WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Comparative Study of Angiosperm Diversity among Dry and Moist Habitats.

[1]C Gokul Reddy (2362054), [2]Mannevaram Abhinava Reddi (2360642), [3]Narra Gowthami (2360644), [4]Hithashri Bojanala (2360379)

Christ University Kengeri Campus

ABSTRACT

The angiosperm diversity and distribution varies with the range of habitats in which they grow. The present investigation concerns the change in the diversity and distribution of Angiosperms between dry lands and wetlands. The dry lands considered are IISER's permanent campus and IIT's campus, and wetlands are the lakes of both the IISER campuses. The angiosperm diversity, richness, evenness, and species similarity in both habitats were analyzed with the Shannon-Wiener and Simpson diversity indices, species accumulation curves, and similarity indices. The diversity index calculations and the accumulation curves majorly suggest that the diversity of angiosperms is higher in wetlands. We have also observed from the similarity index that due to less geographical variation and less variation in rainfall, temperature, and humidity among our study sites for dry and wet habitats, the number of species common for both habitats was more.

1. INTRODUCTION

Eastern ghats are home to unique biodiversity and ecosystems. Tirupati is located at the foot of the Seshachalam hills of the eastern ghats. The ghats are species-rich zones with 178 families of angiosperms, contributing to 53.6% of the total plant species[0]. To study their diversity and distribution, two habitats were compared, dry and wet.

The interaction between environmental factors creates different habitats[11]. We considered the dry habitat as the one not surrounded by a water body and the wet habitat as the one with a water body. Climatic conditions play a significant role in affecting species diversity and species richness. The factors that greatly influence species richness and diversity are precipitation[1], light intensity[2], and temperature[3]. Compared to the dry habitat, wet provides favorable conditions with relatively high precipitation and cooler temperatures for plants to thrive.

Our study mainly hypothesizes that the diversity of angiosperms is higher in wetlands. We also predict that there are more common species in our study sites due to less geographical variation.

2. OBJECTIVE

Our Study mainly compares species diversity and richness among the dry and wet habitats. The Results of our study aim to answer:

1. Which habitat has more species diversity and

2. Why are more common species observed?

3. METHODS

3.1. Study sites:

The dry lands considered are **IISER's permanent campus** and **IIT's campus**, and wetlands are the **lakes of both the IISER campuses**. *Kapilatheertham* was considered as an additional study site for reference.

The Map showing our study site[4]

