Biodiversity of Fungi in Coffin Woods

Massimiliano Devine, Rowan Shenoy, Vihaan Pranav

Abstract

The question being answered in this project is *How does the theory of island biogeography apply to the woods behind Portledge School?* In order to answer this question, we collected fungi from the middle of the woods, and the edge of a path. The fungi was brought back and put into the freezer to be sent off for DNA Barcoding. From these samples, it can be concluded that the Theory of Island Biogeography is inapplicable to the fungi in Coffin Woods.

Introduction

While walking through the woods, fungi was noticed everywhere. The places that sparked the most interest were the middle of the forest, and a path going through the forest. Intrigued, the question of, *How does the theory of island biogeography apply to the woods behind Portledge School (Coffin Woods)* came to mind? The theory of island biogeography (Wilson & MacArthur, 2001) describes how abiotic factors can have an effect on species diversity based on location. In this case, the goal was to find out the biodiversity of fungi on the path, compared to the middle of the woods with no human interaction.

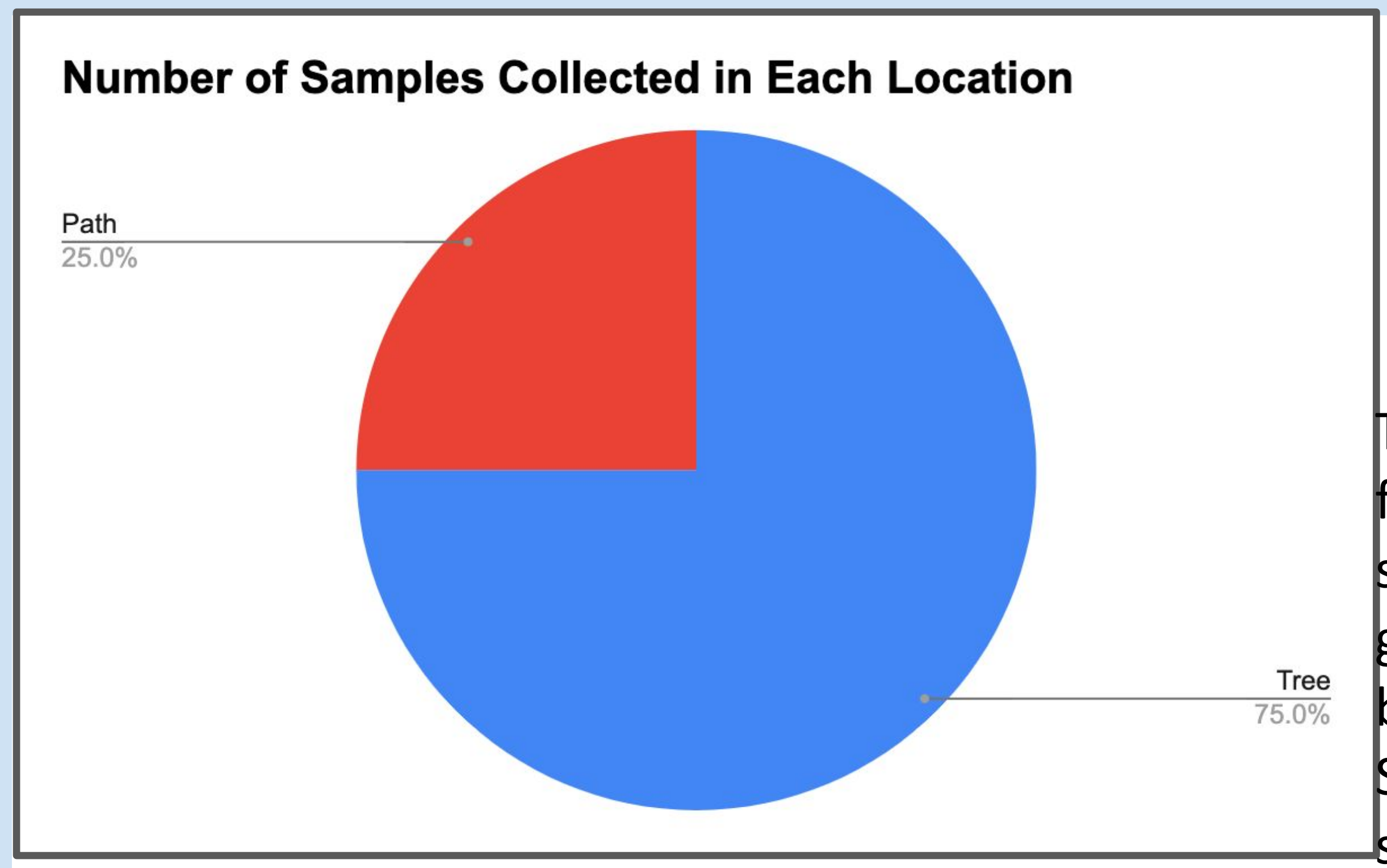
Methods & Hypothesis

The hypothesis of this experiment stated, there will be a difference in fungi biodiversity on the path compared to the deep woods. For this experiment, fungi samples were collected in Coffin Woods behind Portledge School. 