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Editorial

The purpose of the *Science and Technology Undergraduate Research Notes (SATURN) Journal* is to provide a venue for publication of undergraduate research. This research may include any novel findings of note while providing an opportunity for undergraduates to experience dissemination of their findings to the scientific community. Our goal is for the *SATURN Journal* to serve as both an educational and research tool. Each publication in this issue of the *SATURN Journal* has been reviewed by the professor for the course and by an outside scientist. Worthwhile data from embedded research in laboratory course curricula can be disseminated to the world community. By contributing their own novel findings for the greater good, students can be engaged in science through embedded research pedagogy more than through conventional pedagogy, and a source of large-scale cataloging information can be developed by many students contributing novel data.

The *SATURN J.* Tree Survey pedagogy is an ongoing, cost competitive method of including embedded research in a non-majors science course, and has been successfully implemented at SCCC since the Spring Semester of 2012. It easily fits into the curriculum of contemporary Principles of Biology non-major science courses. Also, it has evolved into an instructed, crowd sourcing method for research that can readily be adopted by other institutions. This pedagogy has the capacity to provide valuable and long-term undergraduate research experience nationwide. The *SATURN J.* began its' first issue with students from a Principles of Biology class at Suffolk County Community College (SCCC) in New York contributing their findings from a research project embedded in the laboratory curriculum. Specimens of each tree found on residential properties were brought to class. The species of each tree was identified by using a traditional dichotomous key. Students collaborated in groups to develop hypotheses based on the locations of the properties where the trees were found, the distribution of species, circumferences of trunks and population densities. The students followed the instructions for authors at the web site for the *SATURN Journal* (www.saturnjournal.org), and submitted their manuscripts to their instructor who acted as a peer reviewer. Those students whose manuscripts were accepted upon revision received a grade of "A" and were given extra credit for the revision and publication. This has been a cost-effective exercise that has resulted in enthusiastic student engagement, and is building a catalogue of the distribution of tree species on residential properties in Suffolk County, New York. There was also a publication in this issue by a group of students who were enrolled in a statistics course. They compared the growth rates of different cultivars of the American Elm (*Ulmus americana*) planted on campus at SCCC.

In the second issue of the *SATURN Journal* there was a continuation of student publications pertaining to the embedded research project analyzing tree species distribution. Students found it helpful to compare their findings to the findings of student investigators who have published previously in the *SATURN Journal*, which resulted in citations of previously published students. The second issue also contained publications from a research project embedded in a microbiology course from which students reported their findings from tests of the antimicrobial properties of spices.

In the third issue of *SATURN J.* there was continuation of the tree survey and studies on the antimicrobial properties of spices that produced publications in the previous journals. New publications compared findings to a larger battery of previously identified trees. Students used the web site from the United Stated Geological Survey (www.usgs.gov) to report the latitude and longitude of properties included in the studies. Additional web-based tools used by students included online dichotomous keys such as vTree at Virginia Tech located in Blacksburg, Virginia (http://dendro.cnre.vt.edu/dendrology/idit.htm).

The fourth issue of *SATURN J.* included an article published by students at Molloy College regarding

sweeteners and inflammation in macrophages, three additional articles from the microbiology course at SCCC, and a continuation of the *SATURN J.* tree survey. In addition, the abstracts from the MAY 2014 Northeast Regional Sigma Xi Conference held at SUNY Old Westbury were presented.
In the fifth issue of the *SATURN Journal* we presented an additional article from the microbiology course at SCCC that compares soil bacterial communities on Long Island, and multiple articles that continue the *SATURN J.* Tree Survey.

In the sixth issue of the *SATURN Journal* we presented additional articles from the microbiology course at SCCC that compares soil bacterial communities on Long Island. In addition, we presented two articles from students at Molloy College that test the effects of teratogens on *Planeria*. We present an article that is a statistical analysis of a 2016 presidential poll. We also presented multiple articles that compare soil composition, and multiple articles that continue the *SATURN J.* Tree Survey. Both are from a Principles of Biology course at SCCC.

In the seventh issue of the *SATURN Journal* we presented an additional article from a microbiology course at SCCC that compares soil bacterial communities on Long Island, an article that compares soil composition from a Chemistry course, and an article that is a statistical study of variables on opinions regarding voting preferences. We also presented multiple articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC.

In the eighth issue of the *SATURN Journal* we presented an article on the effect of carboplatin on tadpole and planarian regeneration, an article on the effects of dopamine and serotonin on bacterial growth, and an article that is a statistical study of variables on opinions of travel bans. We also presented multiple articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC.

In the ninth issue of the *SATURN Journal* we presented an article on the identification of a housekeeping gene for use in inflammatory studies, an article pertaining to the water quality of a lake in in a developing watershed in Minnesota, and an article that is a statistical study of variables on opinions regarding gun control. We also presented multiple articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC.

In the tenth issue of the *SATURN Journal*, we presented two articles authored by students in Ramsey Community College in Minnesota. One of these articles is a study on wildlife restoration, and the other is a water quality study. We also presented multiple articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC.

In the eleventh issue of the *SATURN Journal*, we presented a study of the distribution of hard-shelled ticks (*Ixodidae*) in preserves on Long Island, NY. We also present multiple additional articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC.
In the twelfth issue of the *SATURN Journal*, we presented a study of variants in the MC4R gene that could potentially contribute to obesity and weight gain from students at Molloy College in N.Y., a second study from students at Molloy College of the MC1R gene and ageing rate and potential skin carcinoma predispositions, and a DNA barcoding study of a dietary profile for the American Cliff Swallow from students at Moreno Valley College, CA. We also presented multiple additional articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC. Many of these articles were written by students taking classes during the pandemic, and all of the resources used to collect and analyze data were available for free online.

In this thirteenth issue of the *SATURN Journal*, we present a study of the FIGLA gene in humans that affects fertility from students at Molloy College in N.Y., a second study from students at Molloy College of the PPP4C gene and its involvement in autism, and SCCC student's study of a comparison of worm growth and reproduction between a compost pile and natural soil. We also present multiple additional articles that continue the *SATURN J.* Tree Survey from a Principles of Biology course at SCCC.

We encourage instructors to have their students participate in the *SATURN Journal.* The publications in the journal are a source of embedded research project designs that instructors may include in their curricula. The journal serves as a venue for dissemination of student research and a source for students to compare their work to the work of others. Instructors are welcome to design additional projects from which their students can submit manuscripts.

Louis Roccanova, Ph.D.
Editor in Chief *SATURN Journal*

Peer Review Policy:
Each article published in this issue of the *Science and Technology Undergraduate Research Notes (SATURN) Journal* has been reviewed by two professors from accredited colleges and universities in the United States at the invite of the Editor in Chief of the Journal.

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Deciduous Trees are Dominant to Coniferous Trees in Lakeland County Park, Islandia, New York

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Keywords: Deciduous, Coniferous, Native, Non-native, Taxonomy

Abstract:

Forty trees were identified by their species in two separate 10 x 10-meter areas in Lakeland County Park in Islandia, NY. The trees were identified by using the mobile application LeafSnap. In this location, it was found that deciduous trees were the most common types of trees when compared to coniferous trees. Out of the forty trees that were identified, the most common species was the Northern Red Oak (*Quercus rubra)*, a deciduous tree.

Introduction:

Taxonomy is referred to as the classification of organisms. A native plant is defined as one that has been a part of a particular region or ecosystem for hundreds or thousands of years. Only plants that have been in the United States before the arrival of European settlers are defined as native plants. (USDA 2021) A non-native plant is one that has been introduced by humans or other means into a new type of habitat where it was not previously known to be found. When non-native plants are introduced to areas where they are not native, they are unable to reproduce rapidly without additional assistance from humans. (USDA 2021)

The climate of Islandia is generally warm and temperate, with the annual temperature being around 11.8°C. In a whole year, the amount of rainfall is 122.3 cm. It is very dry in the month of July with 87 mm of rainfall, while the precipitation peaks in December with an average of 123 mm. The warmest month is July, with an average temperature of around 23.5°C while January is the coldest month of the year with an average temperature of 0.2°C. (climatedata.org 2021)

Deciduous trees are easily identified by their broad leaves and a larger surface area that allows them to maximize the amount of light that they absorb through photosynthesis. During autumn, the leaves tend to change colors such as orange, yellow, red, or brown, before they fall off the tree. Coniferous trees are identified by their needle like leaves and the shape helps to minimize water loss due to evaporation. Also, their leaves allow them to photosynthesize year-round and to survive in harsh environments. Coniferous trees are both waterproof and windproof. Unlike deciduous trees, they also keep their leaves during the colder parts of the year, such as autumn and winter. (Martin 2021)

Method:

Two separate 10 x 10-meter areas were chosen in Lakeland County Park in Islandia, NY in order to identify the species of trees that inhabited the area. The trees were identified using the mobile application “LeafSnap.” LeafSnap utilizes the phone’s camera in order to identify the species of tree in question. Once each tree was identified, the common name, scientific name, and circumference of the tree was recorded, as well as its status as native or non-native. (Leaf Snap 2021) A chi-square test of independence was utilized to see if there was a significant difference between deciduous trees and coniferous trees in the area. After the test was completed, the result of the experiment was recorded.

The latitude and longitude of the areas that were surveyed was found by using the mobile application “My GPS Coordinates.” This application allowed the researcher to immediately identify the

latitude and longitude of the area in question. Once the latitude and longitude of the two areas was found, it was recorded in the result section.

Results:

The tables below demonstrate the data collected. Table 1 includes the locations that were surveyed along with their respective latitude and longitude. Table 2 shows the number of trees found and identified in area 1. Table 2.1 shows the circumferences of the trees that correspond to the data in Table 2. Table 3 shows the number of trees found and identified in area 2. Table 3.1 shows the circumferences of the trees that correspond to the data in Table 3. Tables 2 & 3 demonstrate the species of tree that was identified by their common and scientific name, the amount found, their status as native or non-native, and whether they are deciduous or coniferous.

Table 1: Locations Surveyed

	Location #1	**Location #2**
Town	Islandia, NY	Islandia, NY
Coordinates	Latitude: 40.1425 Longitude: -73.1533	Latitude: 40.8017 Longitude: -73.1526
Number of Trees	20	20

Table 2: Tree Species Observed in Area #1

Common Name	**Scientific Name**	**Amount Found**	**Native Or Non-Native**	**Deciduous Or Coniferous**
White Pine	*Pinus strobus*	3	Native	Coniferous
Northern Red Oak	*Quercus rubra*	10	Native	Deciduous
Scarlet Oak	*Quercus coccinea*	2	Native	Deciduous
Pin Oak	*Quercus palustris*	1	Native	Deciduous
Eastern Spruce	*Picea rubens*	1	Native	Coniferous
Red Maple	*Acer rubrum*	1	Native	Deciduous
American Cherry	*Prunus serotina*	1	Native	Deciduous
Shumard Oak	*Quercus shumardii*	1	Non-Native	Deciduous

A total of twenty trees were identified by their species in Area #1. The deciduous trees were far more common than the coniferous trees in this area. 80% of the trees were deciduous, while 20% were coniferous. In addition, 95% of the trees that were found were native, while only 5% were non-native.

Table 2.1: Circumference of Trees found in Area #1

Species Name	**Scientific Name**	**Circumference**
White Pine	*Pinus strobus*	3.98 cm
White Pine	*Pinus strobus*	3.98 cm
White Pine	*Pinus strobus*	13.96 cm
Northern Red Oak	*Quercus rubra*	19.94 cm

Northern Red Oak	*Quercus rubra*	47.87 cm
Northern Red Oak	*Quercus rubra*	91.76 cm
Northern Red Oak	*Quercus rubra*	55.85 cm
Northern Red Oak	*Quercus rubra*	87.77 cm
Northern Red Oak	*Quercus rubra*	65.83 cm
Northern Red Oak	*Quercus rubra*	75. 80 cm
Northern Red Oak	*Quercus rubra*	121.68 cm
Northern Red Oak	*Quercus rubra*	131.66 cm
Northern Red Oak	*Quercus rubra*	17.95 cm
Scarlet Oak	*Quercus coccinea*	21.94 cm
Scarlet Oak	*Quercus coccinea*	19.94 cm
Pin Oak	*Quercus palustris*	75.80 cm
Eastern Spruce	*Picea rubens*	11.96 cm
Red Maple	*Acer rubrum*	49.87 cm
American Cherry	*Prunus serotina*	9.97 cm
Shumard Oak	*Quercus shumardii*	31.18 cm

Table 3: Tree Species Observed in Area #2

Common Name	**Scientific Name**	**Amount Found**	**Native Or Non-Native**	**Deciduous Or Coniferous**
Red Maple	*Acer rubrum*	3	Native	Deciduous
Northern Red Oak	*Quercus rubra*	3	Native	Deciduous
White Sassafras	*Sassafras albidum*	8	Native	Deciduous
White Pine	*Pinus strobus*	4	Native	Coniferous
Scarlet Oak	*Quercus coccinea*	1	Native	Deciduous
European Spindle	*Euonymus europaeus*	1	Non-Native	Deciduous

A total of twenty trees were identified by their species in Area #2. Once again, the deciduous trees were far more common than the coniferous trees. 80% of the trees were deciduous, while 20% of the trees were coniferous. In addition, 95% of the trees were native, while only 5% were non-native.

