Indiana dunes field trip

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**Abstract**

This paper presents the report of the field trip to Indiana Dune National Park. It presents the analysis of data collected from the field and based on the data. It is evident that the distribution of the species is directly related to the age of a dune. The study was conducted to determine certain hypothesis. It determines whether the grass cover is directly proportionally to the age of dune. And based on the result, the hypothesis is accepted and therefore, the older the Dune the lower the ratio of the grass covers. The purpose of the study was to determine the existence of the species within the park and the distribution pattern as well. The study therefore, meant to provide knowledge and understanding on how different species are distributed within the park. The report therefore presents the result of the field trip to Indiana Dunes on the distribution of grass and trees, diversity of species, soli organic matters and ground cover affect on the age of the dunes. This efficient to help in understand how the dune affects the ecosystem and the diversity as well.

**Introduction**

The report provides detailed illustration of the field trip to Indiana Dunes National Park. The trip was an academic field trip to study the distribution of different species within the locality. The Indiana Dunes National Park is regarded as one of the diverse parks in the United States. Indiana Dunes is large and distributed sparsely with several sections within the park, providing a clear view of the species. Over the years, there has been decline of dunes and reduction of soil organic matters within the Indian Dunes national Park. The reduction of the organic matter affect the ecosystem since most organism depends on the soil matters within the Park. It is therefore, important to study the components or development of soil organic matters within the park to determine the component of the organic after a period of time. Therefore, the study focuses on several components to get a clear understand of the Indiana Dune National park.

The study was therefore, conducted to composition of the organic matter on different Dunes, which are based on the age of the dune. It was done to test the first hypothesis whether the soil organic matter in a dune increases as the age of a dune increases due to certain biological reasons. It is meant to study the diversity of species which exist within the Indiana Dune. Therefore, the study analyzed and the existence of different dunes within the Park. The study was also meant to analyse the ground cover within the park and therefore, it tested the hypothesis whether the ground cover is determine or depend on the age of the dune. The study also meant to determine the grass to Forb ratio and whether grass to Forb within the dune decreases based on the age of the dune. The Study was meant to provide knowledge and understanding on how different species are distributed within the park. The report therefore presents the result of the field trip to Indiana Dunes on the distribution of grass and trees, diversity of species, soli organic matters and ground cover affect on the age of the dunes.

**Materials and methods**

The experiment was conducted using different tools such as ruler, measurement tape, and other writing materials. The software like SPSS and excel was also used to analyze the data collected for accurate presentation of the report. The experiment was carried out through counting and measurement of the various species. First, the species were placed into quadrants and therefore, the species were first divided into three (3) quadrants. After that the counting was done in every quadrant based on the hypothesis derived in order to obtain accurate result from the experiment.

 **Result of the experiment**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dune | Sand (mm) | Organic Matter (mm.) | Total | % Organic Matter |
| Dune 1 | 2.5 | 0.5 | 5 | 10 |
| Dune 1 | 3 | 0 | 1 | 0 |
| Dune 1 | 3.5 | 0.5 | 1 | 50 |
| Dune 5 | 3 | 0.5 | 1 | 50 |
| Dune 5 | 3 | 1 | 1 | 100 |
| Dune 5 | 3.5 | 1.5 | 1 | 150 |
| Black Oak Savannah | 1.5 | 3.5 | 5 | 70 |
| Black Oak Savannah | 0.9 | 2.1 | 3 | 70 |
| Black Oak Savannah | 2.5 | 0.5 | 3 | 16.66666667 |

Diagram 1: % of organic matter against the dune age

|  |  |  |  |
| --- | --- | --- | --- |
| Dune 1 | Plot 1 | Plot 2 | Plot 3 |
| Marram Grass | 2 | 0 | 1 |
| little blue stem  | 2 | 3 | 0 |
| Type 1 | 2 | 1 | 1 |
| cotton wood | 0 | 0 | 1 |
| white flower | 0 | 0 | 0 |
| VA S. | 0 | 0 | 0 |
| Type 3 | 0 | 0 | 0 |
| Yellow Flower | 0 | 0 | 0 |
| Purple Flower | 0 | 0 | 0 |
| Hoary Puccoon  | 0 | 0 | 1 |
| Total  | 6 | 4 | 4 |

