the RbcL primer. Once this was amplified, we turned our DNA samples into the laboratory to be sequenced and so we could determine the species of the oak trees. We used these results to discover the population of oak trees, how healthy they were based on abundance (more population meant healthier). We used that data to determine how many oak trees were in a certain area and how the environment, location, and health of the trees affected the population of the varied species of oak trees in Central Park. For our qualitative data, we wrote about our observations of the environment, which later would be compared with observations of NYC's environment throughout the years.

To the right, we see the results from our DNA amplification section. The inconclusive results are ones that show up with red above the green, and the conclusive show up with green above the red.

To find the locations of the trees we were planning on studying, we used the iNaturalist website, which has locations and the species of trees that you want to look at. We used these locations to gather data and samples from our oak trees.







Sample ID	Blast Result (top five)		Aln Length	Bit Score	e	Mis-Matches
WGJ-002	Lithocarpus edulis	japanese stone oak	533	962	0	0
WGJ-002	Quecus Velutina	black oak	533	962	0	0
WGJ-002	Quercus Rubra	Northern red oak	533	962	0	0
WGJ-002	Quercus Palustris	pin oak	533	962	0	0
WGJ-002	Quercus Myrtifolia	myrtle oak	533	962	0	0
WGJ-006	Lithocarpus edulis	Japanese stone oak	530	957	0	0
WGJ-006	Quercus Myrtifolia	Myrtle oak	530	957	0	0
WGJ-006	Quercus Incana	bluejack oak	530	957	0	0
WGJ-006	Quercus Nigra	Water oak	530	957	0	0
WGJ-006	Quercus Hemisphaerica	Laurel oak	530	957	0	0
WGJ-013	Platanus Orientalis	Oriental Plane tree	517	933	0	0
WGJ-013	Platanus Occidentails	American sycamore	517	933	0	0
WGJ-013	Platanus Racemosa	California sycamore	517	924	0	2
WGJ-013	Nelumbo Lutea	American lotus	517	897	0	8
WGJ-013	Nelumbo Nucifera	sacred lotus	517	893	0	9
WGJ-014	Lithocarpus edulis	japanese stone oak	535	966	0	0
WGJ-014	Quercus Velutina	black oak	535	966	0	0
WGJ-014	Quercus Rubra	Northern red oak	535	966	0	0
WGJ-014	Quercus Palustris	pin oak	535	966	0	0
WGJ-014	Quercus Myrtifolia	myrtle oak	535	966	0	0
WGJ-016	Quercus Macrocarpa	Bur oak	536	967	0	0
WGJ-016	Quercus Margarettiae	Dwarf Post Oak	536	967	0	0
WGJ-016	Quercus Bicolor	swamp white oak	536	967	0	0
WGJ-016	Quercus muelenbergii	chinkapin oak	536	967	0	0
WGJ-016	Quercus Alba	white oak	536	967	0	0
WGJ-019	Fraxinus profunda	pumpkin ash	545	984	0	0
WGJ-019	Fraxinus Americana	white ash	545	984	0	0
WGJ-019	Fraxinus pennsylvanica	Green ash	545	984	0	0
WGJ-019	Fraxinus Greggii	littleleaf ash	545	975	0	2
WGJ-019	Fraxinus Excelsior	European Ash	545	975	0	2
WGJ-021	Quercus Macrocarpa	bur oak	495	893	0	0
WGJ-021	Quercus Margarettiae	Dwarf Post Oak	495	893	0	0
WGJ-021	Quercus Bicolor	swamp white oak	495	893	0	0
WGJ-021	Quercus muelenbergii	chinkapin oak	495	893	0	0
WGJ-021	Quercus Alba	white oak	495	893	0	0