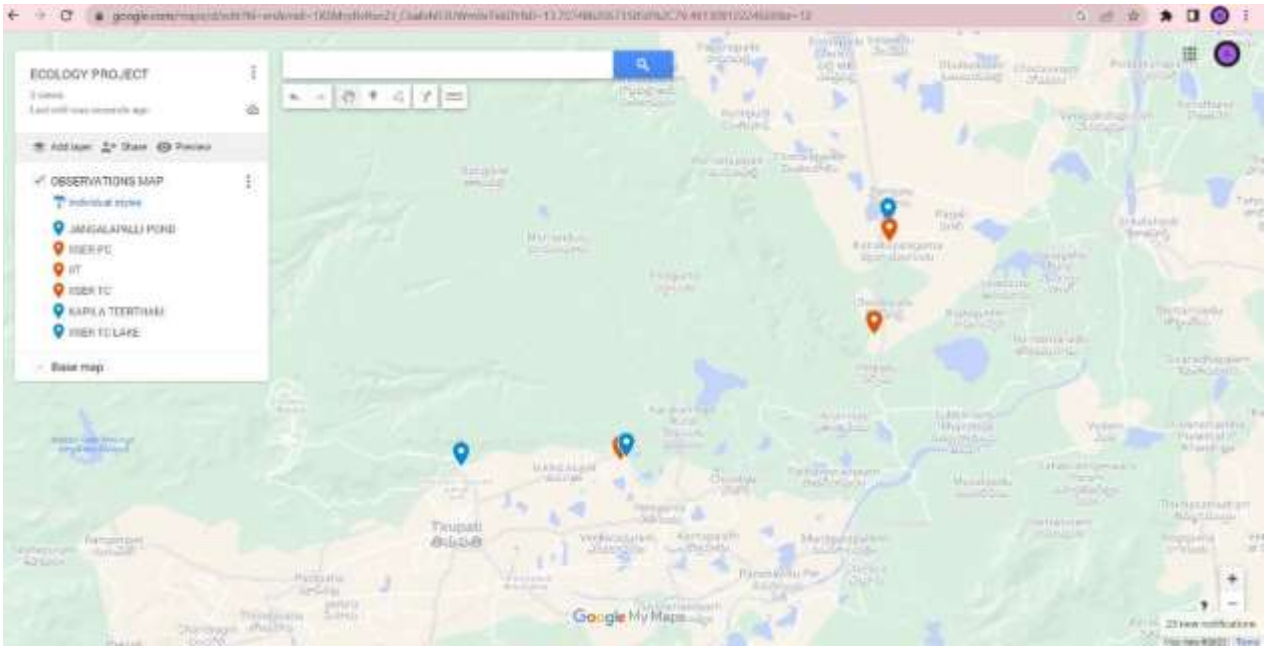
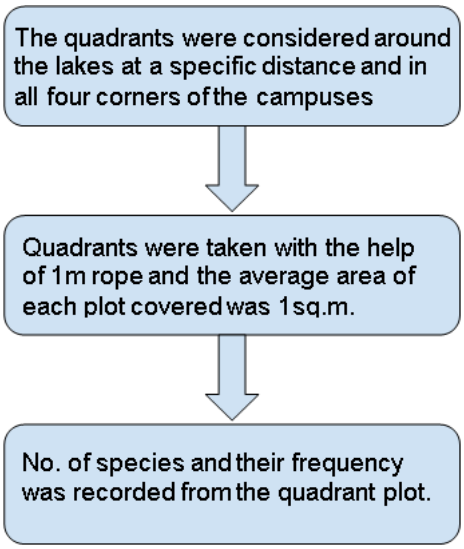


Fig 1: map showing study sites, the blue color represents the study sites for wet habitats, and the red color represents the study sites for dryland.

3.2. Data collection

The Observations were collected from August 10th, 2022, to October 25th, 2022. The study sites for dry lands have high human intervention, and uneven distribution of plants was observed. To obtain accurate data from each study site following procedure was followed:



3.3. Data organization and identification

To compare the species richness and diversity, identifying species is necessary. The iNaturalist app was used to record and identify the species observed in every study site and for those in the quadrants.

3.4. Data analysis

3.4.1 Quantitative Analysis:

Diversity Indices:

Shannon Wiener and Simpson's diversity indices were used for comparing the diversity of species found in dryland and wetlands quantitatively.

- Shannon Weiner diversity index of a community is given by[7]:

$$\mathbf{H = -\sum (n_i / N) \ln (n_i / N)}$$

Where, n_i = No. of individuals of ith species

N = Total no. of individuals

Simpson's diversity index was also used to measure the diversity of species found in drylands and wetlands quantitatively. It takes into account both species richness and evenness in a community.

- Simpson's diversity index is given by[8]:

$$\mathbf{D = = 1 - \sum (n_i / N)^2}$$

Where, n_i = No. of individuals of ith species,

N = Total no. of individuals

D is the diversity index ranging from 0 to 1 (values closer to 0 indicate low diversity and values closer to 1 indicate higher diversity),

Similarity Indices:

The similarity indices were used to check the extent of similarity between two study sites of each habitat. The two major indices were:

- The Jaccard index compares two sites based on the presence or absence of species and is used with qualitative data (e.g., species lists). It is based on the idea that the more species both sites have in common, the more similar they are. The Jaccard index is the proportion of species out of the total species list of the two sites, which is common to both sites:

$$\mathbf{SJ = c / (a + b + c),}$$

where SJ is the similarity index, c is the number of shared species between the two sites and a and bare the number of species unique to each site.

- The Sorensen index is a similarity index frequently referred to as the coefficient of the community (CC):

$$\mathbf{CC = 2c / (a + b + 2c).}$$

This index differs from Jaccard's in that the number of species shared between the two sites is divided by the average number of species instead of the total number of species for both sites. For both indices, the higher the value, the more ecologically similar the two sites are.