Diagram 2: Average Diversity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dune | Quadrant | Grasses | Forbs | Ratio |
| 1 | 1 | 6 | 0 | 1 |
| 1 | 2 | 4 | 0 | 1 |
| 1 | 3 | 2 | 1 | 0.66666667 |
| 2 | 1 | 12 | 0 | 1 |
| 2 | 2 | 11 | 0 | 1 |
| 2 | 3 | 8 | 0 | 1 |
| 3 & 4 | 1 | 4 | 10 | 0.28571429 |
| 3 & 4 | 2 | 2 | 17 | 0.10526316 |
| 3 &4 | 3 | 6 | 12 | 0.33333333 |
| 5 | 1 | 12 | 8 | 0.6 |
| 5 | 2 | 2 | 24 | 0.07692308 |
| 5 | 3 | 0 | 0 | 0 |
| Black Oak Savanna | 1 | 23 | 6 | 0.79310345 |
| Black Oak Savanna | 2 | 1 | 8 | 0.11111111 |
| Black Oak Savanna | 3 | 3 | 12 | 0.2 |

Diagram 3: Ground Cover

|  |
| --- |
| Question 3: How does % Ground Cover change with Dune Age? |
| Dune Age |   | Average percent Cover | Standard Error |
| Dune 1 | 35 | 8.062257748 |
| Dune 2 | 42 | 2 |
| Dune 3&4 | 61 | 9.291573243 |
| Dune 5 | 67 | 2.516611478 |
| Dune Black Oak Savanna | 43 | 3.415650255 |

Diagram 4: Grass to Forb

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Graphs |  |  |  |  |  |  |
|  | Grass | Tree |
| Dune | Marram Grass | Little Blue Stem | Type 1 | Black Oak | Cotton Wood | Type 3 |
| Dune 1 | 1 | 1.6666667 | 1 | 0 | 1.666667 | 0 |
| Dune 2 | 8.3333333 | 1 | 1 | 0 | 1 | 0 |
| Dune 3 & 4 | 0 | 3 | 1 | 0 | 0 | 0 |
| Dune 5 | 0 | 4.3333333 | 0.3333333 | 0 | 0 | 0 |
| Dune Black Oak Savanna | 7 | 0 | 2 | 0.3333333 | 0 | 3.666667 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Errors |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | Grass | Tree |
| Dune | Marram Grass | Little Blue Stem | Type 1 | Black Oak | Cotton Wood | Type 3 |
| Dune 1 | 0.57735027 | 0.881917104 | 0 | 0 | 0.3333333 | 0 |
| Dune 2 | 0.8819171 | 1 | 0.5773503 | 0 | 0.57735027 | 0 |
| Dune 3 & 4 | 0 | 1.154700538 | 0 | 0 | 0 | 0 |
| Dune 5 | 0 | 3.844187532 | 0.3333333 | 0 | 0 | 0 |
| Dune Black Oak Savanna | 6.5064071 | 0 | 0.5773503 | 0.3333333 | 0 | 3.17979734 |

Diagram 5: Tree Distribution

|  |  |
| --- | --- |
| Table 1 - Ground Cover  |  |
| Chi-Square  | Degree of Freedom  | P-Value |  |
| 29.89 | 4 | <0.0001 |  |
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|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Table 2 - Species Distribution |
| Species  | Chi-Square  | df | P-Value |
| Marram Grass | 20.23 | 4 | 0.0004 |
| little blue stem  | 5.78 | 4 | 0.2162 |
| Type 1 | 1.33 | 4 | 0.8563 |
| Black oak | 1.33 | 4 | 0.8563 |
| Cotton wood | 4.42 | 4 | 0.3521 |
| Type 3 | 14.67 | 4 | 0.0054 |

Diagram 7: Chi- Square

**Discussion**

**Average diversity against the age of a Dune**

***Graph 1: Average Diversity***

The finding of the study indicates that there is high diversity of species in some dunes compared to others. Based on the data collected, in the beginning we had high species diversity and then the diversity decline as it moves to Dune 2 to Dune 5and then back to the savanna. As indicated on the diagram 2 above, the Dune 1 has a diversity index of 2.8, which is very high compared to Dune 2, Dune 3 and 4 and Dune 5. The result of the analyzed data therefore, approves the hypothesis that the diversity of the species reduces as the age of Dune increases. According to (Yunger, Meserve, & Julio, 2002), the species coexist within the community unuqie and under different condition. And based on he result the age of a Dune determine the the dieversity which exist within the park. From the result obtained and illustrated in diagram 2 above, the a one year old Dune has a high average diversity of 2.8, the two years old has a diversity of 1.47, three and four years old Dune has an average diversity of 1.78 and the fuvev years old Dune ha an average diversity of 1.2. It is therfeore, evident that the older the Dune the lower the avaregae diverisity. Research shows that diversity is an essential component in biodiversity of the ecosyetm and therefore, the existence of the Dune has high effect on the diversity of species. It also means that the Dune, which has existed for years reduce the diversity of especies. According to Afsharzadeh & Abdi (2016) it means that several plant or grass species cannot live or survive for long with Dune. It could be the reason the diversity is very lower where the Dune has existed for years. According to the data in the beginning we had high species diversity and the diversity leveled off from Dune 2 to Dune 5 and then back to Savanna we can notes an increase.

