Warren wood report

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**Abstract**

The study was done to investigate and answer three major questions regarding the forest ecology within Warren Woods, which is locate at State Park in Berrien County, Michigan. The study is meant to answer the question whether lottery competition exist and if either the competitive or coexistence is exclusive are available in the forest based on the data collected from the Warren Woods and analyzed. However, the study discovered that lottery competition is indeed available based on the data due to the fact that the number of individual decreased and as the class increased. It is established that competitive exclusion does exist in the Warrant Woods between Fagus grandifolia and Acer saccharum because of the consistent of recruitment between the two species. The study also reflects that beech trees should have several asymmetric canopies than sugar maple trees. The data collected did not support the whole concept and this led to the rejection of the hypothesis. It was also established that the mechanism of coexistence ended up not being reciprocal replacement but the habitat, which is preferred which is the canopy trees could be responding to the resources preferences. The paper therefore, present a report of the analysis of the data collected from the Warren Wood on how the trees related and the coexistence of various species.

**Introduction**

Warren Woods is purely occupied by two species of trees Acer saccharum and Fagus grandifolia. The dominant of these two types of trees are very interesting because it is a preserved old growth forest and the said types of tries have been in the existed in the same forest for several years, with the same source of light without any of the trees withering off. Warren Woods is a state part and therefore, there are no possibilities of interactions which could create disruption of the natural possibility of the very species. The study also established that the replacements of the species have been consistency and either F. grandifoliaand or A. Saccharyn and therefore, the two species have been the dominant trees, which are found in the Warren Woods part. Research indicates that A. saccharum is larger in number and smaller in size that the existing canopy and the beech trees are still larger in plenty when it comes to canopy trees and sub canopy trees (Beaudet, Brisson and Gravel 460). The study has also established that the differences in spaces in gaps are because the trees are falling under different species. According to Whitemore (15), present evidence suggests that trees species are categorized in one or two groups. And therefore, by contracts larger different groups of species crates large gaps in the forest, which is a clear indication of the existence of different species in the forest.

The study also established that due to nature of the growth of two species of trees such as sugar maple of being straight vertical and F. grandifolia, which branch out and fill the lights gaps, each would be best suited for winning over the other in case of an event. Poulson and Platt (21) pointed that if trees fall, the population of beech trees would reduced drastically and in return the number of sugar maple in the forest would experience a steady growth. However, the F. grandigoliasis would survive better in a canopy compared to sugar maple trees. Most F. grandifiliasis take much time to grow up the canopy and therefore, the study summarized that with time the ratio of F. grandifoliais to A. saccham would reduce.

A different study has also established that after several years the sizes of beech trees in Warren Woods have increased. But only abundant of Sugar Maple of increased and this could be a result of limited lights when the canopy is full allowing only little gaps to be available (Beaudet, Brisson and Dominique 21). However, when more gaps become available in the Warren Woods, the distribution of the trees might change rapidly results of several trees in the canopy areas. The study therefore, predicted that with time and as a result of the existing global climate change, there would be more trees falling (Runkle 1164). The storm is likely to occur more often and this could affect the ecosystem of trees within the Warren Woods. The falling of trees due to storms would therefore, open more gaps for vertical growing of trees. In this case, Acer Saccharum may increase to become the dominant tree in the canopy over Fagus grandifolia.

The purpose of the study was to investigation the three different hypotheses, which would either be accepted or rejected based on the result obtained from the experiment. The experiment is based on the data collected regarding the two competing species, which dominate the forest, and these trees are the beech tree and the Sugar Maple trees (Huo 32). The first hypothesis which was tested is that the forest would display a pattern of distribution, which rank of the smaller sized trees in regardless of the height of the species and the lowest among the largest trees. It is meant to test whether the size of the trees affect the growing of pattern of other species within the same canopy. The second hypothesis tested by this study is both species of trees coexist based on the fact they display coexistent recruitment and they are being more canopy trees than being sub canopy for a single species. The third hypothesis is meant to establish whether Fagus grandifolia has more asymmetric canopies compared to Acer saccharum.

**Materials and methods**

The study was done at Warren Woods State park, which is located at Berrien County, Michigan. The Warren Woods is one of the forest recognized forest in the world and has been studied since 1900s. The Warren Woods forest is dominant by two main species of trees, which is Acer saccharum and Fagus grandifolia and therefore, the study is focused on these two species. The first data collection was done involving the settingup of 10m X10m quadrant. The data was separately gathered for each quadrant. Within the quadrant set, each canopy tree species which was gathered under the quadrant was recorded. The circumference of each tree was then recorded in cm. In same quadrant the sub canopy tree and poles which exist was recorded as well. Then a 2X2 quadrant was setup again within the first and the larger quadrant and then the number of seedling of each species existing in the second quadrant were recorded. The process of repeated five times using different quadrant. The second data collection was done with focus on the sampling of both types of trees.