13 samples were collected in the middle of the forest, and 7 were collected from the edge of a path. Using a sterilized knife, a small piece of fungi was cut and put in a container. The fungi were then put in a freezer at 0 degrees Celsius. DNA Barcoding was completed in three steps: the DNA was isolated using Chelex solution, PCR was done using the ITS primer and gel electrophoresis was conducted to assure the success of the isolation & amplification. The samples were then sent of for sequencing and DNA Subway was used to examine the sequences using bioinformatics analysis.

Results

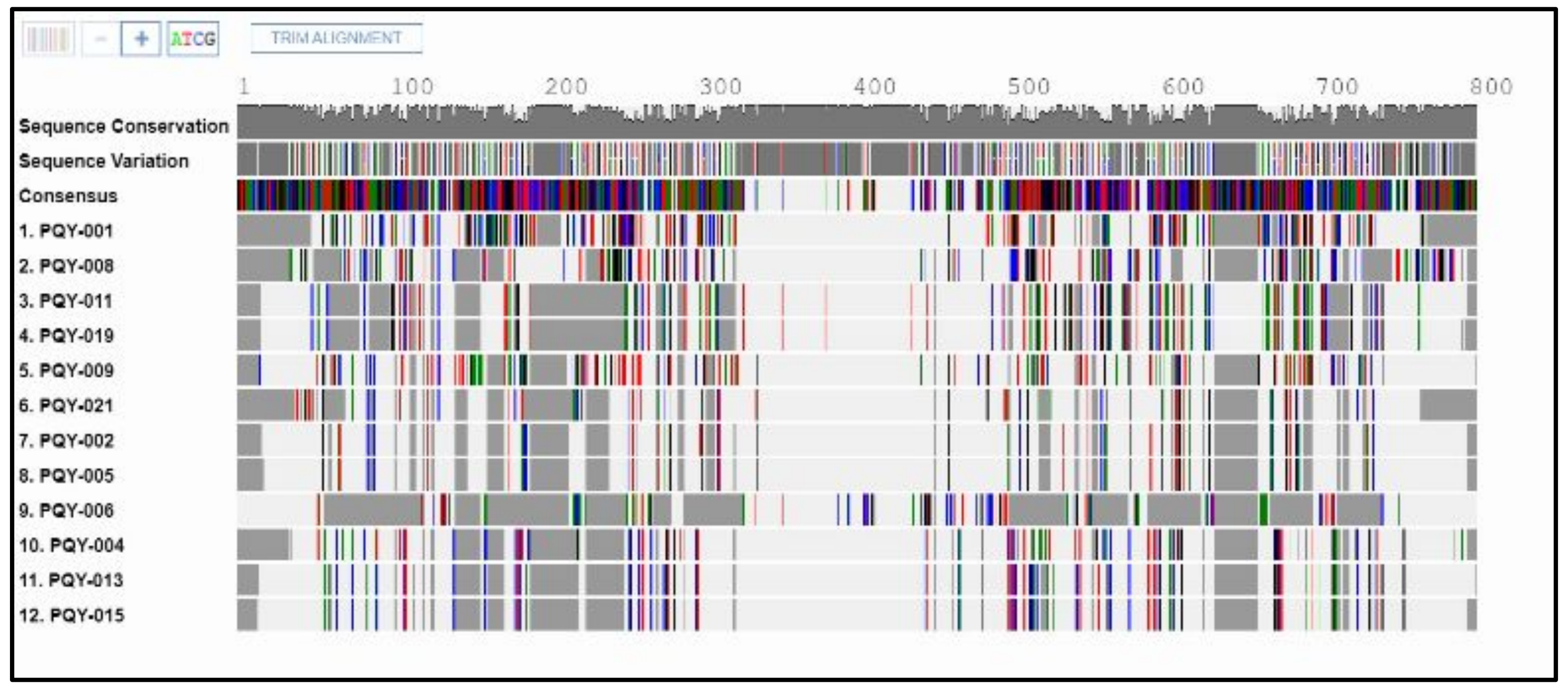
After barcoding our samples, the results showed that there was not a significant difference in biodiversity. Based on the phylogenetic trees produced in our experiment, there isn't a significant difference in species on paths and deeper in woods. Rather, there was more abundance of fungi in woods rather than on paths as seen on the pie chart. On the paths there weren't many places for fungi to grow thus the abundance of said fungi could have been significantly affected. Although this was the case, samples of *Stereum lobatum* came from opposite sides of the woods, but have the same DNA sequence. This is odd, but it shows that there wasn't a significant difference. As well as samples of *Cystofilobasidium capitatum* which also came from different places, but have the same DNA sequence. Both of these observations can be verified using the phylogenetic trees shown to the right.