Table 3.1: Circumference of Trees found in Area #2

Tree Species	**Scientific Name**	**Circumference**
Red Maple	*Acer rubrum*	9.97 cm
Red Maple	*Acer rubrum*	29.92 cm
Red Maple	*Acer rubrum*	11.96 cm
Northern Red Oak	*Quercus rubra*	83.78 cm
Northern Red Oak	*Quercus rubra*	63.83 cm
Northern Red Oak	*Quercus rubra*	219.44 cm
White Sassafras	*Sassafras albidum*	3.98 cm

White Sassafras	*Sassafras albidum*	47.97 cm
White Sassafras	*Sassafras albidum*	7.97 cm
White Sassafras	*Sassafras albidum*	7.97 cm
White Sassafras	*Sassafras albidum*	7.97 cm
White Sassafras	*Sassafras albidum*	19.94 cm
White Sassafras	*Sassafras albidum*	5.98 cm
White Sassafras	*Sassafras albidum*	5.98 cm
White Pine	*Pinus strobus*	65.95 cm
White Pine	*Pinus strobus*	43.83 cm
White Pine	*Pinus strobus*	7.97 cm
White Pine	*Pinus strobus*	9.87 cm
Scarlet Oak	*Quercus coccinea*	129.66 cm
European Spindle	*Euonymus europaeus*	15.95 cm

A chi-square test of independence was also utilized to see if there was a significant difference between the circumference of the deciduous and coniferous trees that were identified. The median was found to be 20.94. Twenty deciduous trees were above the median and twelve were below the median. For coniferous trees, two were above the median and six were below the median. After applying the Chi Square formula to these statistics, a Chi-Square value of 3.63 was found. This was not quite significant at the five percent level of probability ($p < .05$).

Discussion:

This study showed that deciduous trees were more common than coniferous trees. In a study done by Bilbay et al (2019), it was found that coniferous trees were the most common type of tree in the towns of Brentwood, Selden, and Commack, with the most dominant species being the Pitch Pine (*Pinus rigida*) According to a study performed by Naru (2019), it was found that the large majority of trees that were found in the town of Bayshore were deciduous and native to the area, with the most common species being the Sugar Maple (*Acer sacharrium*) and the Norway Maple (*Acer platanoides*) Also, according to Castro et al (2018), it was determined that deciduous trees were the most common type of tree in West Babylon and Bayshore.

Conclusion:

Out of the forty total trees that were surveyed in Lakeland County Park in Islandia, NY, it was found that deciduous trees were the most common type of tree when compared to coniferous trees, and there were more native trees than non-native trees. It can therefore be said that deciduous trees are more common in this area than coniferous trees and there are more native trees that non-native trees.

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Native Trees are Dominant on a Residential Property in Amityville and Non-native Trees are Dominant in the Public Tanner Park in neighboring Copiague

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Keywords: Native, Non-native

Abstract:

Forty-three tree samples were surveyed from two properties, a residential property and a public park of Long Island, NY. Seventeen tree samples were surveyed from the residential property and twenty-six were surveyed from the public park. The most common tree was the White Pine (*Pinus strobus*) in the residential property, which is native to the United States. The most common tree in the public park was the Callery Pear (*Pyrus calleryana*). This species is not native of the United States.

Introduction:

This experiment was conducted in Suffolk County, NY to see the variety of tree species that grow within the zones. "Suffolk County is generally following a four-season weather pattern. Summer is hot, sunny, and humid, while winter is cold, often with snow. The hottest month of the year is July when the average highest temperature is around 82 degrees F (28 degrees C). The coldest month is usually January, when temperatures can drop to an average low temperature of 17 degrees F (-8 degrees C)" *(Hunter College 2021).* Although we have a variety of climates, such as harsh winter and summer in Suffolk County, local trees have adjusted over time to different natural impacts such as soil types and micro-climates. They tend to be more adjusted to developing neighborhood conditions and often require less inputs for effective foundation and can reduce maintenance (*Cornell*. 2019. *CCE Suffolk Long Island).*

In this experiment we found that most of the trees in the residential property were native to the United States. However, in the public park most of the trees were not native and the trees were also invasive. "Invasive plants are a significant problem in New York State, especially on Long Island. An invasive species is a plant or animal that is not native to an ecosystem having enormous potential to cause harm to it" *(Sullivan. J* 2021. *Save native plants).*

Method:

For this experiment, nine species were found on two properties located on Suffolk County, New York. One of the properties was a residential property in the town of Amityville, the other property was a public park called "Tanner Park" in the town of Copiague. Each tree species on the properties was identified using two dichotomous keys. The name of the dichotomous keys were Tree *Finder (Watts, 1998) and Winter Tree Finder (Watts 1970).*

For this experiment the latitude and longitude of both properties was also noted using an online geographic tool, Google Corporation *(Google Earth 2021)*. We got the latitude and longitude by entering the address of each property into the website. Google Earth automatically calculates the latitude and longitude of the address entered.

Results:

Table 1 Locations from where Sample of Trees were Collected.

	Location 1	**Location 2**
Town	Amityville, NY	Copiague, NY
Coordinates	Longitude- 40.72868 Latitude-73.25154	Longitude-40.6790 Latitude- 73.7171
Count of trees	17	26

Table 2 Trees found in the First Property.

Common Name	**Scientific Name**	**Amount Counted**	**Native or Non-native**	**Deciduous or Coniferous**
Red Oak	*Quercus rubra*	1	Native	Deciduous
White Pine	*Pinus strobus*	9	Native	Coniferous
Norway Maple	*Acer platinoids*	5	Non-native	Deciduous
Black Oak	*Quercus velutinid*	1	Native	Deciduous
Sugar maple	*Acer saccharum*	1	Native	Deciduous

A total of seven-teen trees were identified in the first property. Coniferous trees were dominant in the first property. The highest count of trees in the first property was the White Pine *(Pinus Strobes)* with the total of nine trees. We found that native species grew more in comparison to non-native species in the first property. The percentage of deciduous trees was 47% and the percentage of coniferous trees was 53%. The percentage of native trees was 71% and the percentage of non-native trees was 29%.

Table 3 Trees Found in the Second Property.

Common Name	**Scientific Name**	**Amount Counted**	**Type (Native or Non-Native)**	**Type (Deciduous or Coniferous)**
European larch	*Larix decidua*	4	Non-native	Deciduous
Callery pear	*Pyrus calleryana*	10	Non-native	Deciduous
Cluster Pine	*Pinus pinaster*	3	Non-native	Coniferous
Silver maple	*Acer saccharinum*	2	Native	Deciduous
Norway maple	*Acer platanoides*	7	Non-native	Deciduous

On property two, twenty-six trees were observed in total. Twenty-three of them were deciduous and three of them were coniferous. The highest count was Callery Pear *(Pyrus calleryana*) with the total of ten trees. According to the experiment we found that non-native trees were significantly higher in number with comparison with the native trees. The percentage of deciduous trees was 88% and the percentage of coniferous trees was 12%. The percentage of native trees was 8% and the percentage of non-native trees was 92%.

Table 4 Chi-Square

	Residential	Tanner Park
Native	12	2
Non-native	5	24
Total number of trees	17	26

A chi-square test of independence was done using a two-by-two contingency table and it found that the ratio of non-native trees was significantly higher in Tanner Park compared to the ratio of non-native trees in the residential property at the 0.001 level of probability. (Chi-squared equal 18.52).

Discussion:

In this experiment, the deciduous trees were found to be more dominant in the town of Amityville and Copiague, located in Suffolk County. Another experiment by Castro and Rovelo (2018) surveyed an area in Suffolk County called West Babylon and found the same results that were found in Amityville and Copiague. In the experiment they found that the deciduous trees were dominant compared to the coniferous trees in their respected area located in Suffolk County. There were some similarities in both of our results which included finding the same species of trees including the Sugar Maple, Norway Maple, and White Pine. All these trees were found in both experiments.

It was found that there were more non-native trees in Copiague than in Amityville. Of the species found in Amityville most of them were native to Long Island, the Red Oak *(Quercus rubra)*, White Pine *(Pinus strobes),* Black Oak *(Quercus velutinid),* and Sugar maple *(Acer saccharum)*. The only native species found in Copiague was the Silver Maple *(Acer saccharinum)*. The non-native trees were the European larch (Larix decidua), Callery pear (Pyrus calleryana), Cluster Pine (Pinus pinaster), and Norway maple *(Acer platanoides).* Native trees versus non-native trees was determined using the Watts (1991) manual.

This experiment was interesting because some species of trees that are non-native to the United State can be found in different areas of Long Island. The Norway Maple *(Acer platanoides)* is an example of a tree that is non-native to the United States, but it can be found in the residential property as well in the public park. Another experiment by Lasot et al. (2017), also found that the Norway Maple (Acer platanoides) can be found on the South Shore of Long Island. The experiment was conducted by Lasot et al. (2017), both experiments showed similar findings when it comes to the dominance of non-native trees growing on Long Island, despite the experiment being conducted in separate locations.

This experiment was conducted in two different properties of Suffolk County, NY. One residential property in the town of Amityville and the other in a public park called “Tanner Park” in the town of Copiague. In the public park was found that deciduous trees were dominant in the area. Another experiment by *(Biscaro et al. 2018)* and *(Castro Rovelo. 2018)* They also found that deciduous trees were dominant in Suffolk County, NY. However, in the second property in the public park located in the town of Copiague, most of the trees were coniferous. Another experiment was carried out by *(Ohanian and Borah. 2018)*. They found that coniferous trees were dominant in Suffolk County in the town of Deer Park.

Conclusion:

Two properties were surveyed in Suffolk County, NY. One of the properties was a residential property in the town of Amityville and the other property was a public park called “Tanner Park” in the town of Copiague. In the residential property of Amityville, seventeen trees were identified as native trees and

were dominant. On the second property, the public park located in the town of Copiague, it was found that non-native trees were dominant.

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Genotyping Assay of the gene Protein Phosphatase Protein 4 Catalytic Subunit or PPP4C

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Key Words: Autism, PPP4C, Assay, Single Nucleotide Polymorphism, Isoleucine, Methionine

Abstract:

Many genomic locations have been linked to autism spectrum disorder (ASD). Mutations in certain genes may raise the likelihood of autism (Thapar et al., 2021). A mutation in the gene PPP4C can contribute to autism (Kumar et al., 2008). Genotyping compares a DNA sequence to that of another sample or a reference sequence to discover differences in the genome. It can detect single-nucleotide polymorphisms (SNPs), which are the most prevalent type of genetic variation in humans (Malkki et al. 2012). The mutant form of a gene can be examined and contrasted to the normal copy of the gene using an assay and determine whether an individual has a variant that is pathogenic, damaged, or benign. The PPP4C SNP we investigated is rs1170553626. The University of California Santa Cruz (UCSC) genome browser was used to study the protein sequence of PPP4C. Other resources including Polyphen-2 were used to determine that this SNP is damaging. Primer 3 was used to assist in identifying the primers in the SNP in order to create the genotyping assay. This SNP involved an amino acid change from Isoleucine to Methionine. Amino acid changes can have a big impact on a protein's function, which may potentially lead to a change in phenotype and can be pathogenic at times.

Introduction:

Autism Spectrum Disorder is a developmental neurological disorder that affects 75 million people in the world (CDC 2021). Autism is an umbrella term for an array of different symptoms and behaviors. Typical phenotypes associated with autism are trouble with eye contact and communicating, repetitive behaviors and motor delay. A major contributor to neurological disorders such as autism are copy number variations or CNVs. A CNV is when the number of copies of a gene varies from individual to individual. 16p11.2 is a CNV located at the 16th chromosome in the p 11.2 region. This can be a microdeletion or microduplication, meaning there can be less copies or extra copies. Autism is associated with microdeletions of 16p11.2 (Kumar, 2008). When the region is deleted, all of the genes on the location are also deleted. Protein phosphatase 4 catalytic subunit or PPP4C is a gene located within 16p11.2. It is found in the cytoskeleton and the nucleus of a cell (Uniprot Consortium 2021). This gene is involved in microtubule organization at centrosomes, TNF-alpha signaling, DNA repair, regulation of histone acetylation, cell migration and many more processes (STRING). PPP4C is very important in development and DNA regulation. In the development of the brain cells, any delays can lead to developmental disorders such as autism. Since PPP4C is so crucial in the duplication and communication of cells, a mutation could be a potential cause for autism. Using the University of California, Santa Cruz (UCSC) Genome Browser, there are many SNPs, single nucleotide polymorphisms, that can be identified. Missense mutations are mutations where the change in nucleotide completely changes the amino acid that is coded for. The SNP rs1170553626 is a missence mutation that changes the 11th amino acid residue from Isoleucine to Methionine. Isoleucine and Methionine differ structurally due to the lack of CH3 in Methionine and the addition of sulfur. This change may increase the likelihood of the formation of disulfide bonds, thereby changing the secondary structure of PPP4C. By creating a genotyping assay for rs1170553626 assay, the mutated version of the gene can be identified. With this information, the effects of this mutation can be correlated to phenotype.

