Symbiotic Relationships in Different Environments of New York

Britney Pham
Mentor: Lynn DiAndrea
Cold Spring Harbor Laboratory's DNA Learning Center; Farmingdale High School

Cold Spring Harbor Laboratory DNA Learning Center
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Abstract

Long Island and Fire Island are two distinct environments. The experiment investigated the effects of the environmental variation on the relationships and organisms in the ecosystem. Samples were collected from each area then DNA was extracted from each organism. After the DNA was amplified, it was placed in a gel electrophoresis and allowed to band. Unfortunately, there were minimal results. Online identifications websites were used to classify the most probably organisms based on its physical appearance. There was some overlapping of the types of organisms in each of the environments. However, Fire Island seemed to be a more mature ecosystem. Ecological succession has been occurring for the past hundreds of years, leaving those most suitable to its environment with a few remnants. Long Island, on the other hand, it constantly exposed to human interaction. The suburbanization limits the number of organisms in general, diminishing competition. Ecological succession occurs at a much slower rate, and human gardening may have disrupted the natural process. The study reveals the effect of human influence on the environment.

Introduction

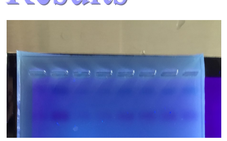
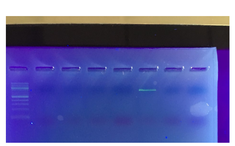
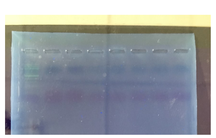
The Sunken Forest on Fire Island in New York is a rare ecological environment. It contains six diverse ecosystems, each with its own unique species and habitat. A cross section of Fire Island, going from the Atlantic Ocean to the Great South Bay, would include the primary dunes, swale, secondary dunes, Sunken Forest and finally, wetlands. The dunes are created when the ocean winds blow specks of sand that slow down when it comes in contact with vegetation, held in place due to the extensive root system of the beach grass. The secondary dunes block a considerable amount of the incoming salt spray, allowing for the existence of the Sunken Forest (*The Sunken Forest*). Certain species, specifically the American Holly, are not typically found as far north as New York. However, the ocean's high heat capacity moderates the temperature and keeps the land warmer than other inland areas (U.S. National Park Service). In 2001, the New York Natural Heritage Program declared the maritime holly forest as "globally rare", meaning that there are a few remaining cases of the particular aggregation of plants in the world ("Life in the").

Symbiotic relationships describe the interaction between organisms of different species ("Symbiosis." Biology Online). The prime relationships are mutualism, commensalism and parasitism with subcategories that include competition, neutralism and predation ("Symbiosis."). The investigation examined the differences in symbiotic relationships between two distinct environments of New York. The different environments influence the types of organisms that coexist in the specific area, affecting the types of symbiotic relationships that form. A major dividing factor between the two ecosystems would be the presence of humans. Humans interact with the environment more significantly on Long Island relative to Fire Island, a protected national park. Humans possess the power to alter symbiotic relationships that may occur naturally.

Materials and Methods

1.Obtain samples of organisms from Long Island and Fire Island
2.Cut small pieces of each sample and place in a labeled centrifuge tube
3.Place an equal amount of nuclei lysis solution in each tube
4.Using new pestles for each sample, grind into very small pieces
5.Incubate the tubes for ten minutes at 65°C
6.Centrifuge for one minute to allow the lysed material to gather at the bottom of the tube
7. Transfer the supernatant to a fresh tube using a micropipette
8. Add an equal amount of silica resin and then shake
9. Incubate the tubes at 57°C for five minutes
10. Centrifuge for thirty seconds
11. Remove the supernatant then add wash buffer
12. Repeat steps ten and eleven two more times
13. After the supernatant is removed, add distilled water to the tubes
14. Incubate the tubes at 57°C for five minutes
15. Centrifuge for thirty seconds, then transfer the supernatant to a fresh tube
16. Amplify the DNA by adding primer mix to each tube and placing in a thermal cycler
17. Create a gel that will be used for gel electrophoresis
18. Pour running buffer into the reservoirs of the gel chamber
19. Micropipette the samples to their respective lanes
20. Connect the gel chamber to a power supply of 130 volts and let it run for thirty minutes

Results

Tables & Figures

Fire Island

Sample 1	Red maple
Sample 2	Siberian elm
Sample 3	Red maple
Sample 4	Sassafras
Sample 5	American Holly
Sample 6	Callery pear
Sample 7	Leprose lichen*
Sample 8	Red cedar

*specific species was unidentifiable

Long Island

Sample 1	Lichen*
Sample 2	Amur maple
Sample 3	Amur maple
Sample 4	Fungus (mushroom)*
Sample 5	Parmelia lichen
Sample 6	Sassafras
Sample 7	Scarlet oak
Sample 8	Eastern white pine
Sample 9	Carolina Silverbell

Discussion

Evidently, the DNA extraction did not work. There could have been errors in extraction in multiple areas. While grinding, the DNA may not have been released from the nuclear membrane. Lichen cell walls contain proteins, polysaccharides and other compounds that make DNA extraction difficult. Future experiments could implement a BeadBeater to separate the break the cells. Additionally, the general primers used may not have correctly bonded to the specific region of DNA, preventing DNA polymerase from functioning properly. (Park). The potential errors in DNA extraction resulted in a nonviable gel electrophoresis. Instead, online sources were needed to identify the most probable organism based on its appearance. Plants were classified using an online database of plant species in northeastern America ("Leafsnap: An Electronic"). Lichen were more difficult to morphologically identity as many look quick similar. An online lichen database reduced the list based on color, form, habitat and its reaction to certain molecules. However, even after selecting the appropriate choices, there was still a multitude of potential species, some of which did not provide pictures for comparison ("Lichens USGA – Identification). The organisms on Fire Island compete for resources more than those on Long Island. On Fire Island, tall trees are more capable of obtaining the necessary sunlight, creating a thick canopy that decreases the number of plants towards the ground. The only plants that exist below the canopy are ones that need minimal light. Most of the Fire Island environment has reached its climax, but remnants, including the red cedar, are scattered throughout the forest (Bullington). Competition on Long Island is minimal; there are not many dense areas where competition would be necessary and human interaction influence the organisms.

Acknowledgments

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References

Bullington, Neal. "Exploring Sunken Forest." *Fire Island National Seashore*. Eastern National Park & Monument Association, 1988. Web. 4 Apr. 2016.
"Leafsnap: An Electronic Field Guide." *Leafsnap*. Columbia University, University of Maryland, Smithsonian Institution, 2011. Web. 05 Apr. 2016.
"Lichens USGA -- Identification Guide -- Discover Life." *Lichens USGA - Identification Guide - Discover Life*. N.p., n.d. Web. 05 Apr. 2016.
Park, Sook-Young, Seol-Hwa Jang, Soon-Ok Oh, Jung A. Kim, and Jae-Seoun Hur. "An Easy, Rapid, and Cost-Effective Method for DNA Extraction from Various Lichen Taxa and Specimens Suitable for Analysis of Fungal and Algal Strains." *Mycobiology*. The Korean Society of Mycology, 31 Dec. 2014. Web. 05 Apr. 2016.
"The Sunken Forest on Fire Island." (n.d.): n. pag. Nassau Boces. Web.
"Symbiosis." *Biology Online Dictionary*. Biology-Online.org, 17 Jan. 2016. Web. 05 Apr. 2016.
"Symbiosis." *Symbiosis*. N.p., n.d. Web. 05 Apr. 2016.