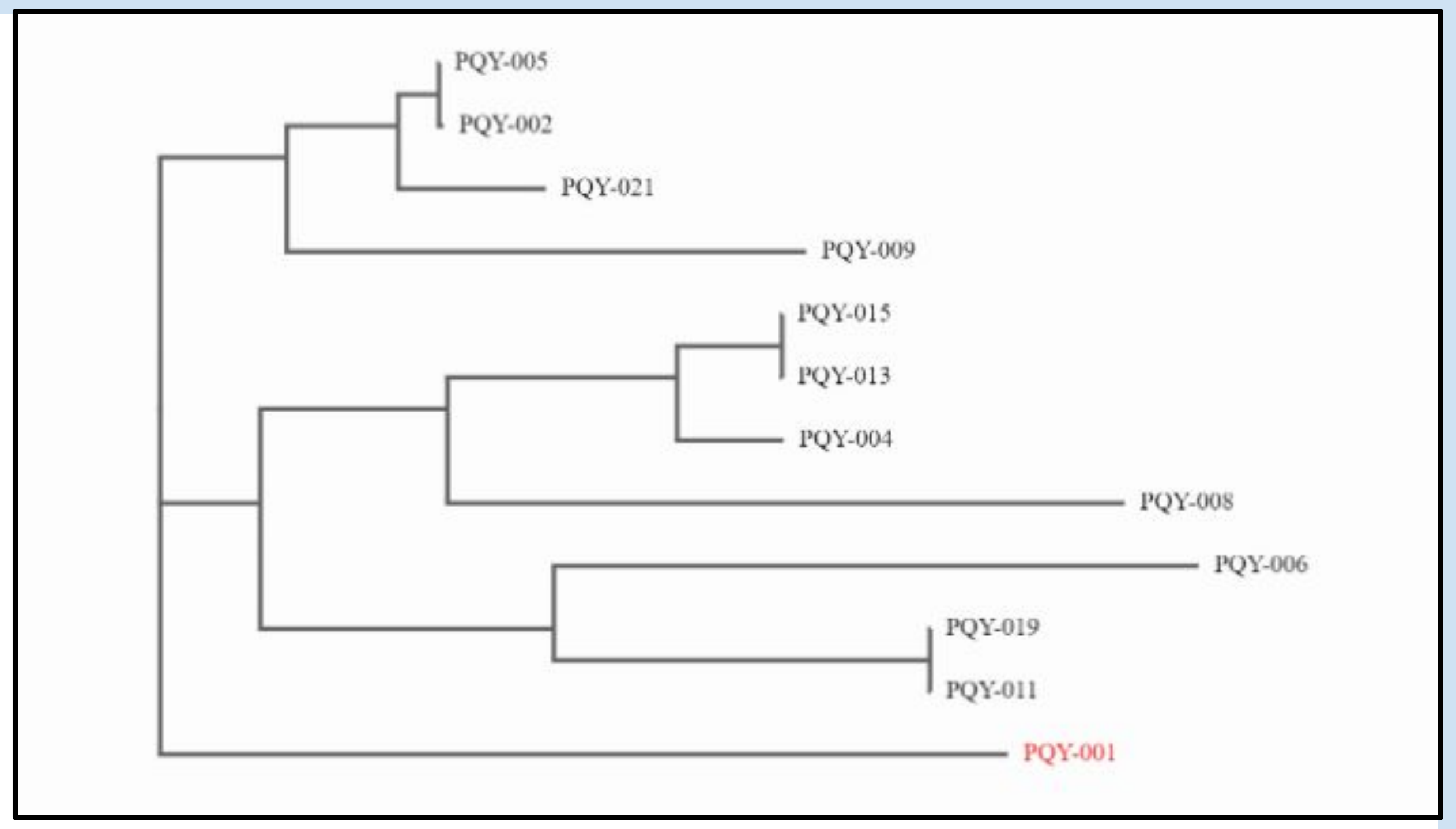
Data & Evidence



This pie chart above shows a graphical representation of the ratio of samples sequenced on a dead tree versus the number of samples sequenced on the side of a path. This made any trends not fully accurate since there is a small number of path fungi which were able to be sequenced.

The graph below is a representation of the frequency of different nucleotides. Most of the samples share nucleotides in spots. There are also grayed out areas suggesting that samples could not be sequenced in the same general areas. Specifically, samples 013 and 015 all have very similar sequences despite them being from different areas





This phylogenetic tree is further supporting that sequences, despite having different abiotic factors, are related. For example, samples 019 and 011 were taken from very different areas and they were one of the most closely related samples.

Discussion

The forests behind Portledge School are not considerably impacted by the Theory of Island Biogeography. This experiment would have needed to be conducted in a much larger area of the woods where the abiotic and biotic variables could have had a substantial impact on the biodiversity of the fungi on the edge vs deep in the woods in order to provide results that support the Theory of Island Biogeography. The places we collected our samples could've easily not been disturbed by humans enough and therefore, not have an effect on the diversity. The richness of fungal species was little different from the edge to the deep woods, despite the fact that we found less