Estimated 10 trees were selected for each species and therefore, about ten trees were used for the study. The circumference of each tree selected for the study was then done. The nearest neighbor tree to the focal tree north neighbor and the distance from each tree to the neighbor was then measured and recorded as well. The size of the canopy was also measured using meter stick from all four angles and directions and the measurement obtained recorded. A measurement of 4X4 was then created, which surround the focal tree and the number of sub-canopy and canopy at the measurement of 3m and (1-3) of the seedlings and the recording was done regardless of the species of the tree. The method was done five times for Sugar Maple focal tree and Beach tree as well to ensure that accurate information is obtained from the study but only three (3) different species were recorded.

**Results**

**Figure 1: Lotto Competition**

**Figure 2: Class and species**

**Figure 3: Canopy Tree Species**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Table 1 |
| T-Test | Means | df | P-Value |
| Beech | 6833.6799 | 6 | 0.602176 |
| Maple | 3059.8487 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Table 2 |  |
| Chi-Squared | df | P-Value |  |
| 1.01 | 1 | 0.3149 |  |

**Figure 1: Chi Squared Analysis**

The result in figure 1 indicates a descending trend and it is clear that average density of a single hectare obtained decreases as the class sized increased. It is also evident that the class canopy had the lowest value of average density of 280 per single hectare while the seedling the seedling has the highest value of 11600 and sapling had a value of 3360 while the sub canopy registered the closes value of 120 and the canopy only had the value of 60 as indicated in figure 1 above.

However, the result indicated in figure 2 (two) above indicates an opposite trend of correlation of the average density which exist in a single hectare between the canopy and sub canopy of the beech and sugar maple trees. As illustrated in the figure 2 (two) above the average density of maple is higher in sub canopy class at about 60 and does not show any value in canopy. However, the average density of beech tree in sub canopy is slightly lower but when it comes to canopy is higher than the value, which is being registered at the sub county. In the figure 4, it is indicated that the P-value of maple and beech trees is 0. 602176, which is above the 0.05 and therefore, there is a correlation between the two species, which is obtained from the Warren Woods forest. The chi square p value is obtained is 0.3149 and targeted trees are 1.01, which include both sugar maple and beech trees.

**Discussions**

As indicated in the figure 1 of the result obtained, it is evidence that there is lottery competition at Warren Woods. The trend indicates that the abundance of the size of classes of trees increased and therefore, it means that none of the species of trees occupy the canopy section of the forest. It could be translated that when there is much light gap in the forest, there are several saplings, seedlings and sub canopy available to fill the gap. However, the finding of this study is not only reflect the hypothesis, which was being tested and also acceptable, it also supported by Poulson and Platt research which stated that over a period of time, when more spaces get created and become available, the dominant trees in the sub canopy take over the light gaps. It is therefore, means that the when the gaps are created in the forest the dominant trees take over the space or gap created and it could be reason why the dominant tree remains dominant forever in the forest. It is also established that the high number of seedlings are proprotionally linked to the low number of canopy. The result indicates that there are several seedlings on the ground, which are waiting for the gap or light gpas to geminate and grow to fill the gaps and they can only manage to grow to a higher height when the canopy is all taken.

The result indicated in the figure 2, as indicated above shows that both Acer Sacchum and Fagus grandifolia are coexistent. The result of established shows an opposite trend in the total average density in hectare, which exist between canopies and sub canopy of the beech and the Maple trees and this could mean that there is existence of maple and beech tree in both canopy and sub canopy classes. As supported by the journal, which established that, the population of the Maple trees would increase in the canopy areas as more spaces is made available and this therefore, supported in the finding in the figure 2. The result shows that beech trees have high average density in an hectare within the canopy are but the maple are having a high value within the sub canopy, which is a bit higher than the beech tree value and therefore, it is highly likely that the beech tree would be the successful candidate to take over the spaces created within the canopy and sub canopy (Whitemore 1241). The light gaps are made available by the climate change, which occurs around the world and therefore, it means that the beech tree would likely to occupy more light gaps within the canopy due to their high value.

The result established therefore, rejected the third hypothesis. The beech tree should have a high index of symmetric canopies compared to maple trees. Bu the result indicates the opposite and therefore, the hypothesis is purely rejected. The result obtained shows that Sugar Maple has a high index value of symmetric. As stated by Poulson and Platt (32) both species maple and beech trees ahave have distinct nature of growth and therefore, beech tree have a bigger potential of horizontal growth, when compared to the vertical growth of maple trees. It therefore, means that the beech tree is supposed to have several assymetric canopies compared to Sugar maple trees (Tatina 102). The result also established that the nearest neighbor would always be the same species. This approve the hypothesis reciprocal replacement hypothesis and from figure 3, it is establsihed that the highest value of the trees were from the same spacies. And based on the data gathered and analyzed, it concludes that the null hypothesis is rejected. The p- value establsiehd is below 0.05 because thenull hypothesis is only accepted when the null hypothesis is above 0.05. It therefore, means that the nearest species or trees identified by the study is not what we would expect. Based on the data, the canopy trees responding to the habitants is supported by the data.