Methods:

The following sequence of bioinformatics tools were used to create a genotyping assay for the SNP rs1170553626 (C/G) in the PPP4C gene. The University of California Santa Cruz (UCSC) Genome Browser was used to find the DNA sequence, the protein sequence of PPP4C, and the level of the conservancy of the SNP across the species (https://genome.ucsc.edu/). The Dec. 2013 (GRCh38/hg38) genome was used to gather this information. The National Center for Biotechnology Information (NCBI) server dbSNP was then used (https://www.ncbi.nlm.nih.gov) to pinpoint all of the SNPs associated with the PPP4C gene, and to specifically locate an exon SNP, given that exons are expressed over introns. Polyphen 2 (http://genetics.bwh.harvard.edu/pph2/) was used to determine which of the exons SNPs were considered deleterious. Ultimately an SNP labeled as "probably damaging" was used as no PPP4C SNP's were labeled as deleterious (refer to Table 1). Next, the New England Biolabs (NEBCutter) (http://nc2.neb.com/NEBcutter2/) was used to locate the restriction enzyme and where it will cut the SNP. After, Primer 3 (https://bioinfo.ut.ee/primer3-0.4.0/) was used to identify the primers in the SNP to assist in creating the genotyping assay. After running the gel electrophoresis, further investigation was conducted to determine why the SNP is pathogenic. Phyre 2 (http://www.sbg.bio.ic.ac.uk/phyre2/html/page.cgi?id=index) was used to predict the structure of the protein and its functions and mutations. Next, MusiteDEEP (https://www.musite.net/) was used to determine if the SNP contained any post-translational modifications. Lastly, MUTPRED2 (http://mutpred.mutdb.org/) was used to predict the probability of pathogenicity in the SNP.

Bench work Protocol:

The polymerase chain reaction (PCR) protocol from Qiagen (Venlo, Netherlands) was used. This protocol calls for 100ul reaction of Qiagen Master Mix, 10ul CoralLoad PCR buffer, 0.5 ul Primer A, 0.5 ul Primer B, 0.5 ul genomics DNA at 2.5 units/reaction. The primer sequence TCGAGCAGCTGCGTCGCT was used for the procedure. Using a thermocycler, the PCR was run at 94°C for 3 min for the initial denaturation, 25- 35 cycles of (94°C for 0.5- 1 min, 50-68°C for 0.5- 1 min, and 72°C for 1 min) followed by a 72°C for 10 min and a 2-8°C hold. The restriction enzyme (Taq1) protocol is from Thermo Fisher Scientific (Waltham, MA). The Protocol for Digestion of PCR Products Directly after Amplification was followed. Using gel electrophoresis, the samples were run on a 3% agarose gel for 45 minutes at 120mV under low power at 65°C, which is the reaction temperature for Taq1.

Following this investigation, the effects of the conversion of Isoleucine to Methionine were further researched. The sulfur-containing methionine was researched in relation to other sulfur-containing amino acids found around it to determine how pathogenicity is facilitated through the disulfide bonds formed.

Results:

Table 1 presents the organization of the potential SNPs and PolyPhen results and the identification of the most deleterious one. The PolyPhen results found that rs1170553626 as predicted is likely to be damaging (Figure 1). After PCR amplification of the fragment in question the restriction enzyme Taq1 was chosen due to its cleaving site within the fragment (Figure 2). The gel electrophoresis prediction would give a band at 74 base pairs (bp) if there were no mutation. If the SNP rs1170553626 was present there would be two bands, one at 48bp, and one at 27bp due to cleavage by Taq1 (Figure 3). We further analyzed the functional consequences of the variation. Phyre 2 was used to compare the wild type protein sequence of PPP4C to one with the rs1170553626 SNP, which yielded no visible change to the secondary structure of the protein. (Figures 4.1, 4.2). MusiteDeep was used to identify that there were no post translational modifications due to rs1170553626 (Figure 5), and

MutPred2 found a gain of intrinsic disorder associated with the mutation (p=0.007) (Figure 6).

Table 1 Compilation of various results from Polyphen-2 for SNPS within PPP4C. Using this data rs1170553626 was chosen by the group.

SNP	Missense	Deleterious?
rs1170553626 C--> G	Ile11Met	1.00 Probably Damaging
rs1477781465 A→ G	Ser5Gly	Benin .003
rs768077357 A→ G	Asn76Ser	Benin .178
rs768077357 A→ G	Asn76 Thr	Benin .273
rs7544724417 C → T	Arg103Cys	Probably Damaging 1.00
rs1469723246 C→ T	Thr93Met	Probably Damaging .998
rs1194304200 T → A	Leu98Gln	Probably Damaging .999
rs1279364638 C → G	Leu100Val	Possibly Damaging .683

Figure 1 Results from Polyphen-2 for rs1170553626.

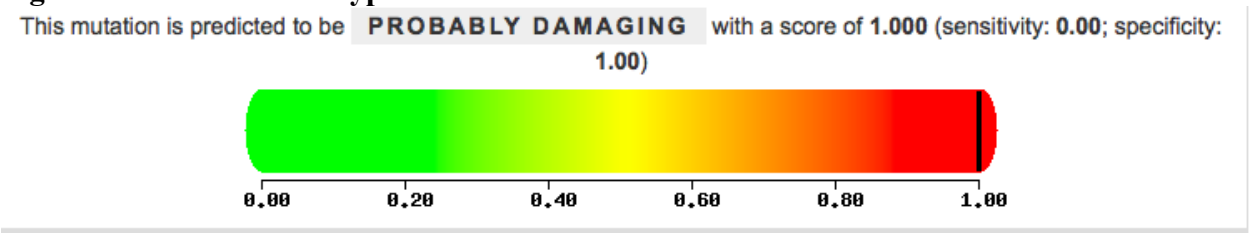

Figure 2 Restriction enzyme cleaving site.

TaqI
5'... T*CGA ... 3'
3'... AGC*T... 5'

Figure 3 Gel Electrophoresis Prediction

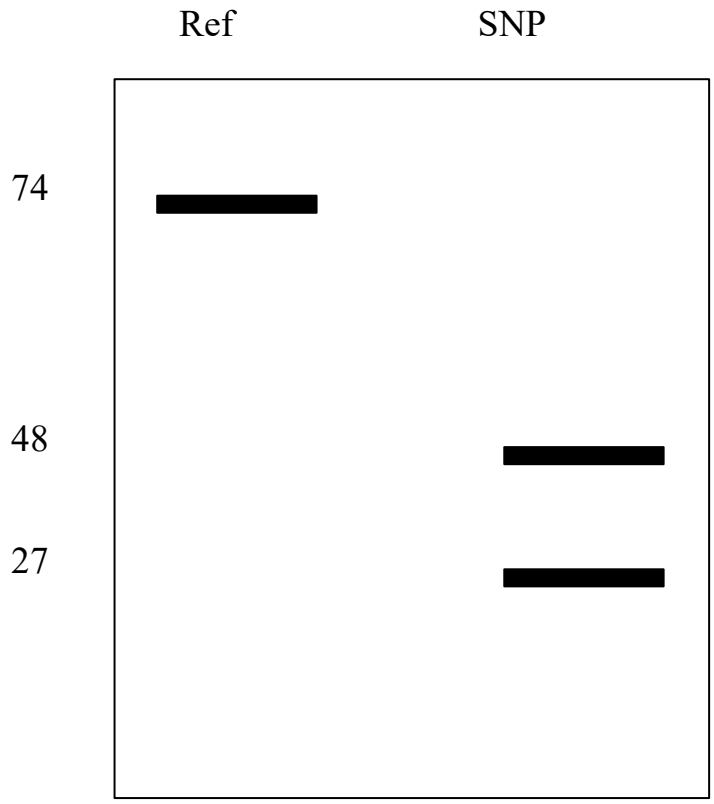

Figure 4.1 Phyre2 Wild Type PPP4C Result

Figure 4.2 Phyre2 Mutation PPP4C Result

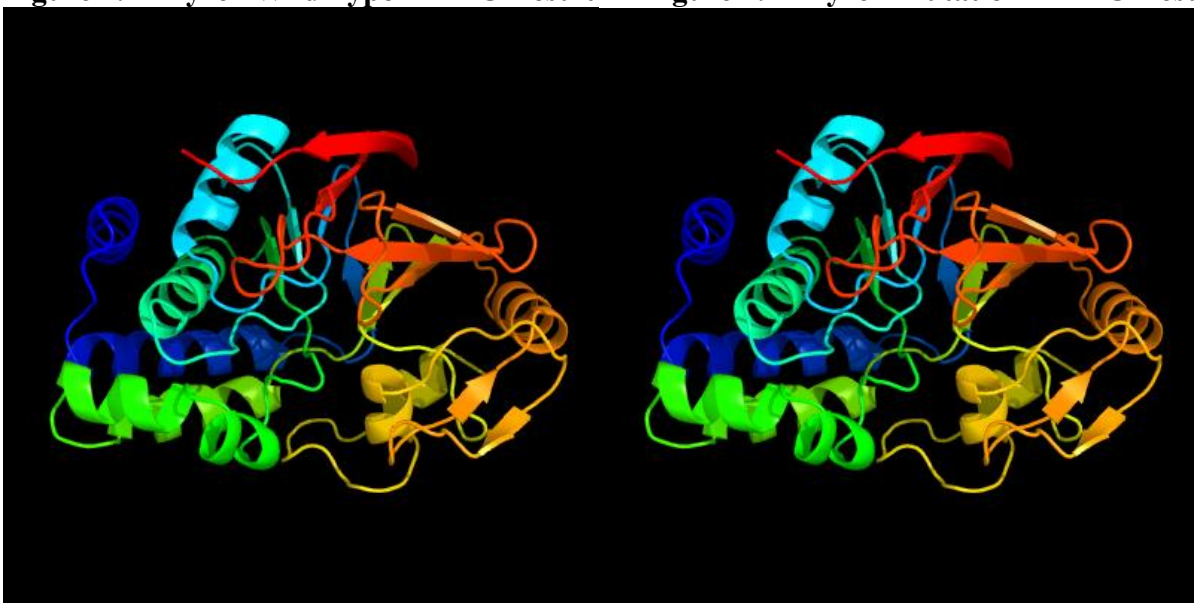

Figure 5 MusiteDeep Post-translational Results

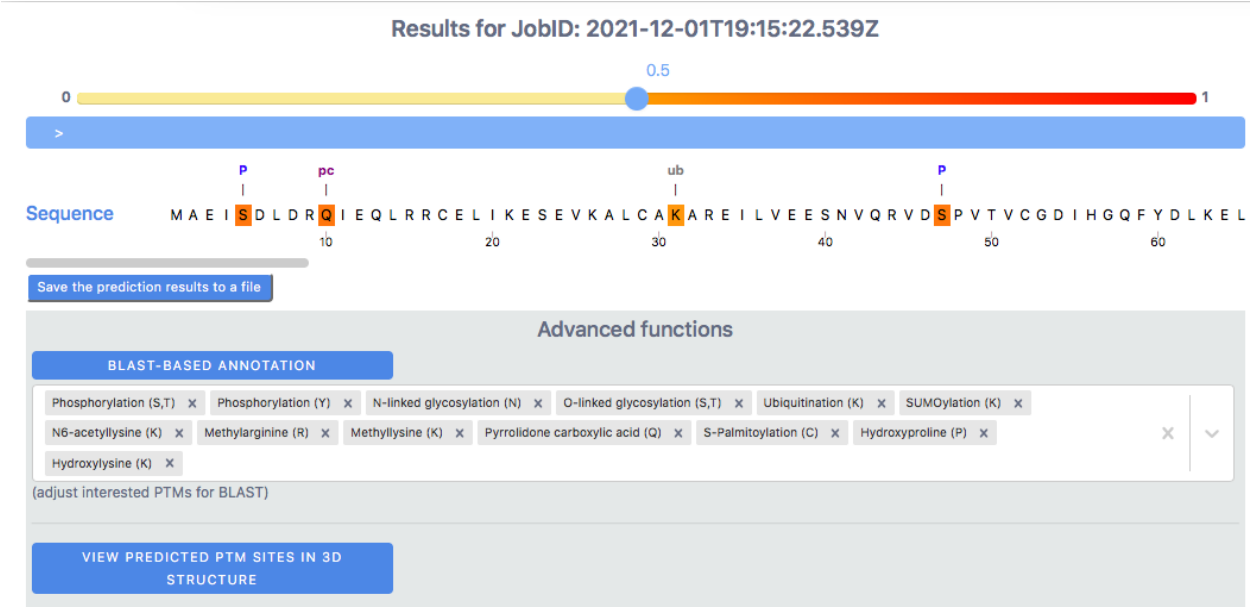

Figure 6 MutPred2 Results

ID	Substitution	MutPred2 score	Remarks	Affected PROSITE and ELM Motifs
PPP4C	I11M	0.683	-	None
Molecular mechanisms with P-values <= 0.05			**Probability**	**P-value**
Gain of Intrinsic disorder			0.41	7.0e-03
Altered Disordered interface			0.33	0.01
Altered Coiled coil			0.11	0.04

Discussion and Conclusion:

The genomic assays used in this study facilitated the identification of the deleterious SNP, rs 1170553626, on the gene PPP4C, in Autism Spectrum Disorder. The consequence of this variation at the molecular level is the induced amino change from methionine to isoleucine. The region where the microdeletion occurs of 16p11.2 can be associated with behaviors presented in ASD patients such as speech delay and other communication and neurological development disorders. Although this mutated gene appears to be low in the frequency of a population, useful knowledge can be drawn from the research conducted on these unique cases. By sequencing an individual's entire genome, genomic assays can offer many benefits to the general population including assisting families with monitoring their health and improving how they went about the activities in their daily lives. Genomic sequencing enables a pathway to determine specific and effective treatment needed by the patient with a complete family history. Using our genotyping assay on individuals with 16p11.2 can further determine a correlation between genotype of PPP4C and phenotype. Sequencing along with genotyping provides better insight into the severity of the disorder as well as the patient's strong suits and vice versa.