fungus on the edge of the woods close to the path. Due to unsuccessful PCR attempts or other aspects of the experiment, only 57% of the samples underwent genetic analysis. The experiment could be extended by going to a greater patch of woods and obtaining 20 samples at the woods' outermost edge and 20 samples at its center. More samples would make a difference because it would result in a more accurate final outcome that would more closely support the claim. This would also provide with more samples that have a successful PCR test. The outcomes of this study would probably be more in line with the Island Biogeography Theory and the experiment's hypothesis.

Acknowledgments and References

Christina Fernandez Marco provided us the materials needed to do PCR and other parts of the experiment
Carolyn Chiu taught, helped and mentored us throughout this experiment
The North Shore wildlife sanctuary allowed us to take samples from their forest to learn more about the fungal biodiversity
Portledge School provided us a place to learn and expand our knowledge upon this topic
Cold Spring Harbor DNALC provided us with a space to complete the experiment as well as letting us use their machinery

MacArthur, Robert H., and Edward O. Wilson. The theory of island biogeography. Vol. 1. Princeton university press, 2001.
"DNA Learning Center Barcoding 101." DNA Learning Center Barcoding 101, https://dnabarcoding101.org/symposium/details/1249. Accessed 31 October 2022.
DNA Subway: Fast Track to Gene Annotation and Genome Analysis, https://dnasubway.cyverse.org/project/browsemy. Accessed 7 March 2023