



Identifying Invasive Species In Prospect Park Using DNA Sequencing

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SCIENCE

SANDBOX

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Abstract

Invasive species are species that are not native to an ecosystem and whose introduction can cause ecological and economic problems. These invasive species can range from plants, animals, and to microbes. The introduction of invasive species to ecosystems can cause significant damage to the environment, and can ultimately affect the overall ecosystem. Our research project consisted of identifying invasive plant species throughout Prospect Park. We hypothesize that invasive species are more likely to be found in live plants rather than dead plants due to an earlier growing season. 33 plant samples were collected and analyzed from Prospect Park, including both dead and live samples. DNA was then extracted using silica and rbcl primers were used for PCR to amplify genomic regions. Our PCR product was sent to Genewiz to undergo Sanger sequencing. We were able to successfully extract DNA from 13 live plant samples and 12 dead plant samples, making it a total of 25 successful DNA extractions. The data was then analyzed through DNA Subway to trim and align the sequences, and BlastN to match our sequences to reference sequences in the NCBI database.

Introduction

- Invasive species threaten to alter the diversity of species and can negatively impact an ecosystem
- Our project focused on visually identifying plant species in Prospect Park in Brooklyn
- Prospect Park is a 526 acres public park designed between 1865-1895 by Frederick Law Olmstead and Calvert Vaux, the masterminds behind Central Park
- The park has varying levels of development with ongoing renovations to enhance the park
- Our study aims to identify nonnative and invasive plant species
- We attempted to visually identify leaves from Prospect Park in March 2023
- A majority of samples were brown leaves while some were green

Materials & Methods

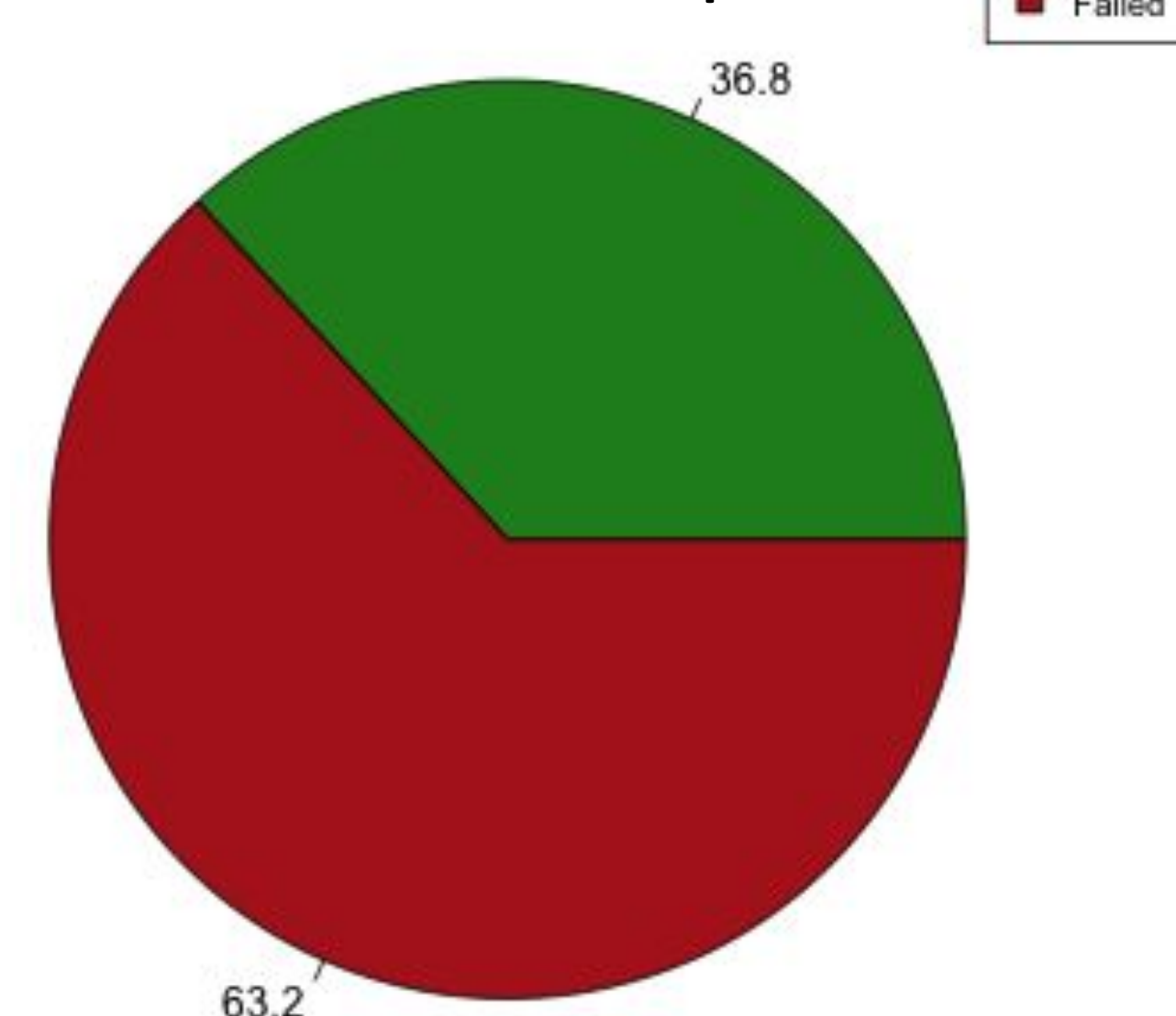
- We extracted DNA from 32 samples of leaves following the DNALC extraction protocol
- rbcl primers were used and PCR was performed before Sanger sequencing
- DNASubway was used to analyze the data
- Our original guesses of plant species was compared to the BLAST hits from DNASubway