Moreover, with the advances in medical technology, genomic assays are useful for uncovering possible causes of ASD and discovering other potentially efficient therapeutic treatments that can be utilized for future case scenarios.

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Holly Trees and White Oak Trees are Dominant Tree Species in Kings Park, Suffolk County, New York

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Keywords: Holly trees, White Oak trees, Suffolk County, Kings Park, Deciduous, Coniferous

Abstract:

Forty-three trees were surveyed in a residential area in Kings Park, New York. These trees were identified using dichotomous keys. It was discovered that 13.95% of these trees were Holly trees (*Ilex aquifolium)* and 11.62% of these trees were White Oak trees (*Quercas alba).* Holly trees and White Oak trees are dominant tree species in this survey. It was also discovered that deciduous trees are also dominant in Kings Park, with 73.9% of species discovered being deciduous species and only 26.1% being coniferous species.

Introduction:

Kings Park, New York is located at approximately (40° 53' 11.39" N -73° 14' 19.80" W) according to Earth Explorer (USGS 2022). It is located on the north shore of Long Island, New York and is listed under the township of Smithtown, New York, in Suffolk County, New York.

According to The New York Water Science Center (2017), the majority of Long island is a flat landscape, however additional features of Long Island's topography include, the two lines of hills that form the "backbone" and the "forks" of the island, the gently sloping plain that extends southward from the hills, the deeply eroded headlands along the north shore, and the barrier beaches along the south shore. The present landforms of Long Island are the result of many geologic processes, some of which began many millions of years ago and some of which began only recently. Most of the major features of the present-day topography, however, are related to the last glaciation, which ended approximately 22,000 years ago. The eroded headlands along the north shore are composed mainly of glacial deposits, but streams and waves sculptured their final form. After the ice sheets retreated northward, the land surface of Long Island rose slightly (rebounded) with respect to sea level. The headlands were deeply eroded, and the many wide and deep harbors along the north shore were carved by northward-flowing streams. Wave erosion has steepened the northern slopes of the headlands into nearly vertical bluffs that, in places, are about 30.48 meters high. Kings Park is located on the north shore meaning along with mostly flat landscapes there are deeply eroded headlands. The area from which this sample was taken is mainly flat land. The soil on the north shore is mainly rocky and sandy but still sustainable to large autotrophic ecosystems. The temperature and climate on Long island consists of hot humid summers and cold windy winters, along with neutral falls and springs. The average temperature ranges between -5 degrees Celsius during the winter to 27.2 degrees Celsius during the summer. During the time this study was conducted the temperature was at an average of 3.9 degrees Celsius, according to Weather spark (2016).

Methods:

Forty-three tree branch and bush specimens were collected from a residential area in Kings Park, (40.87691879272461, -73.26676177978516, altitude 47 meters) according to Earth

Explorer (USGS 2022). These 43 samples consisted of branches, stems, buds, leaves, and flowers from different plants. The samples consisting of branches or stems were all about 7-15 Centimeters in height, samples of leaves consisted of one leaf as were buds, flowers and seeds. These samples were picked from every tree and bush on the property. Each plant within the property line was collected within a sample and surveyed. The property surveyed is 1335.46 Square Meters of land. Each tree and bush sample were chosen at random in no specific order according to species. Each sample was then brought into the lab for analysis. Dichotomous keys were used to identify these specimens. The samples were observed for visible characteristics, including shapes sizes, color, and texture. The stems, leaves, buds, branches, flowers, and seeds of these specimens were all examined to correctly identify the species. Dichotomous keys were used to identify the tree species, the dichotomous keys used include Eastern Trees by George A. Petrides and Janet Wehr (1998), Tree finder by May Theilgaard Watts (1998), Winter Tree Finder by May Theilgaard Watts and Tom Watts (1998), The National Audubon Society's Field Guide to Trees, western region by Elbert L. Little and Alfred A. Knopf (1980), and lastly The Shrub Identification Book by George W. D. Symonds (1973). Even though all can be considered trees, bushes have slightly different characteristics. The samples were observed carefully and identified using a taxonomy system to identify the genus and species name of all trees. For example, starting with the basic shape of a branch, to its texture, to the type of buds it possesses, to its bark color, and so on until a species was identified. The species name and quantity of how many of each species was collected was then recorded and analyzed further for any trends or patterns.

Results:

Table 1 lists all samples that were collected and identified using the dichotomous keys. This table also shows different specifications on each sample identified. Proceeding horizontally across the columns, column one identifies the commonly referred to name of each sample collected, column two identifies the scientific name or genus species name of each sample, and the third column identifies how many samples were collected per species, the fourth lists whether the sample collected is a coniferous or deciduous species, the fifth lists the circumference measured of all of the tree trunks from which each sample was taken. All were collected at the same location. The species in this table are sorted by the number of samples collected from greatest to least, as well as dominance and occurrence in this area.

Table 2 shows that there is no significant difference in the circumferences of deciduous and coniferous tree trunks measured according to the Chi-square Test of Independence.

Table 1: All Species Samples Collected

Sampled in-Kings Park Area (40° 53' 11.39" N -73° 14' 19.80" W) (40.87691879272461, -73.26676177978516, altitude 47 meters)

Common Name	Scientific Name	Samples	Category	Circumference
Holly	*Ilex aquifolium*	6	Deciduous	38.1 cm
White oak	*Quercas alba*	5	Deciduous	58.42 cm
Arbor vitae	*Thuja occidentalis*	4	Coniferous	7.62 cm
Red maple	*Acer rubrum*	4	Deciduous	81.28 cm
Black spruce	*Picea mariana*	3	Coniferous	29.21 cm
Chestnut oak	*Quercus prinus*	2	Deciduous	175.26 cm
Flowering dogwood	*Cornus florida*	2	Deciduous	34.036 cm

Fraser fir	*Abies fraseri*	2	Coniferous	57.15 cm
Canadian serviceberry	*Amelanchier canadensis*	1	Deciduous	39.37 cm
White willow	*Salix alba*	1	Deciduous	20.32 cm
Weeping willow	*Salix babylonica*	1	Deciduous	15.24 cm
Big- toothed aspen	*Populus grandidentata*	1	Deciduous	58.42 cm
Sycamore Maple	*Acer pseudo- platonus*	1	Deciduous	307.34 cm
Marsh blazing star	*Liatris spicata*	1	Deciduous	27.49 cm
Bald cypress	*Taxodium distichum*	1	Deciduous	99.06 cm
Chestnut	*Castanea dentata*	1	Deciduous	86.36 cm
Staghorn sumac	*Rhus typhina*	1	Deciduous	10.16 cm
Eastern red cedar	*Juniperus virginiana*	1	Coniferous	58.42 cm
Red oak	*Quercus rubra*	1	Deciduous	72.39 cm
Eastern hemlock	*Tsuga canadensis*	1	Coniferous	205.74 cm
Pitch pine	*Pinus rigida.p.mill*	1	Coniferous	30.48 cm
Pin oak	*Quercus palustris*	1	Deciduous	35.56 cm
Gray birch	*Betula populifolia*	1	Deciduous	39.37 cm

Table 2: Difference in circumference between deciduous and coniferous

Above or below mean diameter of 69.01cm	**Coniferous**	**Deciduous**
Above	A **1**	B **6**
Below	**C** **5**	D **11**

$$\chi^2 = \frac{(AD - BC)^2 (A + B + C + D)}{(A+C)(B+D)(A+B)(C+D)}$$

$$\chi^2 = 0.7268$$

Discussion:

Holly trees (*Ilex aquifolium)* are deciduous trees that are not native to Long Island. They are brought here from the southeast United States, from southern Pennsylvania to Florida. White Oak trees (*Quercas alba)* are deciduous trees, native to Long Island, according to the Chesapeake Bay Science Program (2022). In this experiment Holly trees (*Ilex aquifolium)* and White Oak trees (*Quercas alba)* were found to be most dominant and they are also both deciduous. According to Denzler and Bertone dos Santos (2021), White oak trees were found to be the dominant tree species of West Islip, New York. In their experiment 71% of trees surveyed in West Islip were White Oak trees (*Quercas alba)*. However, according to Bethsaida and Abarca (2021), Red Cedar Trees as well as Linden Trees were found to be the most dominant species on Long Island. In this experiment some red cedar trees were found as well. According to Zimbelmann and Reyes (2021), Maple trees were found to be dominant on the north shore of Long Island, however their study found 8.93% of all trees were Maple whereas in this study Maple trees were 9.3% of all trees surveyed.

Conclusion:

According to the identification of each sample taken from this area, Holly trees (*Ilex aquifolium)* as well as White Oak trees (*Quercas alba)* are dominant species in Kings Park, New York. Out of the forty-three samples collected six of them were identified as Holly trees (*Ilex aquifolium)* and five out of the forty-three samples were identified as White Oak trees (*Quercas alba).* These two species had the highest number of samples found on the property where this experiment was conducted. It was also observed that Arborvitae trees (*Thuja occidentalis)* were a very common species found in this area as well as Red Maple Trees (*Acer rubrum*). Four samples were identified as Arbor vitae trees (*Thuja occidentalis),* and Four samples were also identified to be Red Maple Trees (*Acer rubrum*). These two species are more commonly found than most surveyed in this experiment, however they were not as dominant or frequent as Holly trees and White Oak trees. The other more common species were identified as Black spruce (*Picea mariana),* which had three samples as well as Chestnut oak (*Quercus prinus)*, Flowering Dogwood (*Cornus florida),* and Fraser fir (*Abies fraseri)* which all had two samples. The rest of the samples were all each a different species. It was discovered that 13.95% of all trees sampled were Holly trees (*Ilex aquifolium)* and 11.62% of all trees sampled were White Oak trees (*Quercas alba),* while the other species were 9.3%, 6.97%, 4.6% or 2.32% of all trees sampled. It was also discovered that deciduous trees are also most dominant in Kings Park, with 73.9% of the species of trees discovered being deciduous species and only 26.1% being coniferous species. There was no significant difference between the circumference of deciduous and coniferous trees according to the chi square tested independence.

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Native Maple Trees are Dominant in the Bay Shore and Brentwood Area of Suffolk County, New York

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Keywords: Maple, Dominant Bay Shore

Abstract:

Forty tree samples were collected from five residential properties in Suffolk County, New York to determine the most dominant species. A branch with three or four leaves from each tree was acquired and the diameter of the tree trunk was measured. The species were identified using two dichotomous keys, *Tree Finder* and *Eastern Trees (Peterson Field Guides) 1988*, and a smartphone application (Picture This, 2017). It was found that native Maple trees were dominant in Bay Shore and Brentwood.

Introduction:

The following is reviewed in the Cornell Cooperative Extension of Suffolk County (2018). Bay Shore belongs to the Riverhead-Plymouth-Carver association. Generally, the soil here is described as Riverhead sandy loam and Carver coarse sand. More specifically, the soil is deep, mostly level to slightly sloping, considerably to excessively drained, and fairly coarse in texture. This type of soil mostly supports Oaks, Maples, and Pines. Brentwood belongs to the Haven-Riverhead association. The soil here is made up of Riverhead sandy loam and Haven loam. Similarly, the composition of the soil is deep, mostly level to slightly sloping, well-drained, and medium-textured. Oak, Beech, and Maple trees usually thrive in this area.

