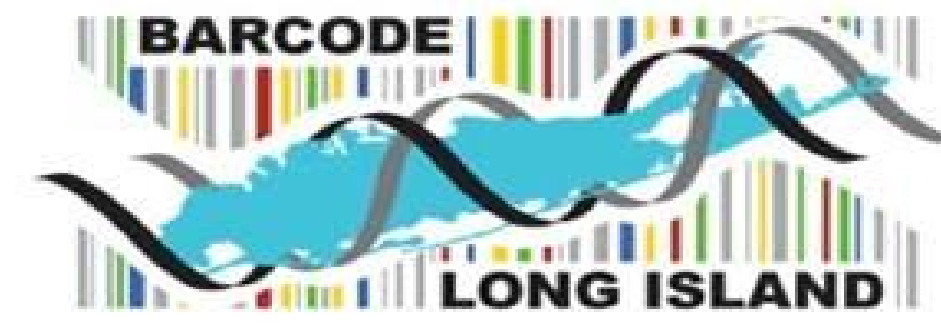


# Using *Ammophila breviligulata* to analyze the beach ecosystem post-Sandy

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## Abstract

The Fire Island dunes have been covered in *Ammophila breviligulata* and other vegetation long before Sandy through efforts to rebuild the primary dunes. Ecological succession allowed the dunes to have another chance to rebuild the ecosystem of Fire Island. New species can invade into the ecosystem, and can influence the environment during this process. The objective of this project were to identify the genetic relationship between the *Ammophila breviligulata* and other species on the rebuilt and non-rebuilt dunes. also to examine the state of the primary dune's rebuilding ecosystem. Most of the necessary materials for the experiment were provided by the DNA Learning Center. The data obtained was able to prove the ecosystem is undergoing ecological succession. The results conveyed that the grass was confirmed to be *Ammophila breviligulata*, and was not previously found on the Sample GenBank. The ecosystem of the primary dunes is still in recovery after Sandy.

## Introduction

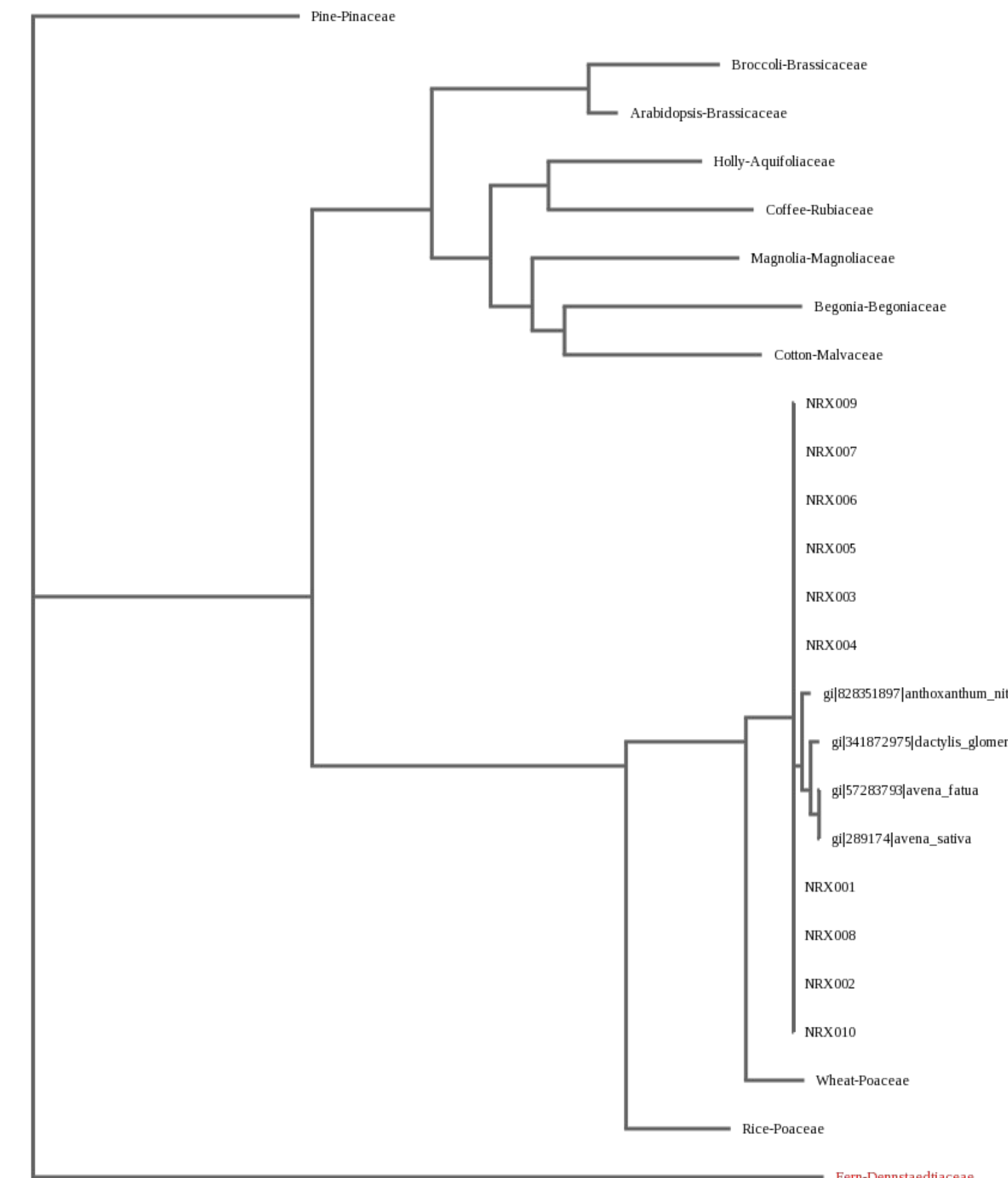
Ecological succession is the change that an ecosystem goes through over a period of time. It can happen after a large disaster, and the ecosystem goes through a progression to rebuild itself. In ecological succession, some species that once lived in the ecosystem may cease to exist, while other species may invade into it and become abundant. On Fire Island, Superstorm Sandy was able to wipe out the dunes and beaches, and lead to a new era of ecological succession. Fire Island has been able to evolve and rebuild as an ecosystem, and changes are bound to have occurred during this process. Before Superstorm Sandy the dunes were mostly populated by the grass species *Ammophila breviligulata*. This grass, alongside other dominant vegetation are the main native plant species found in a healthy dune ecosystem. In 2013, the coast of Fire Island was devastated by Superstorm Sandy. The dunes were extensively eroded, and the beaches became flat and low. Fire Island was at a low when Sandy hit, and left vulnerable with the compromised dunes along the coast. A rebuilding period was vital, and hence a period where new species could be introduced into the ecosystem, which negatively affected biodiversity (7). The most common beach grass in the dunes present in both before and after Superstorm Sandy was *Ammophila breviligulata* (3).