Results

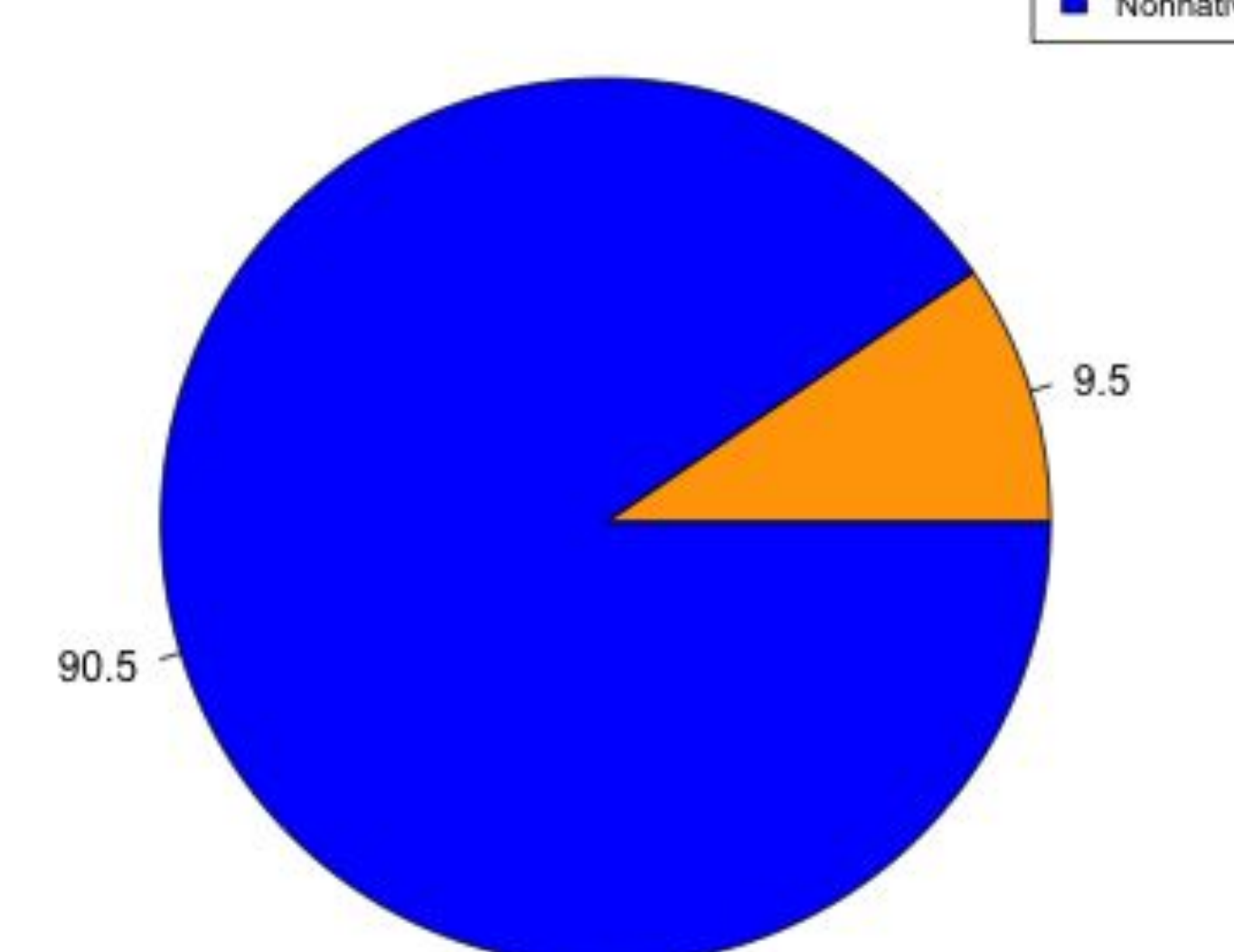
Sample #	Guess	Guess Species Latin Name	Leaf Status	Blast hit	Native/Nonnative
8	Snowdrop	<i>Lonicera japonica</i>	Alive	<i>Pancratium canariense</i>	Nonnative
10	Buttercups	<i>Ranunculus auricomus</i>	Alive	<i>Ornithogalum pedicellare</i>	Nonnative
11	Chives	<i>Allium schoenoprasum</i>	Alive	<i>Allium cepa</i>	Nonnative
12	UNKNOWN- invasive	N/A	Alive	<i>Lonicera japonica</i>	Nonnative
14	Ivy or dogwood	<i>Hedera helix</i>	Dead	<i>Hedera helix</i>	Nonnative
17	Swamp white oak	<i>Quercus bicolor</i>	Dead	<i>Thyrocarpus glochidiatus</i>	Nonnative
18	Southern magnolia	<i>Magnolia grandifolia</i>	Alive	<i>Magnolia x soulangeana</i>	Ornamental
19	Paper birch bark	<i>Betula papyrifera</i>	Dead	<i>Myosotis discolor</i>	Ornamental
20	White oak	<i>Quercus alba</i>	Dead	<i>Thyrocarpus glochidiatus</i>	Nonnative
21	Unknown	N/A	Alive	<i>Thyrocarpus glochidiatus</i>	Nonnative
24	Cypress	<i>Juniperus sp.</i>	Alive	<i>Hesperocyparis macrocarpa</i>	Native
25	Basswood	<i>Tilia americana</i>	Dead	<i>Cassinopsis madagascariensis</i>	Nonnative
27	Oyster mushroom	<i>Pleurotus ostreatus</i>	Alive	<i>Thyrocarpus glochidiatus</i>	Nonnative
28	Eastern hemlock	<i>Tsuga canadensis</i>	Alive	<i>Taxus cuspidata var. latifolia</i>	Nonnative
29	Unknown	N/A	Alive	<i>Rosa hybrid cultivar</i>	Nonnative
30	Balsam fir	<i>Abies balsamea</i>	Dead	<i>Thyrocarpus glochidiatus</i>	Nonnative
31	Dogwood	<i>Cornus</i>	Alive	<i>Thyrocarpus glochidiatus</i>	Nonnative
32	Unknown	N/A	Alive	<i>Hedera helix</i>	Nonnative
33	Dogwood	<i>Cornus</i>	Dead	<i>Cornus officinalis</i>	Native

Table 1 summarizes the species and specific information regarding the plant samples.