In Bay Shore, during the winter, the lowest temperature tends to go no lower than -11.11°C. On average, during the summer, temperatures can be as high as 31.6°C. Brentwood has an average winter low of -11.67°C. Summers are usually no higher than 32.22°C (Climate and Average Weather 2022). Both towns are located in climate zone 7a (USDA 2012).

In the process of this research, the different features in each sample were essential and the use of two dichotomous keys was also necessary to classify all tree branches. Each tree branch and leaves surveyed were compared in similarities and differences based on their structure, color and shape of their leaves. Once identified through the dichotomous keys; keys that are based upon successive choices between alternatives, it can be determined which ancestry group they belong to and whether it is native or not to our region. The number and placement of a plant's leaves will vary depending on the species, with each species exhibiting a characteristic leaf arrangement (Clark, 2018).

Method:

Forty samples were collected from Brentwood and Bay Shore residential properties. The tree trunk diameter of each tree sampled was measured in centimeters at chest height. For each property, the latitude, longitude, and height above sea level were found using a mobile navigation application (Compass Apple, 2020). All samples were identified with the two dichotomous keys (Watts 1998, Petrides and Wehr 1988) by differences in features on the leaves and stems to classify them as their proper species. Factors such as, shape, color, length, texture, and growing pattern were used to classify all samples. A chi-square test of independence was used to determine the probability of native trees being dominant over non-native tree species.

Chi-square test of independence Formula:

$$\chi^2 = \frac{(AD - BC)^2 (A + B + C + D)}{(A+C)(B+D)(A+B)(C+D)}$$

Results:

In this section, as shown below, the location of tree samples is reported in Table One. The elevation is also included. The data found in Table Two is listed by classification and Table Three provides description of the species of the trees surveyed in all five Bay Shore and Brentwood properties. From the data, it is evident the native Maple trees are not only more abundant, but also bigger in circumference. This may be due to the ideal conditions that the soil and weather provided for these trees to thrive in these specific towns. On the other hand, foreign Maple trees, like the Norway, Sycamore, and Japanese Maple trees are less numerous.

Table One: Location and Amount of Tree Samples

	Location 1	Location 2	Location 3	Location 4	Location 5
Town	Bay Shore	Bay Shore	Bay Shore	Bay Shore	Brentwood
Longitude	73°16’51" W	73°14’42" W	73°15’32" W	73° 15 25” W	73° 13 28” W
Latitude	40°42’ 35N	40°43’33” N	40 46’15” N	40° 45’24” N	40° 47 17” N
Height Above Sea Level	5 meters	5 meters	26 meters	19 meters	28 meters
Number of trees	14	6	4	9	7

Table Two: Circumference of Tree Samples

Common and Scientific Names of Trees	Quantity	Circumference
Colorado Blue Spruce (*Picea pungens*)	1	118.11 cm
Sawara Cypress (*Chamaecyparis pisifera*)	1	111.76 cm
Purple-Leaf Sand Cherry (*Prunus x cistena*)	1	48.26 cm
White Mulberry (*Morus alba*)	2	20.32 cm, 241.3 cm
Silver Maple (*Acer saccharinum*)	4	218.44 cm, 136.53 cm 264.16 cm, 187.96 cm
Sycamore Maple (*Acer pseudoplatanus*)	2	284.48 cm, 129.54 cm

Eastern Red Cedar (*Junipersvirgiana*)	4	78.74 cm**,** 66.04 cm 109.22 cm, 59.69 cm
Norway Maple (*Acer platanoides*)	3	128.27 cm, 119.38 cm 123.59 cm
Sugar Maple (*Acer saccharum*)	6	109.22 cm, 118.11 cm 124.46 cm, 97.16 cm 123.19 cm, 116.84 cm
Bigfoot Maple (*Acer grandidentatum*)	1	45.72 cm
Black Walnut (*Juglans nigra*)	1	12.7 cm
Black cherry (*prunus serotina*)	1	231.14 cm
Northern White Cedar (*Thuja occidentalis*)	2	111 cm, 71.12 cm
Red Maple (*Acer rubrum*)	2	128.27 cm, 81.28 cm
Nootka Cypress (*Cupressus nootkatensis*)	2	15.24 cm, 12.7 cm
Gray Birch (*Betula populifolia*)	1	68.58 cm
Japanese Maple (*Acer palmatum*)	2	12.7 cm, 48.26 cm
White Oak (*Quercus alba*)	2	86.36 cm, 114. 3 cm
Pin Oak (*Quercus palustris*)	1	93.98 cm
American Holly (*Ilex opaca*)	1	106.68 cm

Table Three: Tree Species Description

Common and Scientific Names	Description
Colorado Blue Spruce (*Picea pungens*)	Needle-like, arranged singly, needles are 4 sided (easy to roll between fingers).
Sawara Cypress (*Chamaecyparis pisifera*)	Scale-like, yellow/green & flattened.
Purple-Leaf Sand Cherry (*Prunus x cistena*)	Flat/thin, simple, alternating, not fan-shaped, leaves toothed.
White Mulberry (*Morus alba*)	Leaves are flat/thin, simple, alternating, not fan-shaped, toothed, smooth and glossy.
Silver Maple (*Acer saccharinum*)	The leaf has 5 lobes edged with teeth and is deeply lobed.
Sycamore Maple	The leaf is large and has 3 lobes edged with large teeth

(*Acer pseudoplatanus*)	and is not deeply lobed.
Eastern Red Cedar (*Junipers virgiana*)	Leaves are soft, scale-like blueish-green or dark green sprays, growing tightly together on the stems.
Norway Maple (*Acer platanoides*)	Leaves are large with 5 sharp pointed lobes.
Sugar Maple (*Acer saccharum*)	Leaf margins smooth, 5 lobes.
Bigfoot Maple (*Acer grandidentatum*)	Leaves have 3 to 5 lobes.
Black Walnut (*Juglans nigra*)	Leaf margin is serrated, pinnate, alternating.
Black cherry (*prunus serotina*)	Fine blunt teeth, leaves 2 to 6 inches long, bark dark.
Northern White Cedar (*Thuja occidentalis*)	Leaves are yellowish-green scales arranged in fan-shaped sprays.
Red Maple (*Acer rubrum*)	Leaf margins double-toothed, 3 to 5 lobes.
Nootka Cypress (*Cupressus nootkatensis*)	Foliage consists of flat sprays, with dark green, 3-5 mm long scale-leaves.
Gray Birch (*Betula populifolia*)	Leaves double-toothed, shiny green leaves, reddish-brown to silvery-gray bark.
Japanese Maple (*Acer palmatum*)	Broad, deciduous leaves with five to nine lobes.
White Oak (*Quercus alba*)	Rounded lobes, 5 to 9 deep and even lobes and sinuses, leaves hairless.
Pin Oak (*Quercus palustris*)	Pointed lobes, deep sinus extends 3/4 of the way to mid-vein, leaves hairless, bright green and shiny.
American Holly (*Ilex opaca*)	Leaves are spiky and green, they also have red berries

Table 4: Chi-Square Test of Independence

Chi-Square Test of Independence	Maple Trees	Other trees
Above average circumference	A 14	C 6
Less than average circumference	B 6	D 14

The average circumference found in this study is 109.37 cm. In a chi square test of independence, the number of Maple trees above and below the average circumference of all trees was

compared to the non-Maple trees. The Maple trees had significantly larger circumferences at the 5% level of probability ($X^2 = 6.4$). Maple trees are dominant by both numbers of individuals and size.

Discussion:

According to our findings, only six Sugar Maple (*Acer saccharum)*, four Silver Maple (*Acer saccharinum*), and four Red Cedar *(Juniperus virginiana)* trees were found to be the majority of which were considered native to Eastern North America. While other non-native species such as White Mulberry (*Morus alba*), Sawara Cypress *(Chamaecyparis pisifera)*, Purple Leaf Sand cherry (*Prunus x Cistena*), Japanese Maple (*Acer palmatum*), and Norway Maple (*Acer platanoides*) were found to be rare in the area of Suffolk County surveyed. A survey performed recently in Brentwood and Islandia corroborates Silver Maple trees as the dominant species with a total of 63% of 64 trees surveyed being Maples (Akyurek and Rodriguez, 2021). Similarly, another survey collected from Lindenhurst, Brentwood, and West Islip confirms the amount of native Maple trees is far greater than non-native trees as Sugar Maples were found on all three properties (Reilly et al., 2015). In contrast, data found in residential properties in Bayshore, Brentwood, and Lindenhurst show 43 out of the 66 total trees were non-native (Longo et al., 2015). The information obtained in these surveys supports the hypothesis that Maple trees are the most dominant species in most areas than others of Suffolk County.

Conclusion:

Native Maple trees are dominant by both size and number in Bay Shore and Brentwood of Suffolk County, which include the Sugar Maple (*Acer saccharum)*, Silver Maple (*Acer saccharinum),* and Red Maple (*Acer rubrum*) trees.

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Novel Genotyping Assay of a variant in the FIGLA Gene

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Keywords: Biology, Genomics, Infertility, Female Infertility, Genotyping Assay

Abstract:

Infertility is a global health issue that affects millions of reproductive-aged couples worldwide. Recently, specific mutations in the Folliculogenesis-specific basic helix-loop-helix (FIGLA) gene have been associated with infertility in women. While it is known that FIGLA is responsible for encoding a protein which functions in postnatal oocyte-specific gene expression, the exact mechanism and nature of mutations resulting in infertility are not well understood. To assess the relationship between the single polynucleotide variant rs587776535, a pathogenic 22 nucleotide deletion in the FIGLA gene and infertility, we created a genotyping assay. Our assay can help determine individuals with pathogenic variations of the FIGLA gene reducing the need for females to undergo more costly and invasive procedures to identify the cause of infertility.

Introduction:

Infertility has been a growing concern among many people as more people continue to experience issues with fertility. One cause of infertility is associated with premature ovarian failure. Premature ovarian failure is defined as a condition in which the ovaries stop working causing menopause to occur prematurely (Goswami & Conway, 2005). The average age of menopause has been observed to be 51 years of age, but women who are diagnosed with premature ovarian failure experience menopause at age 40 (Goswami & Conway, 2005). One study has determined that the rate of premature ovarian failure in women is 3.7% (Golezar et al., 2019). The 2008 study by Zhao et al., has shown that a number of women who experience premature ovarian failure all shared mutations within the FIGLA gene (Zhao et al., 2008). The gene FIGLA, with the full name folliculogenesis specific basic-helix-loop-helix transcription factor, is responsible for encoding a protein which functions in postnatal oocyte-specific gene expression. Previous research has shown that the FIGLA gene plays an important role in formation of the primordial follicle and coordinate expression of zona pellucida genes (Joshi et al., 2007). The zona pellucida is an extracellular coat that surrounds mammalian eggs and preimplantation embryos. Females that produce eggs that lack this are infertile (Wassarman et al., 1999). The FIGLA gene is also important for folliculogenesis, fertilization and early fetal development (Joshi et al., 2007). FIGLA-specific mutations have been shown to cause fertility issues in a number of women. The FIGLA gene is a transcriptional regulator of ZP genes during follicular development (Mei et al., 2021). Results from previous research have shown mutations of this gene can impact ZP gene transcription which may disrupt the normal formation of the zona pellucida, cause disorders of oocyte maturation, and lead to POI and infertility (Mei et al., 2021). One mutation known as SNP rs587776535 is a deletion of the nucleotide sequence, ATCTAGGACGCCGGGCGCGGGG within the gene FIGLA. This is a pathogenic SNP causing a frameshift, which can contribute to premature ovarian failure. The location of this SNP is found on chr2:70790603-70790633 using the UCSC genome browser build hg38. In this study, the effects of this SNP were examined and a genotyping assay was created.

Methods:

Bioinformatics

The following Bioinformatic tools were used in conducting the genotyping assay:

The National Center for Biotechnology Information (NCBI) server dbSNP (https://www.ncbi.nlm.nih.gov) was used to identify a pathogenic SNP within the FIGLA gene. The Genome Browser on The University of California Santa Cruz (UCSC) Genomics Institute Database (https://genome.ucsc.edu) was used to identify the entire genome of the FIGLA gene. By using the reverse complement website, (http://reverse-complement.com), the reverse complement in the FIGLA region of interest was generated during primer design. Due to the location of the SNP being near the promoter region, it was challenging to locate a primer to amplify the sequence. The deletion is located within the first exon of the FIGLA gene. 1000 nucleotides were added to the front of the sequence in order to ensure a proper nucleotide sequence since the location of the deletion was near the front of the sequence. The website Primer 3 Plus, (https://www.bioinformatics.nl/cgi-bin/primer3plus/primer3plus.cgi), was used to identify an acceptable primer for this gene sequence. PrimerBank (https://pga.mgh.harvard.edu/cgi-bin/primerbank/new_search2.cgi) was used to identify a primer pair for positive control, Beta actin (ACTB). We identified the amino acid sequence using Expasy by the Swiss Institute of Bioinformatics (https://www.expasy.org). The program PSIPRED (http://bioinf.cs.ucl.ac.uk/psipred/) was used to analyze the difference in protein structures of the reference and mutated forms of the FIGLA gene.