Species accumulation curve

The species accumulation curve is a graph recording the cumulative number of species recorded per unit effort. Three species accumulation curves have been plotted: one for all observations, one for species identified in dry habitat, and one for species identified in moist habitat. The curves were plotted based on the exported data of the observations from the iNaturalist app using excel.

3.4.2. Quantitative Analysis:

For qualitative analysis species that were more in number in each habitat were studied, and the species that were rich in both the habitats was also analyzed.

4. RESULTS

The curated data from the iNat app has shown us that the number of species found in the dry habitat are **235** and the number of species found in the wet habitat are **332**, and **97** species were in common for both the habitats.

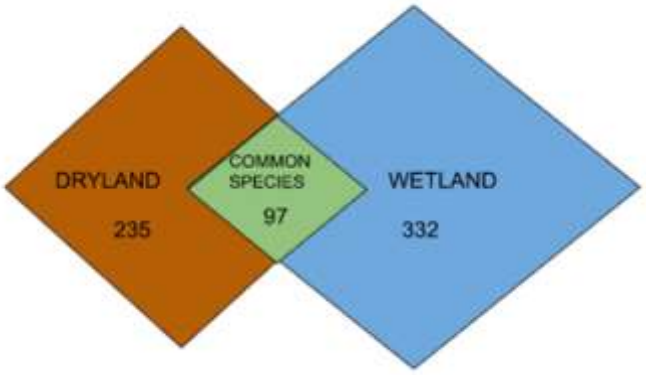


Fig 2: intersection diagram for dry and wet habitats

4.1. Quantitative Analysis:

Diversity Indices:

The values obtained after calculating the Shannon Wiener[9] and Simpson index[10] are:

Classification	Dry habitat		Wet habitat	
Area under study	IISER Permanent campus	IIT Campus	Jangalapalli Lake	Transit campus lake
Shannon Weiner diversity index	**2.150865795**	**1.9616511**	**2.928965983**	**2.245604449**

Table 1: the obtained Shannon Wiener index values for every study site

Classification	Dry habitat		Wet habitat	
Area under study	IISER Permanent campus	IIT Campus	Jangalapalli Lake	Transit campus lake
Simpson's index	**0.85261708**	**0.9490**	**0.92949699**	**0.8947**

Table 2: the obtained Simpson's index values for every study site

- The average Shannon index for dry habitat and wet habitats are **2.0562584475** and **2.587285216** respectively.
- The average simpson's index for dry and wet habitats are, **0.90080854** and **0.912098495** respectively.

Similarity Indices:

As predicted earlier, the closer the habitats are, the more the species they share in common (see table 3). When two study sites of the two habitats were compared, the obtained similarity values are as follows:

Study sites (dry vs wet) Indices	IISER PC vs IISER PC lake	IIT Tirupati vs IISER PC lake	IISER PC vs IISER TC lake
Jaccard CJ C = j / (a + b – j)	a = 10 b = 10	a = 6 b = 10	a = 10 b = 3

	j = 4 **C = 0.25**	j = 3 **C = 0.23**	j = 2 **C = 0.18**
Sorensen CS CS = 2j / (a + b)	a = 10 b = 10 j = 4 **CS= 0.4**	a = 6 b = 10 j = 3 **CS= 0.375**	a = 10 b = 3 j = 2 **CS= 0.3**

Table 3: the similarity index values for two study sites from each habitat

All the calculations were based on the data obtained from quadrants.

Average similarity between both habitats:

- Jaccard CN = **0.22 (22% of similarity)**
- Sorensen CS = **0.3583 (35.8% similarity)**

Species accumulation curves:

All the curves were plotted taking x-axis as the number of observations recorded and y-axis as the number of species identified.

