Ecological Succession in Central Park after Catastrophic Occurrences

Cristina Guzman-Moumtzis[1], Jatna Paulino[1], Alyssa Simon[1], Vincent Joralemin[1]

[1]Frank McCourt High School

Cold Spring Harbor Laboratory DNA Learning Center

NYC URBAN BARCODE PROJECT

Abstract

Ecological Succession is the observable change of an ecosystem over time. Central Park undergoes a type of artificial ecological succession but their impact is uncertain. Using a standard DNA extraction method, fifteen species of plants were studied to determine the impact of ecological succession in Central Park. A majority of the plants were nonnative and had a negative impact but some of the plant's were native and even endangered. This increase in diversity suggests that while ecological succession does allow for invasive species to enter an area, it also allows for weaker native species to thrive.

Introduction

In 1979, Wayne P. Sousa investigated changes to a specie of algae once the original species was devastated and a pioneer specie of algae began to colonize the area. The species of algae changed repeatedly until it it settled on one dominant algae [1] but before then, the ecosystem fluctuated dangerously. In comparison, those who observe the forest fires in Yellowstone Park claim these events are a key factor in shaping the ecology of the park.[2] Most positive examples, such as that of Yellowstone Park, is said to be those areas with semi-frequent events of ecological succession (according to the Intermediate Disturbance Hypothesis[3]). If species are too frequently replaced, the ecosystem will not have the time to adapt but if no change occurs, diversity decreases.

Methods

The samples for this project were collected from a recently renovated area of Central Park;a construction site located on West 81st. Four locations around the construction were chosen as well as four control locations six steps away from the site.Afterwards, all plants which appear different will be collected from both sites to collect a good sample size, had their locations marked and later recorded onto a sample database. By using a standard DNA extraction method [4] the DNA from each of the samples was extracted, amplified and then barcoded.

Results

Database Identifier	Species	Origins [5]
KEN-002	Plantago lanceolata	Nonnative
KEN-003	Plantago lanceolata	Nonnative
KEN-004	Poa Annua	Nonnative
KEN-006 F	Symphyotrichum ciliolatum	Native
KEN-008	Symphyotrichum laeve	Native
KEN-009	Adenocaulon bicolor	Nonnative
KEN-010	Vicia ramiflora	Nonnative
KEN-011	Poa annua	Nonnative
KEN-012	Plantago lanceolata	Nonnative
KEN-014	Plantago lanceolata	Nonnative
KEN-015	Potentilla reptans	Nonnative

Database Identifier	Species	Origins [5]
KEN-030	Lolium temulentum	Nonnative
KEN-031	Trifolium repens	Nonnative
KEN-032	Plantago asiatica	Nonnative
KEN-033	Ulmus americana	Native
KEN-034	Trifolium repens	Nonnative
KEN-035	Trifolium repens	Nonnative
KEN-036	Lolium temulentum	Nonnative
KEN-037	Plantago asiatica	Nonnative
KEN-038	Trifolium montanum	Nonnative
KEN-039	Trifolium montanum	Nonnative
KEN-040	Trifolium montanum	Nonnative

Database Identifier	Species	Origins [5]
KEN-016	Potentilla reptans	Nonnative
KEN-017	Plantago asiatica	Nonnative
KEN-018	Adenocaulon bicolor	Nonnative
KEN-019	Plantago lanceolata	Nonnative
KEN-020	Poa pratensis	Native
KEN-021	Trifolium montanum	Nonnative
KEN-022	Plantago asiatica	Nonnative
KEN-023	Trifolium montanum	Nonnative
KEN-024	Lolium temulentum	Nonnative
KEN-028	Potentilla reptans	Nonnative
KEN-029	Poa supina	Nonnative

Database Identifier	Species	Origins [5]
KEN-041	Trifolium montanum	Nonnative
KEN-042	Plantago asiatica	Nonnative
KEN-043	Poa supina	Nonnative
KEN-044	Trifolium montanum	Nonnative
KEN-045	Poa supina	Nonnative
KEN-046	Prunus spinosa	Nonnative
KEN-048	Prunus spinosa	Nonnative
KEN-049	Poa pratensis	Native
KEN-051	Anthoxanthum nitens	Native
KEN-052	Plantago asiatica	Nonnative
KEN-053	Plantago lanceolata -	Nonnative

This table represents all of the barcoded DNA collected through this procedure. The samples begin at KEN-002 and all unsuccessfully extracted DNA is omitted from the table. In addition to the species name and database identifier, the table also includes a column labeling each plant as a native specie or a non native specie (a specie which was introduced to the country).

Abstract

Central Park's plant diversity ranges from indigenous and introduced species[6] but areas without disruptive events have lower biodiversity. This may be attributed to the lack of care that area of construction have in terms of chemicals such as RoundUp[7], which prevents protein production in plants that utilize EPSP synthase [8]. While this herbicide does remove non native species of plants such as dandelions, it can has a major effect on other native plants. The genetic diversity of areas sprayed with this herbicide may hinder the growth of non native and native species but more research will need to be conducted for a definitive answer.

References

[1] Wayne P. Sousa (Last edited date). Experimental Investigations of Disturbance and Ecological Succession in a Rocky Intertidal Algal Community. <http://www.esajournals.org/doi/abs/10.2307/1942484>

[2] National Park Service U.S. Department of the Interior (2015). *General Format*. Retrieved from <http://www.nps.gov/yell/planyourvisit/upload/RI_2015_fire_sm.pdf>

[3] MICHAEL ALLABY. "intermediate disturbance hypothesis." A Dictionary of Ecology. 2004.*Encyclopedia.com.* 27 May. 2016 <http://www.encyclopedia.com>

[4]"Using DNA Barcodes to Identify and Classify Living Things." *Experiment Protocol | DNA Barcoding 101*. Cold Spring Harbor's Laboratory. Web. 15 Nov. 2016.

[5]"Welcome to the PLANTS Database | USDA PLANTS." *Welcome to the PLANTS Database | USDA PLANTS*. Web. 20 May 2016. <http://plants.usda.gov/>.

[6]"Flora of Central Park." *Flora of Central Park*. Web. 27 May 2016. <http://www.nybg.org/files/scientists/datha/CentralPark/Maps.html>.

[7]Pang, Amelia. "Are NYC Parks Becoming More Toxic?" *The Epoch Times Are NYC Parks Becoming More Toxic Comments*. The Epoch Times, 18 Jan. 2016. Web. 27 May 2016. <http://www.theepochtimes.com/n3/1940550-are-nyc-parks-becoming-more-toxic/>.

[8] "What Is Biology Good For? Controlling Weeds: RoundUp." *IUPUI Department of Biology*. Web. 25 May 2016. <http://www.biology.iupui.edu/biocourses/N100/goodfor13.html>.

Acknowledgements

This work was made possible by the Urban Barcode Research Program (UBRP). UBRP is funded by the Pinkerton Foundation and Cold Spring Harbor Laboratory's DNA Learning Center. We also thank Christine Marrizzi and Melissa Lee for their guidance and support.