PCR Protocol:

The polymerase chain reaction (PCR) protocol from Illumina (San Diego, California) was used to amplify the sequence. The Illumina protocol calls for a 25µL reaction volume of 13.0µL PCR-grade water, 10.0µL of PCR master mix, 0.5µL Primer L, 0.5µL Primer R and 1.0µL template DNA. The PCR thermal profile was: 95ºC for 5 minutes; 30- 40 cycles of (95°C for 15 sec, 60°C for 20 sec, and 72°C for 30 sec) followed by a 72°C for 10 min and a 4°C hold. In our assay to identify SNP rs587776535 we used Primer 3 to identify a left primer 5'-GACGCAGCCTCCAGAGAG-3' and the right primer 5'-GAGGTGCTGGAGGACG-3'. The melting point is Tm: 59.8 ºC and 61.3 ºC. Primers for Beta Actin (ACTB) were used as a positive control. The forward primer for ACTB was 5'-ACCGGGCATAGTGGTTGGA -3' and the reverse primer was 5'-ATGGTACACGGTTCTCAACATC-3'. The Tm values of each respectively were 62.9 and 60.0. All assays were run with a no DNA control. Following PCR, the expected amplicon was checked by gel electrophoresis in a 3% agarose gel for two hours at 80 mV. Bromophenol blue was used as a loading dye in the gel. Gel is visualized by Alpha Imager.

Results:

Bioinformatic techniques were used to generate a genotyping assay for this SNP. The SNP has been identified to affect .01% of the global population. After completion of a PCR using our primer pair for the FIGLA assay, a 242 base pairs fragment will be amplified in a reference sample with no mutation present. In a sample containing the mutation, the fragment produced is 220 bp long due to the presence of a 22 nucleotide deletion (**Figure 2**). Our bioinformatic research showed the presence of this SNP results in the removal of seven amino acids from the sequence (Proline, Alanine, Proline, Glycine, Valine, Leucine and Aspartic Acid) (**Figure 1ab**).

Figure 1a: PSIPRED was used to identify the protein structure of the FIGLA gene when the SNP is present. This SNP shows the removal of seven amino acids. The arrow represents the location where the amino acid sequence is removed.

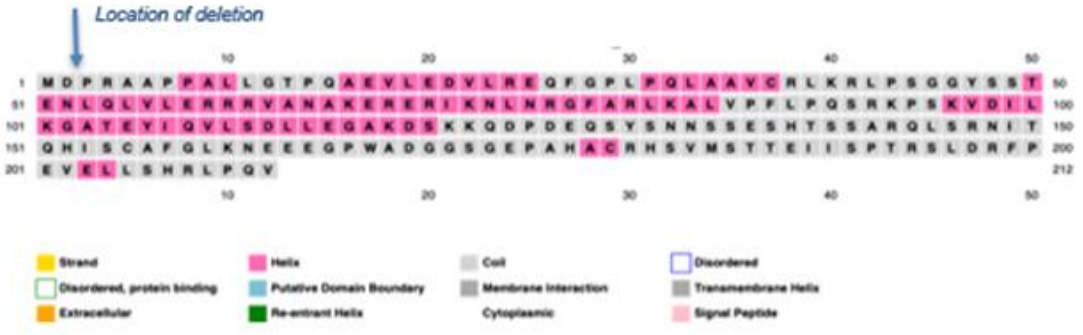


Figure 1b: PSIPRED was used to identify the protein structure of a normal FIGLA gene. The highlighted region displays the region that is removed as a result of the SNP.

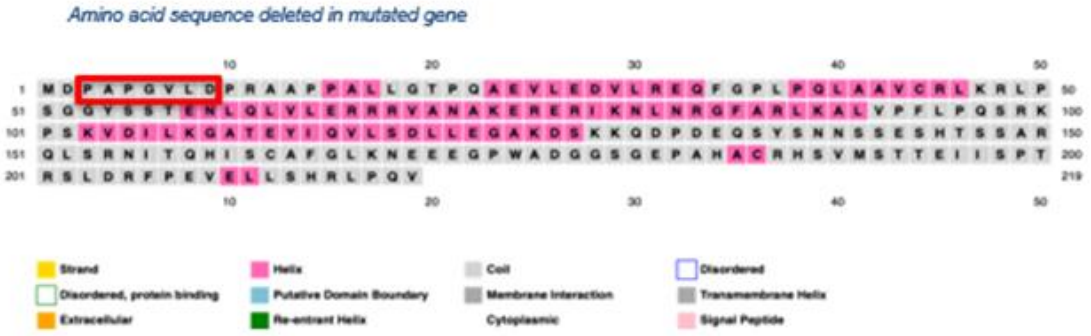
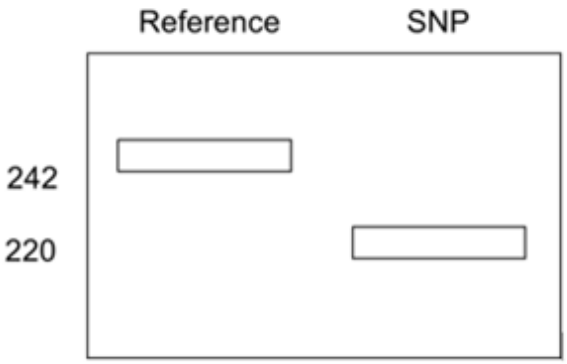


Figure 2: Genotyping assay as run on gel electrophoresis. The reference without mutation will run 242 base pairs. The SNP will run 220 base pairs when the deletion is present.



Discussion:

Since the FIGLA gene is associated with a protein which functions in postnatal oocyte-specific gene expression, we can theorize that the absence of amino acid residues in the mutated gene may

result in errors of protein function. There is no major or minor allele associated with this gene mutation. Previous research has shown that proper FIGLA gene activity is necessary for fertilization and early embryonic survival (Zhao et al., 2008), so the removal of seven amino acids due to the mutation may impact these factors. A genotyping assay of the FIGLA gene is beneficial because it allows us to identify variations that can cause fertility issues. This can lead to more efficient personalized risk assessments and treatment plans for patients in collaboration with physicians and geneticists to address possible risks that may be present in those who express rs587776535. Our genotyping assay aims to help in the identification and diagnosis of a mutation that can lead to fertility issues among women.

Conclusion:

We discovered the specific amino acid sequence of the FIGLA gene that is deleted in women expressing the variation rs587776535. This allowed us to conclude that the gene function will be disrupted, leading to fertility issues. Our gel electrophoresis results also portray the impact that the deletion has on the FIGLA gene. These results can serve as an explanation for women experiencing infertility and can aid in future diagnoses.

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The Differences of Earthworm Weight Being Compared to Garden Compost Soil and Natural Soil at Mill Pond and San Souci Trail

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Keywords: Earthworm, Weight, Compost, Garden, Mill Pond

Abstract:

Do Earthworms thrive in a compost soil made by humans, or do they do better in the environment's natural soil? Earthworms from three different soil types are collected and compared to see if there is any significant change in weight. Average weight in grams of an Earthworms show no significant difference when compared to different selective soil types. Furthermore, the data shows that there are more Earthworms and Earthworm biomass found in the compost soil compared to natural soil.

Introduction:

"Earthworms, also called Angleworms, are one of more than 1,800 species of terrestrial worms of the class Oligochaeta (Phylum Annelida)- in particular, members of the genus *Lumbricus*" (Britannica 2017). Earthworms are decomposers, which means they eat decaying organic matter. The compost used in this experiment has a great deal of decaying organic matter due to frequently adding garden soil, egg shells, an abundance of fruit peels, potato peels, old vegetables, grass trimmings and coffee grounds. "Earthworms feed on organic matter; by adding compost and leaving the clippings when you mow the lawn are keeping them well fed" (The Sustainability Institute at Molloy College 2018). This compost has been collecting over the past two years and is still growing. Compost is compared to two natural soil types found at Mill Pond, and San Souci Trail on Long Island, New York.. Mill Pond's soil is wet, along with San Souci's Trail soil which is moderate to dry.

Methods:

A square that is 61 cm (2 ft.) width and 91.5 cm (3 ft.) length was made three times in each selected soil type. Within each square dirt was dug out no more than 30.5 cm (1 ft.) in depth with a small hand shovel for a total volume of approximately 0.17 cubic meters. The Earthworms were pulled out by tweezers, dipped in water to get access soil off and weighted using a Maxus milligram scale. Each worm is weighed using grams, then returned safely into their habitat. A Chi-Square Test of Independence was used to compare the number of worms above the mean body mass of all worms combined to the number below the mean body mass for the three locations different locations.

Results:

Throughout the 9 squares 45 Earthworms are collected. The amount of Earthworms found in the compost soil is 21 with a total weight of 32.863 grams. At Mill Pond 14 Earthworms were collected with a total weight of 17.864 grams, and at San Souci's Trail 10 Earthworms were found with a total weight of 11.411 grams. The total weight of all the Earthworms is equal to 62.138 grams. The average is calculated by the weight in total Earthworms divided by the number of Earthworms which is 1.380 grams. The data is then categorized by how many Earthworms are less than or greater than average weight. The compost soil showed 12 Earthworms is less than average weight and 9 is more than the average weight. Mill pond and San Souci Trail are combined because they are both natural soils. 14 Earthworms were less than average weight and 10 were greater than average weight. According to the

Chi-Square Test of Independence comparing to number of worms above the mean body mass of all worms combined to the number below the mean body mass, the chi-square value is calculated to be 0.0065066 which is not significant.

Table 1: Earthworm Weight Chart (grams per 0.17 cubic meters)			
	A. Garden Compost (21)	B. Mill Pond (14)	C. San Souci Trail (10)
1)	8.421 grams	4.647 grams	3.464 grams
2)	9.314 grams	5.609 grams	3.419 grams
3)	15.128 grams	7.608 grams	4.528 grams
Total	32.863 grams	17.864 grams	11.411 grams
Average	1.564904 grams	1.276 grams	1.1411 grams

Discussion:

According to the Chi-square value there is no significant difference in weight of Earthworms in compost soil compared to natural soil. The weight in Earthworms is consistent regardless of soil type. Although the data did not establish a difference in mass of individual Earthworms, the compost soil did have more Earthworms per square meter, and more Earthworm biomass per cubic meter.

Conclusion:

Weight in grams of Earthworms show no significant value when compared to different selective soil types. Furthermore, the data shows that there are more Earthworms found in the compost soil compared to natural soil. This suggests that Earthworms thrive in compost soil compared to natural soil by the quantity and overall biomass, not by weight.

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Residential Properties in Yaphank, NY are in Secondary Succession Close to the Climax Community

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Keywords: Yaphank, White Oak, Eastern White Pine

Abstract:

A total of 62 trees were identified and measured from one residential property in a residential community located in Yaphank, NY. The trees were identified using a dichotomous key as both White Oak Trees (*Quercus alba*) and Eastern White Pine Trees (*Pinus strobus*). Both trees were also identified as indigenous.

Introduction:

The climate data in Yaphank, NY was found from the Farmers Almanac (2021). It showed that from the months of December 2020 to May 2021 the climate was very cool and rainy, with a sandy soil. It was found on Weather Atlas, that the seasons frost in Yaphank, NY starts from October 27th and ends around April 14th. The winter season has a high temperature of 7.1°C and a low temperature of -0.8°C. The summer season has a high temperature of 25.3°C and a low temperature of 17.3°C.

Methods:

On a residential property located in Yaphank, NY, a total of 62 trees were identified and measured. The property was measured at 111.4837 square meters. The longitude and latitude were found using a web tool (www.findlatitudeandlongitude.com) and was recorded in table 1, while the height above sea level was found using a web tool (www.whatismyelevation.com) and was also recorded in table 1. Both trees, White Oak Trees (*Quercus alba*) and Eastern White Pine Trees (*Pinus strobus*), were identified with the help of The Winter Tree finder/dichotomous key (Watts & Watts, 1970). After carefully identifying all the trees, measurements were taken at chest height using a tape measure.

Results:

There were two different tree species found on the property surveyed. The trees were identified using The Winter Tree finder (Watts & Watts, 1970). 40 oak trees were measured to be an average of 80.26 cm and 12 pine trees were 56.64 cm. 15 of the oak trees were found to be more than 80.26 cm and 55.88 cm of the oak trees were found to be less than 80.26 cm. All 12 of the pine trees were found to be less than 80.26 cm. The results from the chi-square for the test of independence was 7.01, making the circumference of the oak trees significantly greater than the circumference of the pine trees at the one percent level of probability when comparing the number of oaks to the number of pines above and below the median circumference of all trees in this study using a 2 x 2 contingency table.