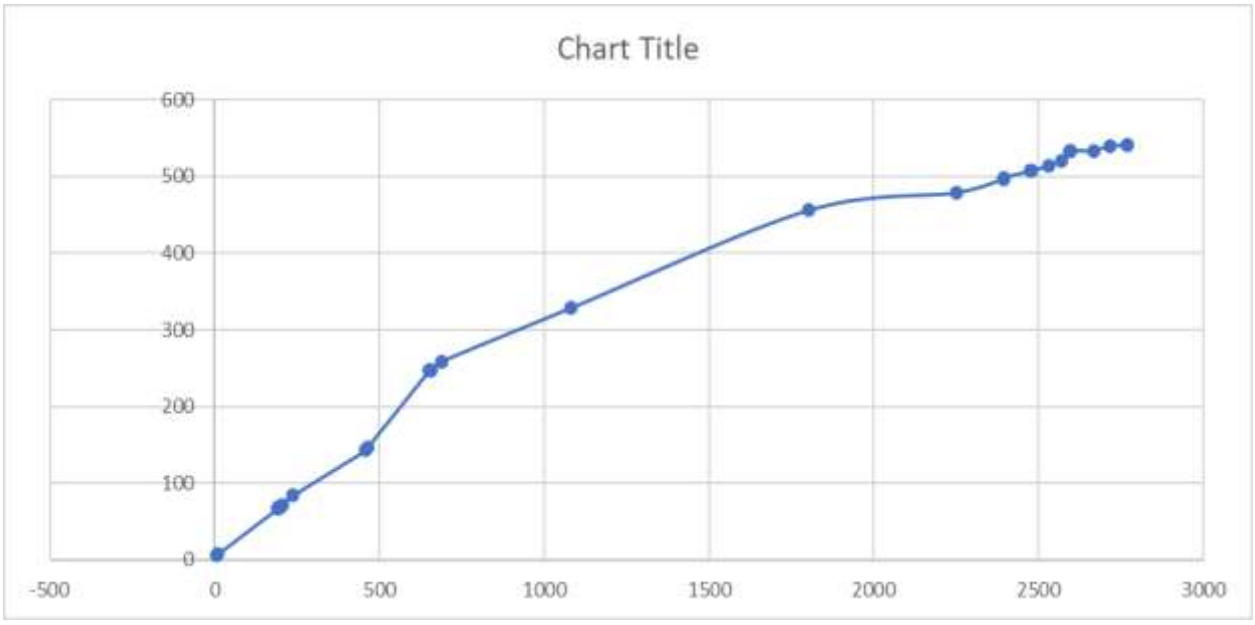


Fig 3: total observations accumulation curve

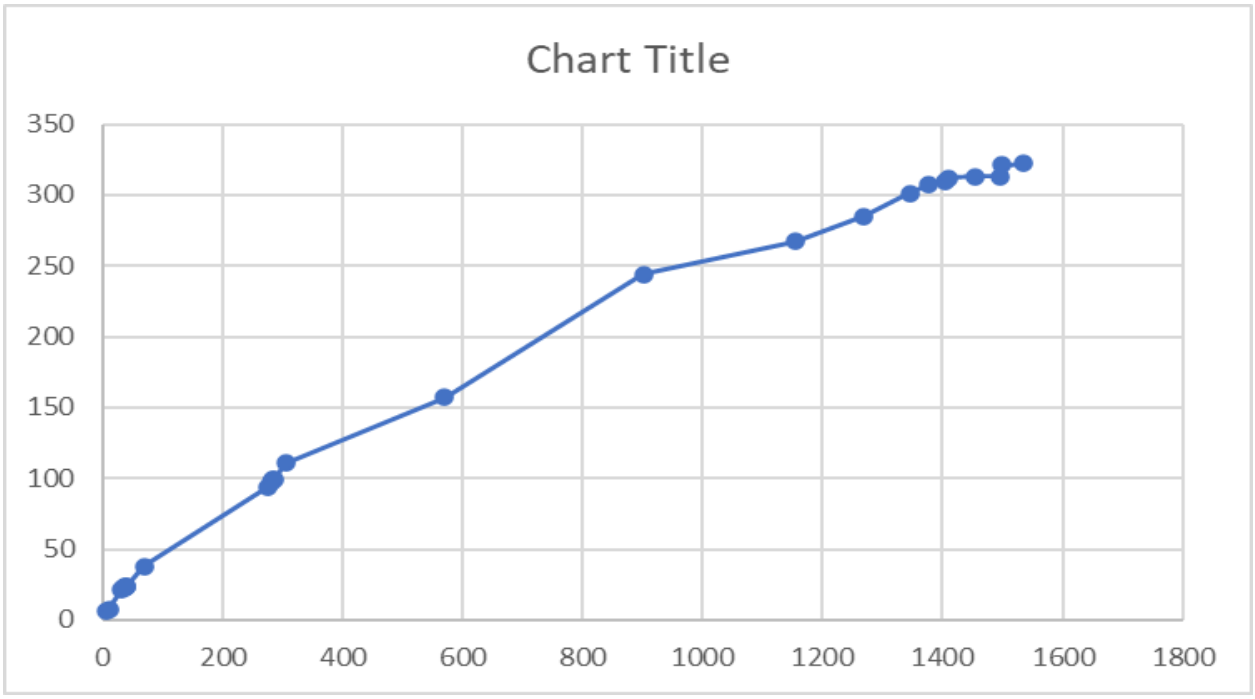


Fig 4: Dry habitat's accumulation curve

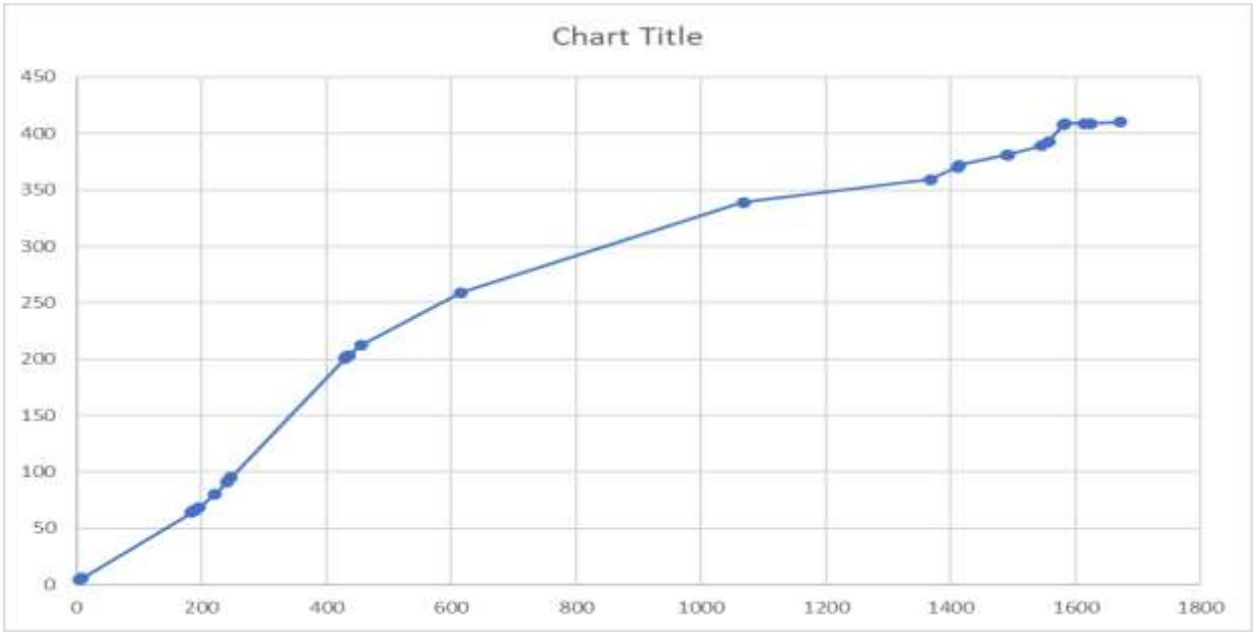


Fig 5: Wet habitat's accumulation curve

- The wet habitats accumulation curve implies that for all the 1600+ observations, 400+ species were identified.
- The dry habitat's curve implies that for every 1450+ observations 300+ species were identified.

4.2. Qualitative Analysis:

The following pie charts explain the species richness in both the habitats.