The reason DNA barcoding was involved was to see the genetic diversity of the old and new *Ammophila breviligulata*, or to see if there was a difference between the planted and replanted grass on the dunes. These native plant species play the fundamental roles in building and stabilizing dune ecosystems. If the genetic relationship is similar, that means that the dunes are as a matter of fact undergoing ecological succession. Potentially 30 years in the future, the population of this pioneer species is going to decrease as more pioneer species are introduced to the Fire Island dune's ecosystem. The vegetation, especially the *Ammophila breviligulata*, commonly known as American beach grass, was wiped out on some of the primary dunes, and the ecosystem had to rebuild itself, but man stepped in and accelerated the pace of this ecological succession (1).

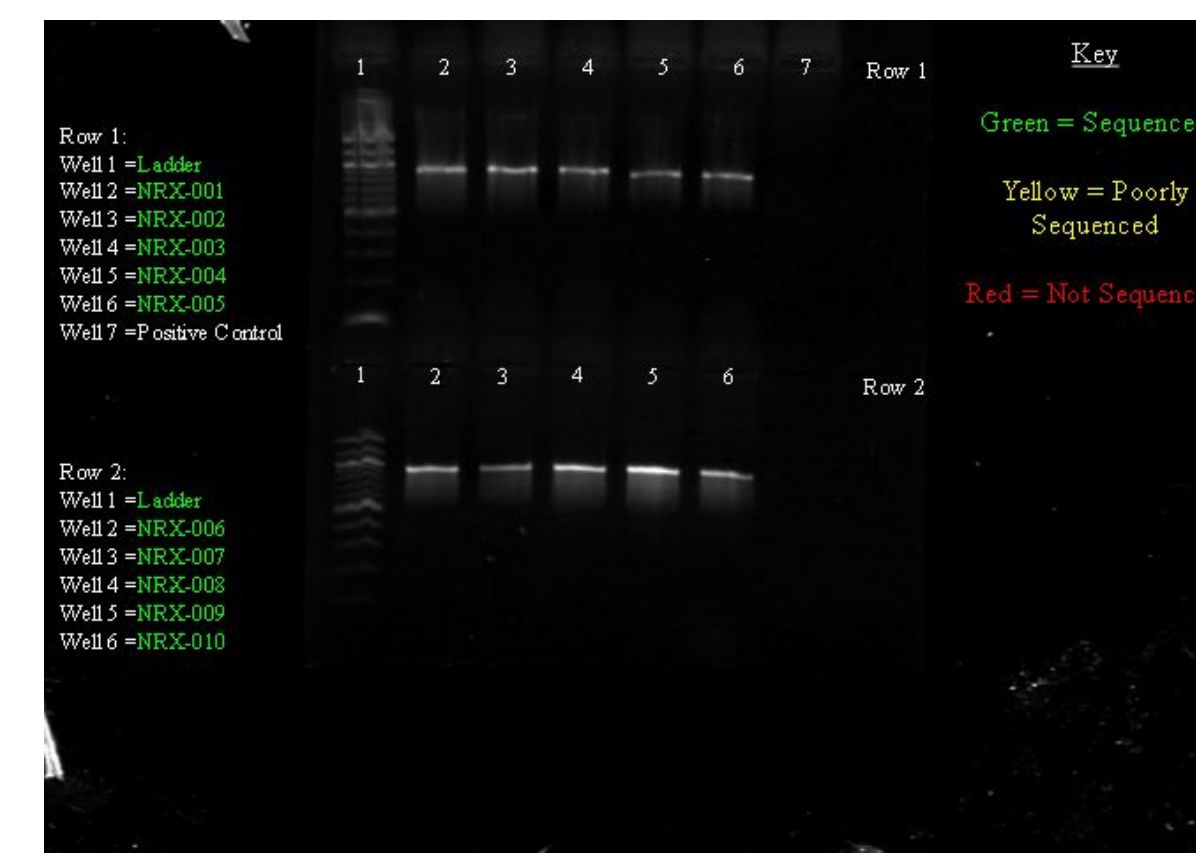


**Figure 1:** A- The sample picture of NRX-008 in the lab B- The sample in the wild on the non-rebuilt dune. C- The exact location in which the sample was collected

## Results



**Figure 2:** The ML phylogenetic tree with the sequenced *Ammophila breviligulata* compared to common species. The Fern- Dennstaedtiaceae served as the outgroup.



**Figure 3:** The gel with the extracted rbcL gene that underwent gel electrophoresis. This picture shows that all the sequences were good along with the positive control. The samples from this point on were all sequenced due to their band strength..

## Materials & Methods

The grass samples were collected from both the rebuilt and non rebuilt Fire Island dunes as well surrounding areas. There were from both the rebuilt and untouched dunes. The latitude and longitude of where the grass was sampled was recorded. The grass was sampled in the middle of October 2015, each with a single blade of grass from the *Ammophila breviligulata* plant. The collected grass samples remained in airtight ziploc bags to preserve them, then stored in Babylon High School laboratory freezer. The grass was analyzed in Cold Spring Harbor labs where the rebuilt and non-rebuilt dune plants' DNA was extracted. Equipment and materials were supplied by CSHL. The rbcL gene, which is a universal