**Soil Development Organic Matters**

***Graph 2: Organic matters***

The finding of the study also indicates that the % of the organic matters of the soil increases with the dune age as a result of biological reason of facilitation. It is established that as the age of the Dune increases the soil organic matter increases. As illustrated in the diagram 1 above one year old Dune registered 0% organic matter and increases step by step until it reaches five years then start to reduce further. It means that the soil fertility could be high where an old Dune exists. The aged of the Dune is therefore, important for the soil organic matters. The result indicates that Dune aged 5 year has organic matters of lowest of 50% and the highest of 150%, and one year old has lowest of 0% and the highest of 30% and indicated on the diagram 1 above. The result also indicates that the organic matters of the soil reduced on the black oak savanna. It is therefore, evident that the organic matter depends on the age of the Dune and even the savanna oak has the lowest organic matter. Therefore, it could the reason of lower number of species at the old Dune compared to the other locations including savanna.

**Ground cover**

**Graph 3: Ground cover**

The result also indicates that the ground cover changes as the age of a Dune changes. The test was done to determine whether the ground cover is directly related to the age of a Dune. And based on the result obtained, the hypothesis is rejected. Statistically, the P-Value obtained is <0.0001. The P-value is less than 0.05 and therefore, the null hypothesis is rejected and therefore, we can conclude that our observed result not equal to the expected. iao, Zhao, Xiufang, Liu, Xuehua, & Dong (2012) pointed that the soil cover depend on the organic matters of the soil and therefore, it is evident that the age of a Dune determines the ground cover. The experiment, we can see an increase of cover across within the dune age then a slightly decrease in the Black Oak Savanna.

 **Grass Forb**

***Graph 4: Grass to forb***

The study established that the grass to Forb decreases as the age of the dune increases. At the beginning the grass to forb was 0.9, in the second year the forb to grass increased to 1 and then it started to reduce drastically. The result indicates that the grasses to forb decreases with age and increases with savanna. In our graph that our Grasses to Forb ration Decreases within dune Age and increased at Black Oak Savanna, it is therefore evident that the age of Dune determines the grass to forb. In the Indiana Dune National park, the ground coverage is highly visible in places where the Dune has existed for a short period. From the experiment it can be concluded that the grass coverage are highly visible in places where the organic matters is lower. Based on the result obtained, it can be concluded that the grass forb cannot survive well in a highly fertile ground. According to Álvarez-Molina & Pérez-Maqueo (2013) grass forb requires less orgnic component to grass and a lot of fertility killsthe forb. This could be the reason there is low grass to forb in places where there are high fertility of the soild and that is in a Dune, which is old. In the graph 4 above it is evident that the as the age of a dune increases the grasss to forb ratio reduces as the well. This means that the age of dune is directly related to the grass to forb within a park.

**Grass species distribution**

*Graph 5: Grass Species distribution*

The study indicates that grass distribution is based on the age of a Dune. Experiment indicates that the higher the older the Dune the higher the ratio of grass distribution. It also indicates that Marram grass is highly distributed at the Dune 2 and Dune five and lower at Dune 1 and dune 3. The pattern of distribution of Marram is therefore, unique and does not support the hypothesis. However, the distribution of little blue stem is even and it supports the hypothesis. It is established that the older the age of a Dune the higher the distribution ratio of the Little Blue stem within the park (Isermann, 2011).

Tree Species distribution

**Graph 6: tree Species distribution**

The result also indicates that the distribution of trees is determined by the age of the Dune. The result indicates that type 3 tree does not exist in dune from the beginning. The Type 3 is only highly distributed in Dune Black Oak savanna. As illustrated on the graph above, black Oak, cotton woods are distributed at the beginning from when the Dune is 1 year and 2 years. But the two species are not distributed at Dune 3 and 4, Dune 5 and Dune black oak savanna. However, the black oak is distributed at Dune black oak savanna only. This is a unique distribution type being presented by the study (Caughlin, Ferguson, Lichstein, Bunyavejchewin, & Levey, 2014).

**Conclusion**

The finding of the study accepted and rejected the hypothesis as well. The study accepted that the distribution of the species is directly determined by the age of a Dune. This means that the age of a Dune is very significant within an ecosystem and therefore, it is also support diversity of various species.

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Appendix 1: Data of Dune against the soil organic matter



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| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| Graphs |  |  |  |  |  |  |
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