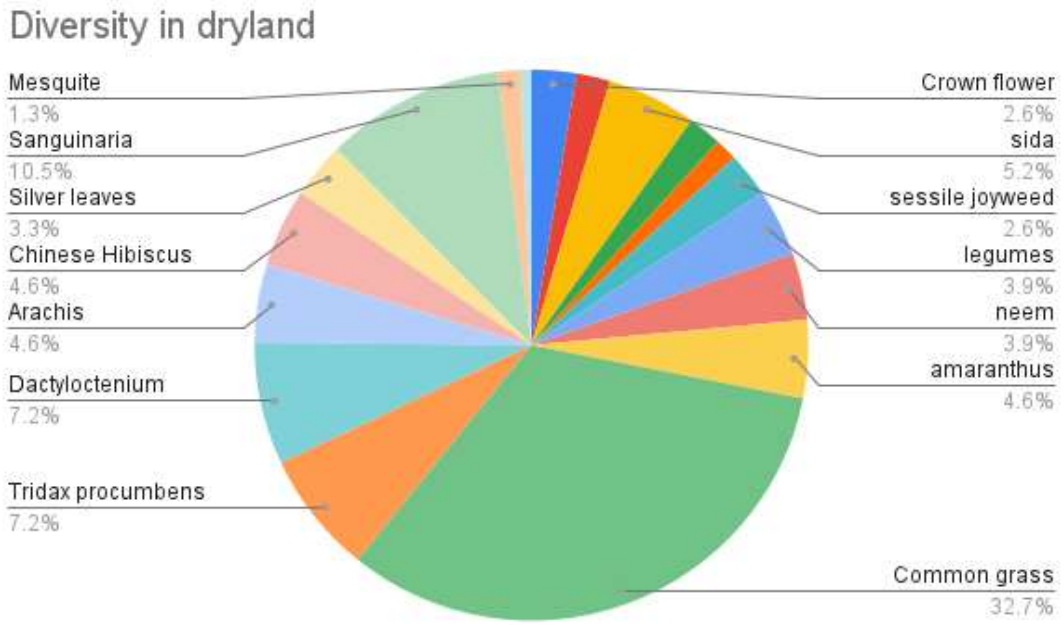


Fig 6: diversity in dry habitat, common grass is more rich in dry habitat

The reason for the abundance of grasses in the dryland is that it is sturdy and also requires minimum care . Adequate amount of sunlight ,water and nutrients help them to grow accordingly .

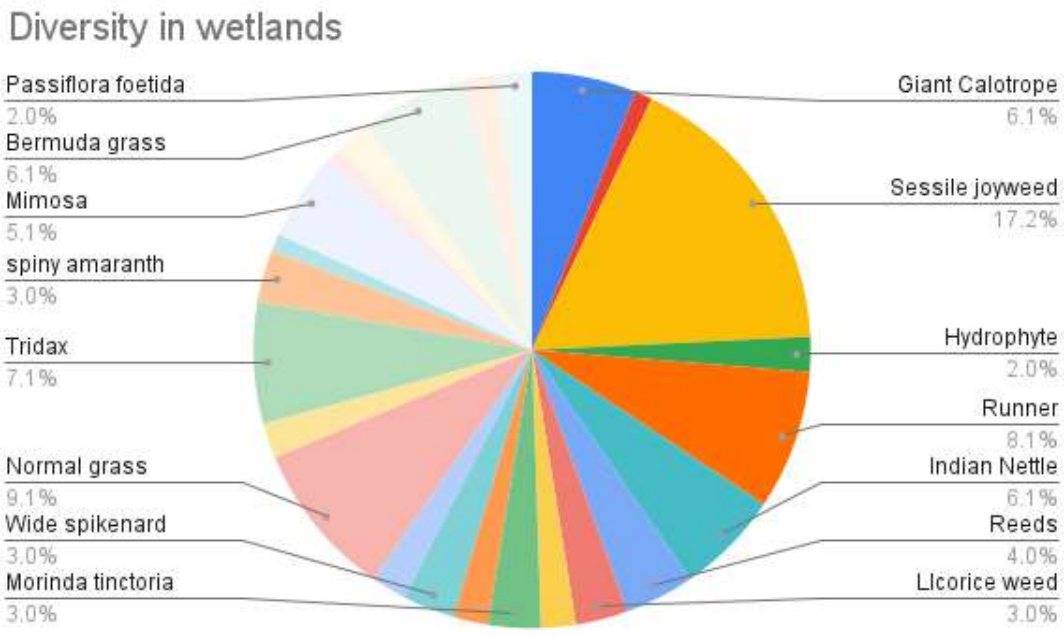


Fig 7: diversity in wet habitats, sessile joyweed is more rich in wet habitats

The Conditions for the growth of sessile joyweed are alkaline soils, poor sandy or loam cotton soils, and it cannot sustain in low light areas. It is more adapted to water logged areas.These conditions are satisfied by the moist habitats. So the sessile joyweed is mostly found and also more in number in the moist habitats.It is more evident from the pie chart that- Sessile joyweed is more dominating than any other species in the moist habitat .The moist habitat has more availability of light, more quantity in minerals, always the habitat is wet.

