

# Vegetation Classification and Its Response to Soil Organic Matter along Simly Lake Using Ordination Technique

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**Abstract-** A study on herbaceous vegetation of Simly Lake, Islamabad was undertaken. The purpose is to determine and quantify the floristic composition of vegetation data around Simly Lake. The floristic distribution was analyzed by the use of multivariate techniques. Total 21 species belonging to 19 families were recorded from 50 quadrats from Simly Lake. The vegetation data was analyzed by using ordination methods like TWINSpan and Detrended Correspondence Analysis. The relationship of vegetation data with soil organic matter and its significant influence was analyzed by Canonical Correspondence Analysis (CCA). The most abundant species were *Cynodon dactylon*, *Anagallis arvensis*, *Parthenium hysterophorus* and *Malvestrum coromendalium*.

Key words-Classification, Islamabad, Spatial Distribution, Simly lake, Vegetation

## 1 INTRODUCTION

VEGETATION can be defined as an organization of impulsively growing plants. It also refers to the ground cover that is provided by plants present throughout the world. The effective means of stabilizing soils and erosion control is vegetation. It protects soil from the collision of falling rain, reduces the flow velocity and disperses flow.

Vegetation provides the rough surface that slows the run off velocity and promotes infiltration and deposition of sediment. Vegetation is now declining rapidly due to the negative activities of human beings. [1] Dam is an obstacle that is built crossways a water channel to control and hold back the water flow. Some dams redirect the flow of water of river into a canal, pipeline or course. Generally dams are constructed in hilly reach of the river where the basin is narrow and the base is good. Dams are for different purposes. These purposes may be Hydro-power, Irrigation, Flood Control, Water-supply, Navigation, Recreation and Fishing. Pakistan's entire nation, one or the other way depends on dams. Water in dams is used for the agricultural purposes and also to supply electricity to a state

of nearly 16 million people.

Lake is a still water body, having no connection with sea, and has land all around. [2] Lakes have their own system and create an environment suitable for ecosystem. Amount of water in lake is dependent on the natural sources. Natural sources include rainfall, snowmelt and springs. [3] Pakistan is home to several lakes and reservoirs. These lakes and wetlands are important sources of water supply and these also support biodiversity of flora and fauna that consists of important plant, bird and animal species, as well as eighteen threatened species of wetlands mammals and twenty threatened bird species.

Soil around the lake affects the lake because it contributes nutrients and also controls the pace of runoff from the land into the lake. Soil is also necessary for the growth of plants and trees. Soil is made up humus pieces and rocks. Humus and rock mix to form soil. Soil is one of the important resources. Soil characteristics around the lake depend upon the water level with in the lake. [4]

Variability determination of soils has been of concern to geographer's and soil scientists for quite long time. Information related to properties of soil is generally available from a narrow number of point measurements and spatial estimates are prepared. Relationship of ecology between vegetation and environment and their classification methods and ordination techniques has become vital means in the research field

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vegetation ecology. Classification depends on the abundances of ground vegetation species. [5]

Ordination techniques are widely used by the ecologists to study the relationship between environment and vegetation. Many examples are found in literature which shows the importance of multivariate analysis.

In Ireland for the investigation of the diversity, nature and structure of vegetation along streamside 10 forest sites were selected. Vegetation sampling was done according to the Braun-Blanquet method. TWINSpan was used for the vegetation classification that classified the vegetation into five types. Broadleaved vegetation has double plant species richness than that of plantations of conifer. Vegetation cover and richness of plant species decreased when the distance increased from the stream that may be due to the reduction of light penetration, nutrients, soil and water as moving away from the stream. [6]

Simly Lake lies between 33°43'30" North latitudes and 73°20'51" East longitudes. Simly Lake is an 80m high earthen embankment lake on the Soan River. The lake has an area of 28,750 hectares. It is the largest reservoir of drinking water to people living in Islamabad. It not only stores the constant flow from the springs of the Patriata/ Murree mountain aquifer but also stores a large part of flood water of the Soan River. Simly Dam is a tiny dam that is built on the Simly Lake. It is situated 35 kilometers northeast of Islamabad. Water for drinking purposes is stored in it.

The basic aim of the study was to classify and quantify the herbaceous vegetation along Simly Lake and it was achieved by doing spatial analysis and finding spatial distribution of vegetation pattern by using ordination techniques.