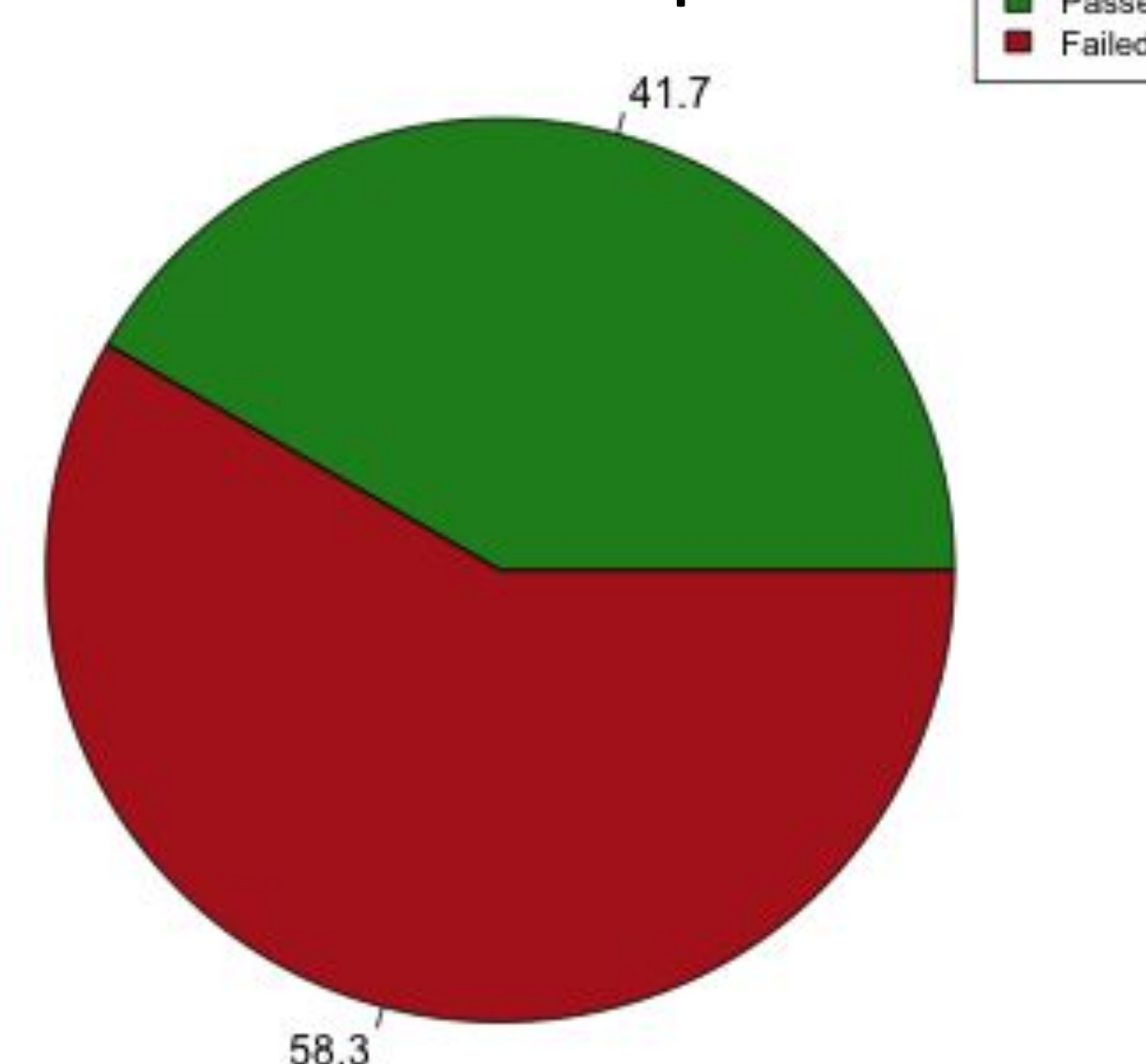
Percent of Brown Leaves Sequenced



Percent of Native vs. Nonnative



Percent of Green Leaves Sequenced



Discussion

- Since plants were collected in early March, most leaves hadn't burst yet. To compensate for this, dead leaves were collected as well.
- We inferred that live plants would be more likely to be successfully sequenced.
- We also inferred that green leaves would be more likely to be invasive
- 12 out of 17 nonnative samples were from live leaves
- The success rates of DNA extraction for green leaves and brown leaves were very similar
- Several samples in red came back with the same Blast hit despite different leaf morphology
- We believe there was contamination during the DNA extraction process or PCR which cross-contaminated samples
- This reduces the reliability of our results.
- It is unlikely that a random plant native to China would be so present in Prospect Park and have the foliar plasticity to mimic dogwood leaves or balsam fir needles
- A few ornamental species came back in the blast hits. These species were planted along paved trails in Prospect Park. We believe these species were intentionally planted due to their aesthetic value to enhance the beauty of the park

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