5. DISCUSSION

All the diversity indices and species accumulation curve infer that the wetlands have more species diversity and richness. In both the curves (see fig 4 & 5, at the mark of 1450 observations on x-axis, the identified number of species in dry habitat are 310+, whereas the identified no. of species in the wet habitat are 400+, proving our hypothesis. The Shannon Wiener and Simpson diversity index values are higher for wet habitats, which tells us that the wet habitat is more diverse than the dry habitat, i.e., it has greater species richness and is more evenly distributed (as seen in the curves). The Simpson's diversity index also tells us that if any two individuals are picked from a dry habitat, then there are 90.08% chances that both of them are different species. The chances for the same are 91.2% for wet habitat, which again proves our hypothesis.

The similarity indices calculated for two study sites, one from each habitat, show that the similarity on an average is 22% for Jaccard CN and 35.8% for Sorenson CN (see table . When the similarity index for the overall observations in both the habitats is calculated (from the fig 2), the Jaccard CN shows 0.206382979 or 20% and Sorenson CN shows 0.342151675 or 34.2%. This 0.2% change difference in Jaccard CN and 1.6% change in Sorenson CN was seen because of less geographical variations as predicted earlier.

Drawbacks:

- Major drawback was being unable to conduct a proper and elaborate qualitative analysis due to inaccurate identification of species and shorter span of time.
- The other drawback was being unable to explore most possible factors causing the difference in both the habitat's diversity like soil pH, soil porosity and soil nutrients.
- As we chose five study sites we faced difficulties in the process of analysis and calculations.
- For the wetlands we were unable to study some areas as it seemed too risky.

References

[0]https://www.tirupatibiodiversity.org/events/eastern-ghats-symposium

[1]https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=0CAQQw7AJahcKEwjYueLwwr37AhUAAAAAHQAAAAAQAg&url=https%3A%2F%2Fwww.sciencedirect.com%2Fscience%2Farticle%2Fpii%2FS1470160X22002333&psig=AOvVaw0QWsX1IukbFfsB3GOLt-2u&ust=1669059881639812

[2]https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjfsp33w737AhV1TWwGHWWRAa8QFnoECA0QAw&url=https%3A%2F%2Fonlinelibrary.wiley.com%2Fdoi%2Fpdf%2F10.1111%2Fjbi.12173&usg=AOvVaw1TGs5sWa9li2xWTPyzS617

[3]https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi60rnew737AhWeSWwGHe3cB9oQFnoECA0QAw&url=https%3A%2F%2Fwww.researchgate.net%2Fpublication%2F343300490_Plant_species_richness_increases_with_light_availability_but_not_variability_in_temperate_forests_understorey&usg=AOvVaw1KXr4f57c96bUecHyJqvXM

[4]https://www.google.com/maps/d/edit?mid=1XEMrpRvRxoZJ_CkalbhR3UWm9xTkkDY&usp=sharing

[5]https://docs.google.com/spreadsheets/d/1v0p6AO-JNTwDBxoaePzeZsaMaQrPKOGtdVyLnVL4WOA/edit?usp=sharing

[6]https://docs.google.com/spreadsheets/d/1ptRKw7LbEhdYQSWapDSOJslNgWIBkBFgV_lVGM-f9f8/edit?usp=sharing

[7] https://www.statology.org/shannon-diversity-index/

[8] https://geographyfieldwork.com/Simpson'sDiversityIndex.htm

[9] https://www.omnicalculator.com/ecology/shannon-index

[10] https://www.omnicalculator.com/ecology/shannon-index

[11] *Wiedemann, 1984, The interaction between environmental factors creates different types of habitats*

[12] https://homeguides.sfgate.com/grass-need-survive-93360.html

[13]https://www.inaturalist.org/projects/comparative-study-of-plants-distribution-between-drylands-and-wetland