gene in the plant kingdom, was tested for presence. The rbcL gene underwent PCR with the help of CSHL. Once sequenced, the genetic sequences of the rebuilt dunes beach grass to the non-rebuilt dunes beach grass were compared. This showed if there is any significant genetic relationship between the rebuilt *Ammophila breviligulata* and the non rebuilt *Ammophila breviligulata*. The genetic structure of the native *Ammophila breviligulata* to related species were compared as well. This evidence shows a the genetic diversity of the grasses and will allow further investigation to the biodiversity and state of the dunes years after this natural disaster

## Discussion

The results proved our hypothesis correct. The DNA among all the plants was found to be very similar although some had very minute genetic differences which are exactly what we were looking for in the dune ecosystem. There were no genetic deviations between our samples, and hence shows the lack of biodiversity in the ecosystem. This lack of biodiversity is as a matter of fact not bad. The evidence shows that the dunes were undergoing ecological succession and shows that the grass acted as a pioneer organism for this rebuilding ecosystem. To continue this project, we would study the genetic similarities and diversities of various grasses in different dune areas.

## Resources

1. Fire Island National Seashore Short-term Community Storm Surge Protection Plan (2003) Retrieved from [http://www.nps.gov/fiis/learn/management/upload/EA\\_CommunityBeachProtection\\_6-3-03.pdf](http://www.nps.gov/fiis/learn/management/upload/EA_CommunityBeachProtection_6-3-03.pdf)
2. Fire Island's Plants (2015) Retrieved from <http://www.nps.gov/fiis/learn/nature/plants.htm>
3. Fire Island's Sand Dunes (2015) Retrieved from <http://www.nps.gov/fiis/learn/nature/sanddunes.htm>
4. Long Island Sound Habitat Restoration Initiative (2004) Retrieved from <http://www.longislandsoundstudy.net/wp-content/uploads/2004/12/Coastal-barriers-and-beaches.pdf>
5. Protecting your dunes from the next Sandy: Seaside Primary Dune Development-Northern Beach Grass Dune (2013) Retrieved From [http://www.fireislandsun.com/dunes\\_2013.html](http://www.fireislandsun.com/dunes_2013.html)