Table 1: Location of Trees

Longitude and Latitude	Longitude: -72.90 Latitude: 40.85
Height Above Sea Level	1,310 cm
Lot Size	111.4387 square meters
Tree Count	62 total 40 Oak, 12 Pine

Table 2: Identification of Trees

Common Name	Scientific Name	Quantity on Property	Indigenous or Not
Oak Tree	*Quercus alba*	40	Yes
Eastern White Pine Tree	*Pinus strobus*	12	Yes

Discussion:

It was found that oak trees were also dominant in Smithtown, NY. From a total of 260 trees that were measured, Ayasse et al. (2017) stated that 106 of them were Oak, while 79 of them were Pine. Another study done by Greco et al. (2015) found that Oak trees are a dominant species across Long Island. They measured 48 trees between 4 different locations on the island. One of the properties in South Huntington, NY had 17 Oak trees, while the other properties did not have many trees on them.

Conclusions:

It was found that the circumferences of the oak trees were significantly greater than the circumferences of the pine trees at the one percent level of probability according to the chi-square test of independence. The 40 oak trees outnumbered the 12 pine trees, 77% to 23%. This suggests that the residential property in Yaphank, NY is in secondary succession between the pine and an oak Forest and is close to becoming a climax community.

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Deciduous Trees are Older than Coniferous Trees on Private Property in East Setauket

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Keywords: Suffolk County, East Setauket, Leyland Cypress (*Hesperotropsis leylandii)*

Abstract:

This study tested the relative ages of deciduous trees and coniferous trees on Long Island. On a residential East Setauket property, I classified and measured 120 trees in order to test the hypothesis that the deciduous trees were on average older than the coniferous trees by measuring the circumference of the trees. It was found that there was a much greater number of coniferous trees than deciduous trees, but the deciduous trees had a larger circumference than the coniferous trees significanct at the 1% level of probability (χ^2=7.714) according to the Chi-square Test of Independence. The Leyland Cyprus (*Hesperotropsis leylandii*) was the dominant tree (30.83%), and the White Cedar (*Thuja occidentalis*) was the second most dominant (19.17%).

Introduction:

According to the Merriam-Webster dictionary (2021), Taxonomy is the study of the general principles of scientific classification. Being able to identify and study the wildlife around us is paramount for being able to understand our environment and learn how our actions may influence our surroundings.

This study was conducted in East Setauket, NY to see if the deciduous trees were older than the coniferous trees in this area despite there being more coniferous trees on this property. I wanted to understand how our local tree ecology may be changing due to the chopping down of deciduous trees and the replanting of coniferous trees for the use of natural fencing between properties.

East Setauket's lowest monthly average temperature is -0.6° C during January and the highest is 25.6° C in July and August. Monthly precipitation ranges on average from 20.07 cm to 10.92 cm during the year (Weather WX, 2021).

Methods:

This study began by identifying the size of the plot of land using the survey of the land provided by the landowner. Starting from one corner of the property, I took various photos of the property which included every tree that was going to be measured and classified. This was so that as I measured and classified the trees, I could mark the photo and avoid measuring a tree twice or refer back to it on a different day if necessary.

For each tree, I first measured the circumference in inches at chest height using a tape measure and would record the measurement on the photo. Then I would classify the tree using an application called LeafSnap to do the initial classification (LeafSnap*, 2021).* This was followed by the Virginia Tech Dendrology Dichotomous Leaf Key on the Virginia Tech Dendrology website to confirm that the initial classification was correct (Virginia Tech Dendrology, 2021). The name of the tree would be recorded next to the circumference measurement on the photo.

After repeating the measurement and classification with every tree on the property, I transported the data onto an Excel spreadsheet which included the tree's common name, scientific name, whether it is coniferous or deciduous, the measurement in inches and the conversion into centimeters (View Table

1). Using this data, I found the average circumference of all the trees, the average circumference of the coniferous trees, the average circumference of the deciduous trees, the number of coniferous trees with a circumference above and below the mean, and the number of deciduous trees with a circumference above and below the mean (View Table 2).

Using the number of trees above and below the mean, I performed a Chi-Square Test of Independence to find out if my hypothesis that the deciduous trees are older than the coniferous trees in East Setauket is true. I calculated if the number of deciduous trees with a circumference above the mean was significantly greater than the number of coniferous trees (View Calculation 1). After the calculation, I used the Distribution of X^2 Chart to find the significance of the results (View Table 3).

Results:

The private plot of land in East Setauket used in this study is 67.67 M by 49.38 M based on the property survey and is located at Latitude 40.9424 and Longitude -73.1260. The majority of the trees were coniferous while the minority were deciduous (View Table 2). While there were more coniferous trees (80%), the deciduous trees were older as measured by circumference at a significance level of 1% (χ^2=7.714) according to the Chi-square Test of Independence (View Calculation 1 and Table 3).

Table 1. Summary of Data in Appendix A			
Tree Name	Deciduous or Coniferous	Quantity	Average Circumference (cm)
Apple Tree (*Malus domestica*)	Deciduous	2	17.15
Atlas Cedar (*Cedrus atlantica*)	Coniferous	2	17.78
Balsam Fir (*Abies balsamea*)	Coniferous	3	37.68
Black Locust (*Robinia pseudoacacia*)	Deciduous	1	7.62
Bur Oak (*Quercus macrocarpa*)	Deciduous	2	120.65
Cherry Tree (*Prunus avium*)	Deciduous	5	54.61
Common Fig (*Ficus carica*)	Deciduous	1	3.81
Common Juniper (*Juniperus communis*)	Coniferous	1	25.4
Douglas Fir (*Pseudotsuga menziesii*)	Coniferous	3	45.72
Eastern Red Cedar (*Juniperus virginiana*)	Coniferous	2	36.83
English Yew (*Taxus baccata*)	Coniferous	9	23.99
Leyland Cypress (*Hesperotropsis leylandii*)	Coniferous	37	42.39
Norway Spruce (*Picea abies*)	Coniferous	4	84.77
Peach Tree (*Prunus persica*)	Deciduous	1	17.78
Pin Oak (*Quercus palustris*)	Deciduous	9	134.76
Plum Tree (*Prunus americana*)	Deciduous	2	26.04
Red Spruce (*Picea rubens*)	Coniferous	1	78.74
Weeping Willow (*Salix babylonica*)	Deciduous	1	71.12
White Cedar (*Thuja occidentalis*)	Coniferous	21	20.62
White Pine (*Pinus strobus*)	Coniferous	5	51.61
White Spruce (*Picea glauca*)	Coniferous	3	3.39
	Total Trees: 120		Average Circumference: 43.73

Table 2. Tree Circumference Averages and Number of Trees Above and Below Mean	
Average Circumference of All Trees	43.73 cm
Average Circumference of Coniferous Trees	34.73 cm
Average Circumference of Deciduous Trees	79.75 cm
Number of Coniferous Trees with Circumference Above Mean	34
Number of Coniferous Trees with Circumference Below Mean	62
Number of Deciduous Trees with Circumference Above Mean	16
Number of Deciduous Trees with Circumference Below Mean	8

Table 3. Chi-Square Table. Distribution of X^2 (Roccanova, L, 2021)
(Reprinted with permission from Roccanova 2021.)

	n					
		1	**2**	**3**	**4**	**5**
P	0.99	0.00016	0.0201	0.115	0.297	0.554
	0.98	0.00063	0.0404	0.185	0.429	0.752
	0.95	0.00393	0.103	0.352	0.711	1.145
	0.90	0.0158	0.211	0.584	1.064	1.610
	0.80	0.0642	0.446	1.005	1.649	2.343
	0.70	0.148	0.713	1.424	2.195	3.000
	0.50	0.455	1.386	2.366	3.357	4.351
	0.30	1.074	2.408	3.655	4.878	6.064
	0.20	1.642	3.219	4.642	5.989	7.289
	0.10	2.706	4.605	6.251	7.779	9.236
	0.05	3.841	5.991	7.815	9.488	11.070
	0.02	5.412	7.824	9.837	11.668	13.388
	0.01	6.635	9.210	11.345	13.277	15.086
	0.001	10.827	13.815	16.268	18.465	20.517

Formula 1. Chi-Square Test of Independence (Roccanova, L, 2021)

$$X^2 = \frac{(ad - bc)^2(a + b + c + d)}{(a + b)(c + d)(b + d)(a + c)}$$

Calculation 1.

$$X^2 = \frac{(ad - bc)^2(a + b + c + d)}{(a + b)(c + d)(b + d)(a + c)}$$

$$X^2 = \frac{(62 * 16 - 8 * 34)^2(62 + 8 + 34 + 16)}{(62 + 8)(34 + 16)(8 + 16)(62 + 34)}$$

$$X^2 = \frac{(992 - 272)^2(120)}{(70)(50)(24)(96)}$$

$$X^2 = \frac{62{,}208{,}000}{8{,}064{,}000}$$

$$X^2 = 7.714$$

Discussion:

On residential properties in Bay Shore, NY, deciduous trees were found to be dominant (Sidra, 2019). Evergreen trees were found to be dominant in various North Shore towns on Long Island (Kurtz et al. 2014).

In a private property in Levittown and in North Babylon, the coniferous trees were larger in circumference on average than the deciduous trees on those properties (Alcindor & DiNapoli 2012).

Many of the smaller trees on this property, both coniferous and deciduous, were planted within the last 20 years by the landowner. In future research I would like to do this study in multiple locations on Long Island to discover if my findings are isolated to this location or if the same results are found in different areas.

Conclusion:

While there was a majority of coniferous trees on the East Setauket private property, deciduous trees were larger and older at a significance at the 1% level of probability (χ^2=7.714) according to the Chi-square Test of Independence. The Leyland Cyprus (*Hesperotropsis leylandii*) was the dominant tree (30.83%), and the White Cedar (*Thuja occidentalis*) was the second most dominant (19.17%).

This would suggest that the natural forest was deciduous and private property owners are replacing the deciduous trees with coniferous trees. This may be due to their quality of not losing their leaves in the winter and can act as natural barriers between properties.

Appendix 1: Total Collection of Tree Data					
Tree #	**Common Name**	**Scientific Name**	**Coniferous or Deciduous**	**Measurement in Inches**	**Metric Conversion in cm**
1	White Cedar	*Thuja occidentalis*	Coniferous	1	2.54
2	White Cedar	*Thuja occidentalis*	Coniferous	1	2.54
3	Bur Oak	*Quercus macrocarpa*	Deciduous	69	175.26
4	Balsam Fir	*Abies balsamea*	Coniferous	4.5	11.43
5	White Cedar	*Thuja occidentalis*	Coniferous	5	12.7
6	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	7.5	19.05
7	Black Locust	*Robinia pseudoacacia*	Deciduous	3	7.62
8	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	4.5	11.43
9	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	7	17.78
10	White Cedar	*Thuja occidentalis*	Coniferous	5	12.7
11	White Cedar	*Thuja occidentalis*	Coniferous	6	15.24
12	Weeping Willow	*Salix babylonica*	Deciduous	28	71.12
13	Pin Oak	*Quercus palustris*	Deciduous	40	101.6
14	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	4	10.16
15	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	4.5	11.43
16	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	5	12.7
17	Pin Oak	*Quercus palustris*	Deciduous	60	152.4
18	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	7	17.78
19	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	7	17.78
20	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	5.5	13.97
21	Douglas Fir	*Pseudotsuga menziesii*	Coniferous	14.5	36.83
22	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	19	48.26
23	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	33	83.82
24	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	24	60.96
25	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	28.5	72.39
26	Leyland	*Hesperotropsis*	Coniferous	29.5	74.93

	Cypress	*leylandii*			
27	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	7.5	19.05
28	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	20	50.8
29	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	4	10.16
30	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	30	76.2
31	Cherry Tree	*Prunus avium*	Deciduous	23	58.42
32	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	16.5	41.91
33	Cherry Tree	*Prunus avium*	Deciduous	21	53.34
34	Atlas Cedar	*Cedrus atlantica*	Coniferous	6	15.24
35	White Spruce	*Picea glauca*	Coniferous	1	2.54
36	White Spruce	*Picea glauca*	Coniferous	1	2.54
37	Common Juniper	*Juniperus communis*	Coniferous	10	25.4
38	White Cedar	*Thuja occidentalis*	Coniferous	6	15.24
39	Cherry Tree	*Prunus avium*	Deciduous	14.5	36.83
40	Red Spruce	*Picea rubens*	Coniferous	31	78.74
41	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	9.5	24.13
42	Douglas Fir	*Pseudotsuga menziesii*	Coniferous	26	66.04
43	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	10	25.4
44	White Cedar	*Thuja occidentalis*	Coniferous	13	33.02
45	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	12	30.48
46	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	24	60.96
47	White Cedar	*Thuja occidentalis*	Coniferous	12	30.48
48	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	12	30.48
49	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	17	43.18
50	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	15.5	39.37
51	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	25	63.5
52	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	27.5	69.85
53	White Cedar	*Thuja occidentalis*	Coniferous	10.5	26.67
54	White Cedar	*Thuja occidentalis*	Coniferous	6.5	16.51
55	White Spruce	*Picea glauca*	Coniferous	2	5.08