**Conclusion**

It is important to state that the study accepted two hypothesis ad rejected one and therefore, it reflect what the data analyzed indicates about the Warren Woods forest. The study discovered that lottery competition is indeed available based on the data due to the fact that the number of individual decreased and as the class increased. It is established that competitive exclusion does exist in the Warrant Woods between Fagus grandifolia and Acer saccharum because of the consistent of recruitment between the two species. The study also reflects that beech trees should have several asymmetric canopies than sugar maple trees. The data collected did not support the whole concept and this led to the rejection of the hypothesis. It was also established that the mechanism of coexistence ended up not being reciprocal replacement but the habitat, which is preferred which is the canopy trees could be responding to the resources preferences. The paper therefore, present a report of the analysis of the data collected from the Warren Wood on how the trees related and the coexistence of various species.

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APPENDICES

Appendix 1: Circumferences

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Quadrant  | Class | Species | Circumference (in) | Circumference(m) | Circumference (cm) |
| 1 | Canopy | Beech | 4.4 | 0.11176 | 11.176 |
| 1 | Sub-canopy | Maple | 3.1 | 0.07874 | 7.874 |
| 2 | Canopy | Beech | 8.3 | 0.21082 | 21.082 |
| 2 | Sub-canopy | Maple | 2.7 | 0.06858 | 6.858 |
| 3 | Sub-canopy | Maple | 1.2 | 0.03048 | 3.048 |
| 3 | Sub-canopy | Beech | 1.1 | 0.02794 | 2.794 |
| 4 | Canopy | Beech | 9.1 | 0.23114 | 23.114 |
| 4 | Canopy | Beech | 9.3 | 0.23622 | 23.622 |
| 4 | Canopy | Beech | 6.8 | 0.17272 | 17.272 |
| 4 | Sub-canopy | Beech | 4 | 0.1016 | 10.16 |
| 5 | Canopy | Beech | 4.7 | 0.11938 | 11.938 |
| 5 | Canopy | Beech | 8.1 | 0.20574 | 20.574 |
| 5 | Sub-canopy | Maple | 3.2 | 0.08128 | 8.128 |

Appendix 2: Counts

|  |  |  |  |
| --- | --- | --- | --- |
| Quadrant | Class | Species | Count |
| 1 | Canopy | Beech | 1 |
| 1 | Canopy | Maple | 0 |
| 1 | Sub-canopy | Beech | 0 |
| 1 | Sub-canopy | Maple | 1 |
| 1 | Saplings | Beech | 0 |
| 1 | Saplings | Maple | 31 |
| 1 | Seedling | Beech | 25 |
| 1 | Seedling | Maple | 30 |
| 2 | Canopy | Beech | 1 |
| 2 | Canopy | Maple | 0 |
| 2 | Sub-canopy | Beech | 0 |
| 2 | Sub-canopy | Maple | 1 |
| 2 | Saplings | Beech | 4 |
| 2 | Saplings | Maple | 34 |
| 2 | Seedling | Beech | 50 |
| 2 | Seedling | Maple | 45 |
| 3 | Canopy | Beech | 0 |
| 3 | Canopy | Maple | 0 |
| 3 | Sub-canopy | Beech | 1 |
| 3 | Sub-canopy | Maple | 1 |
| 3 | Saplings | Beech | 5 |
| 3 | Saplings | Maple | 27 |
| 3 | Seedling | Beech | 20 |
| 3 | Seedling | Maple | 105 |
| 4 | Canopy | Beech | 3 |
| 4 | Canopy | Maple | 0 |
| 4 | Sub-canopy | Beech | 1 |
| 4 | Sub-canopy | Maple | 0 |
| 4 | Saplings | Beech | 7 |
| 4 | Saplings | Maple | 22 |
| 4 | Seedling | Beech | 25 |
| 4 | Seedling | Maple | 60 |
| 5 | Canopy | Beech | 2 |
| 5 | Canopy | Maple | 0 |
| 5 | Sub-canopy | Beech | 0 |
| 5 | Sub-canopy | Maple | 1 |
| 5 | Saplings | Beech | 10 |
| 5 | Saplings | Maple | 28 |
| 5 | Seedling | Beech | 55 |
| 5 | Seedling | Maple | 165 |

|  |  |  |  |
| --- | --- | --- | --- |
| Quadrant  | Class  | Maple | Beech |
| 1 | Canopy | 0 | 1 |
| 1 | Sub-canopy | 1 | 0 |
| 1 | Saplings | 31 | 0 |
| 1 | seedlings | 30 | 25 |
| 2 | Canopy | 0 | 1 |
| 2 | Sub-canopy | 1 | 0 |
| 2 | Saplings | 34 | 4 |
| 2 | seedlings | 45 | 50 |
| 3 | Canopy | 0 | 0 |
| 3 | Sub-canopy | 1 | 1 |
| 3 | Saplings | 27 | 5 |
| 3 | seedlings | 105 | 20 |
| 4 | Canopy | 0 | 3 |
| 4 | Sub-canopy | 0 | 1 |
| 4 | Saplings | 22 | 7 |
| 4 | seedlings | 60 | 25 |
| 5 | Canopy | 0 | 2 |
| 5 | Sub-canopy | 1 | 0 |
| 5 | Saplings | 28 | 10 |
| 5 | seedlings | 165 | 55 |