56	Eastern Red Cedar	*Juniperus virginiana*	Coniferous	4	10.16
57	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	17.5	44.45
58	Cherry Tree	*Prunus avium*	Deciduous	29	73.66
59	White Cedar	*Thuja occidentalis*	Coniferous	7	17.78
60	White Cedar	*Thuja occidentalis*	Coniferous	8	20.32
61	White Cedar	*Thuja occidentalis*	Coniferous	9	22.86
62	White Cedar	*Thuja occidentalis*	Coniferous	6	15.24
63	White Cedar	*Thuja occidentalis*	Coniferous	7	17.78
64	White Cedar	*Thuja occidentalis*	Coniferous	7	17.78
65	White Cedar	*Thuja occidentalis*	Coniferous	7.5	19.05
66	White Cedar	*Thuja occidentalis*	Coniferous	10.5	26.67
67	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	30	76.2
68	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	26.5	67.31
69	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	21	53.34
70	English Yew	*Taxus baccata*	Coniferous	7.5	19.05
71	White Cedar	*Thuja occidentalis*	Coniferous	15	38.1
72	White Pine	*Pinus strobus*	Coniferous	22	55.88
73	White Pine	*Pinus strobus*	Coniferous	17.5	44.45
74	English Yew	*Taxus baccata*	Coniferous	7	17.78
75	White Pine	*Pinus strobus*	Coniferous	18.6	47.244
76	White Pine	*Pinus strobus*	Coniferous	22	55.88
77	White Pine	*Pinus strobus*	Coniferous	21.5	54.61
78	Pin Oak	*Quercus palustris*	Deciduous	35.5	90.17
79	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	23	58.42
80	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	24.5	62.23
81	White Cedar	*Thuja occidentalis*	Coniferous	18.5	46.99
82	White Cedar	*Thuja occidentalis*	Coniferous	24	60.96
83	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	21.5	54.61
84	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	17.5	44.45
85	Apple Tree	*Malus domestica*	Deciduous	5.5	13.97
86	Peach Tree	*Prunus persica*	Deciduous	7	17.78
87	Plum Tree	*Prunus americana*	Deciduous	7.5	19.05
88	Apple Tree	*Malus domestica*	Deciduous	8	20.32
89	Plum Tree	*Prunus americana*	Deciduous	13	33.02
90	Bur Oak	*Quercus macrocarpa*	Deciduous	26	66.04

91	Pin Oak	*Quercus palustris*	Deciduous	50	127
92	Norway Spruce	*Picea abies*	Coniferous	39	99.06
93	Pin Oak	*Quercus palustris*	Deciduous	33	83.82
94	Douglas Fir	*Pseudotsuga menziesii*	Coniferous	13.5	34.29
95	Pin Oak	*Quercus palustris*	Deciduous	47	119.38
96	Pin Oak	*Quercus palustris*	Deciduous	92.5	234.95
97	Pin Oak	*Quercus palustris*	Deciduous	60.5	153.67
98	White Cedar	*Thuja occidentalis*	Coniferous	1	2.54
99	White Cedar	*Thuja occidentalis*	Coniferous	0.5	1.27
100	Pin Oak	*Quercus palustris*	Deciduous	59	149.86
101	White Cedar	*Thuja occidentalis*	Coniferous	0.5	1.27
102	White Cedar	*Thuja occidentalis*	Coniferous	0.5	1.27
103	White Cedar	*Thuja occidentalis*	Coniferous	0.5	1.27
104	Leyland Cypress	*Hesperotropsis leylandii*	Coniferous	19.5	49.53
105	Balsam Fir	*Abies balsamea*	Coniferous	19	48.26
106	Balsam Fir	*Abies balsamea*	Coniferous	21	53.34
107	English Yew	*Taxus baccata*	Coniferous	7	17.78
108	English Yew	*Taxus baccata*	Coniferous	12	30.48
109	English Yew	*Taxus baccata*	Coniferous	5	12.7
110	Norway Spruce	*Picea abies*	Coniferous	34	86.36
111	English Yew	*Taxus baccata*	Coniferous	13	33.02
112	English Yew	*Taxus baccata*	Coniferous	6	15.24
113	English Yew	*Taxus baccata*	Coniferous	15	38.1
114	English Yew	*Taxus baccata*	Coniferous	12.5	31.75
115	Norway Spruce	*Picea abies*	Coniferous	40.5	102.87
116	Eastern Red Cedar	*Juniperus virginiana*	Coniferous	25	63.5
117	Cherry Tree	*Prunus avium*	Deciduous	20	50.8
118	Common Fig	*Ficus carica*	Deciduous	1.5	3.81
119	Atlas Cedar	*Cedrus atlantica*	Coniferous	8	20.32
120	Norway Spruce	*Picea abies*	Coniferous	20	50.8

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Comparison Between the Coniferous and Deciduous Trees in Brentwood Timberline Park

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Keywords: Coniferous, Deciduous, Brentwood

Abstract:

A survey was done in Timberline Park, 400 Broadway, Brentwood, NY 11717, where 75 trees were surveyed, and their circumferences were measured. The trees were identified using a dichotomous key called "Leafsnap", and to confirm it "Vtree" was used. It was found that deciduous trees are larger in circumference than coniferous trees and this was significant at the 5% level of probability ($\chi^2 = 4.1$) according to the Chi-Square Test of Independence.

Introduction:

Roberto Clemente Town Park, also known as the Timberline Park, is a multiple-use recreational park. It occupies 30 acres on the west side of Broadway, north of West 18th Street and south of Nolin Street (Enviroscience Consultants, INC. 2014).

Trees can be categorized as coniferous or deciduous. Deciduous trees lose their leaves in the fall, while coniferous trees do not. Coniferous trees were reported as dominant in the town of Brentwood by Burak et al. (2019). Coniferous trees must use a large amount of energy for pollination, while deciduous trees do not need to use relatively as much. This gives deciduous trees the advantage to grow faster.

Methods:

To do this experiment, a survey on the trees of a local park in the town of Brentwood was performed. The name of the park is Timberline Park which is located in 400 Broadway, Brentwood, NY 11717. A standard measuring tape was used to measure the circumferences of the trees in centimeters. The survey was taken all around the park. An online dichotomous key called "Leafsnap" (2019) was used to identify the trees, and it was confirmed with a second dichotomous key called "Vtree" (2013). To find if it is significance at the 5% level of probability, all results were plugged into the 2x2 Contingency Table Formula:

$$\chi^2 = (ad - bc)^2 (a + b + c + d) / (a + b) (c + d) (b + d) (a + c)$$

Results:

In total, 75 trees were measured and identified. There were 23 deciduous trees and 52 coniferous trees. The average circumference was 36.37cm. From the deciduous trees, 7 were below average and 16 were above average; from the coniferous trees, 29 were below average and 23 were above average (Table 1). When plugging these results in the 2x2 Contingency Table Formula the result is 4.1, which is between 2-5% level of probability (Table 2).

Table 1: Deciduous vs Coniferous Trees Circumference

Number	Name	Circumference	Type of Tree
1	*Acer Negundo*	53.21 cm	Deciduous
2	*Acer Negundo*	47.14 cm	Deciduous
3	*Pinus Sylvestris*	25.56 cm	Coniferous
4	*Lindera Benzoin*	46.25 cm	Deciduous
5	*Pinus Sylvestris*	18.01 cm	Coniferous
6	*Pinus Sylvestris*	39.53 cm	Coniferous
7	*Pinus Sylvestris*	34.45 cm	Coniferous
8	*Pinus Sylvestris*	18.37 cm	Coniferous
9	*Pinus Sylvestris*	38.18 cm	Coniferous
10	*Pinus Sylvestris*	27.97 cm	Coniferous
11	*Pinus Sylvestris*	22.75 cm	Coniferous
12	*Pinus Sylvestris*	17.84 cm	Coniferous
13	*Pinus Sylvestris*	26.33 cm	Coniferous
14	*Pinus Sylvestris*	22.02 cm	Coniferous
15	*Pinus Sylvestris*	29.21 cm	Coniferous
16	*Pinus Sylvestris*	58.43 cm	Coniferous
17	*Acer Macrophyllum*	56.54 cm	Deciduous
18	*Pinus Sylvestris*	17.35 cm	Coniferous
19	*Pinus Sylvestris*	20.66 cm	Coniferous
20	*Pinus Sylvestris*	39.17 cm	Coniferous
21	*Pinus Sylvestris*	34.33 cm	Coniferous
22	*Pinus Sylvestris*	29.09 cm	Coniferous
23	*Pinus Sylvestris*	28.51 cm	Coniferous
24	*Pinus Sylvestris*	32.34 cm	Coniferous
25	*Pinus Sylvestris*	24.23 cm	Coniferous
26	*Pinus Sylvestris*	32.96 cm	Coniferous
27	*Acer Rubrum*	41.55 cm	Deciduous
28	*Acer Palmatum*	5.47 cm	Deciduous
29	*Ixora Clara*	26.48 cm	Coniferous
30	*Pinus Sylvestris*	21.46 cm	Coniferous
31	*Pinus Sylvestris*	37.87 cm	Coniferous
32	*Pinus Sylvestris*	33.79 cm	Coniferous
33	*Pinus Sylvestris*	31.94 cm	Coniferous
34	*Pinus Sylvestris*	53.23 cm	Coniferous
35	*Acer Platanoides*	39.24 cm	Coniferous
36	*Pinus Sylvestris*	28.56 cm	Deciduous

37	*Pinus Sylvestris*	4.57 cm	Coniferous
38	*Pinus Sylvestris*	37.44 cm	Coniferous
39	*Pinus Sylvestris*	37.05cm	Coniferous
40	*Pinus Sylvestris*	34.76 cm	Coniferous
41	*Pinus Sylvestris*	15.67 cm	Coniferous
42	*Pinus Sylvestris*	14.46 cm	Coniferous
43	*Pinus Sylvestris*	34.35 cm	Coniferous
44	*Pinus Sylvestris*	21.78 cm	Coniferous
45	*Pinus Sylvestris*	28.59 cm	Coniferous
46	*Acer Macrophyllum*	26.22 cm	Deciduous
47	*Acer Marophyllum*	38.13 cm	Deciduous
48	*Acer Macrophyllum*	36.44 cm	Deciduous
49	*Acer Macrophyllum*	36.55 cm	Deciduous
50	*Pinus Sylvestris*	33.56 cm	Coniferous
51	*Quercos Rubra*	46.13 cm	Deciduous
52	*Pinus Sylvestris*	37.02 cm	Coniferous
53	*Querco Rubra*	37.55 cm	Deciduous
54	*Pinus Sylvestris*	36.56 cm	Coniferous
55	*Pinus Strobus*	32.87 cm	Coniferous
56	*Pinus Strobus*	41.58 cm	Coniferous
57	*Pinus Strobus*	45.78 cm	Coniferous
58	*Pinus Strobus*	51.29 cm	Coniferous
59	*Prunus Serrulata*	64.85 cm	Deciduous
60	*Prunus Serrulata*	62.43 cm	Deciduous
61	*Pinus Strobus*	68.27 cm	Coniferous
62	*Prunus Serrulata*	37.94 cm	Deciduous
63	*Salix Caprea*	59.36 cm	Deciduous
64	*Pinus Strobus*	40.73 cm	Coniferous
65	*Pinus Strobus*	48.55 cm	Coniferous
66	*Pinus Strobus*	44.82 cm	Coniferous
67	*Pinus Strobus*	46.84 cm	Deciduous
68	*Tamarix Gallica*	50.35 cm	Coniferous
69	*Pinus Strobus*	26.38 cm	Coniferous
70	*Pinus Strobus*	45.45 cm	Coniferous
71	*Salix Alba*	39.82 cm	Deciduous
72	*Salix Alba*	45.76 cm	Deciduous
73	*Salix Alba*	51.23 cm	Deciduous
74	*Ulmus Americana*	83.44 cm	Deciduous

75	*Castanea Sativa*	28.85 cm	Deciduous

Table 2: Chi-square of Independence

Average 36.29cm	Deciduous Trees	Coniferous Trees
Below Average	7 *(a)*	29 *(b)*
Above Average	16 *(c)*	23 *(d)*

Although there are less deciduous trees found in comparison to the coniferous trees, 69% of them are larger than the average circumference, while only 31% is below. Coniferous trees are more abundant, however 55% are smaller and 45% are larger than the average circumference. These is consistent with the results the chi-square of independence; where it was found that deciduous trees are larger than coniferous trees and it is significant at the 5% level of probability.

Discussion:

Another experiment in Bay Shore, East Northport, Islandia and Brentwood was conducted. The circumference of the trunks was different on each tree, but it was found that the deciduous trees were larger in circumference than the coniferous trees (Alexandra et al. 2012). These results are consistent with the findings of this experiment.

Conclusions:

According to the results of this experiments, coniferous trees are dominant in the Town of Brentwood. However, the deciduous trees are larger in circumference than coniferous trees. This could be because as mentioned before, deciduous trees might be using almost all their energy into growing, while coniferous trees are putting it into pollination.

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