## 2 MATERIALS AND METHODS

For Vegetation collection field trips were made. Vegetation was picked by Quadrat method. By Domin cover scale value, herbaceous vegetation and their estimated cover value was recorded using the visual estimation from every quadrat. [7] 50 quadrats of size of 1×1 m<sup>2</sup> were laid down randomly. Plant community's distribution was recorded from each of these quadrats. The collected specimens were preserved for the identification and then were identified by the experts.

The data was analyzed firstly by Two Way Indicator Species Analysis. It is used for overall classification and grouping of plant species. TWINSpan was run by using the PC-ORD software. This was used as tools for the development of classification for floristic data and vegetation types. Species cover was analyzed to determine various vegetation groups. Various cut levels were studied. For the examination of relationship and distribution patterns of different vegetation groups in Simly Lake, Detrended Correspondance Analysis (DCA) was conducted. Study of species correlation with organic matter in soil, CANONICAL CORRESPONDANCE ANALYSIS (CCA) techniques was used.

## 3 RESULTS & DISCUSSION

Present survey has been conducted in the Simly Lake. No particular research regarding the herbaceous flora of Simly Lake has been conducted so far although this dam is of eminent importance as it is a major source of water for the residents of Islamabad. This study classified the species distribution and abundance in the Simly Lake. The most frequent species in the lake were *Cynodon Dactylon*, *Parthenium hysterophorus*, *Malvestrum coromandelianum* and *Anagallis arvensis*. Sum of 21 species belonging to 19 families from all over the lake area were recorded.

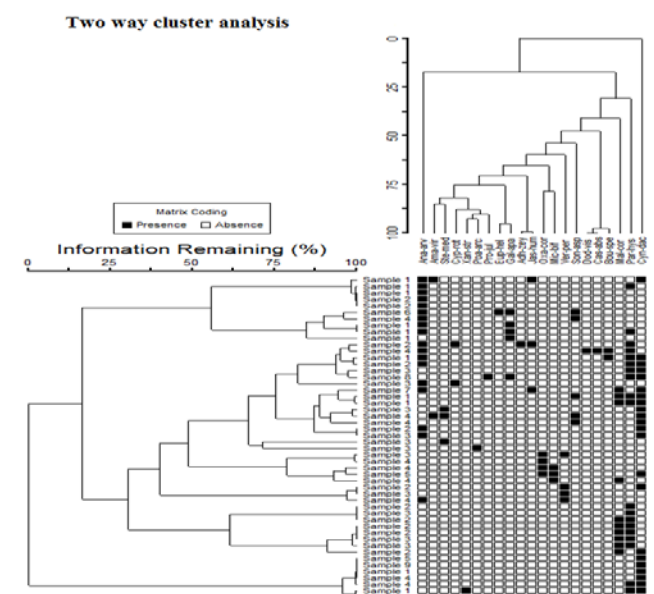


Figure 1: Two Way Cluster Analysis of Species along Simly Lake

TWINSPAN led to the division of all the species data into two main groups. Group 1 consisted of single specie and was not further dissevered while group 2 was further divided into different subgroups. Group 1 consisted of *Cynodon dactylon* which was the most diverse specie in the area. *Anagallis arvensis* that was present in group 2 had the diverse presence in this area but did not form any associated group with species. Community 1 was the major community in group 2 and it consisted of *Amaranthus viridus*, *Stellaria media*, *Cyperus rotundus*, *Xanthium strumarium*, *Poa arctica* and *prosopis juliflora*. The most prominent of these species were *Amaranthus viridus* and *Stellaria media*, hence the name given to this community will be *Amaranthus-Sellaria*(ama-ste). They had a diverse presence in the Simly Lake but did not form community with any other species.

Detrended correspondence analysis of Simly Lake resulted in ordination of the species into two main groups. One was designated as major community because the number of species exceeded the other community. Major community consisted of 17 species and the minor community consisted of 3 species i.e *Cynodon dactylon*, *Malvestrum coromandelianum*, *Xanthium strumarium*, *Anagallis arvensis*, *Amaranthus viridus*, *Sonchus asper*, *Jasminium humile*, *Parthenium hysterophorus*, *Prosopis juliflora*, *Euphorbia helioscopia*, *Bougainvillea spectabilis*, *Cassia absus*, *Adhatoda zeylanica*, *Stellaria media*, *Dodonaea viscosa*, *Galium aparine* and *Cyperus rotundus* formed the major community and minor community consists of *Oxalis corniculata*, *Micromeria biflora* and *Veronica persica*. The results obtained were identical with TWINSPAN.

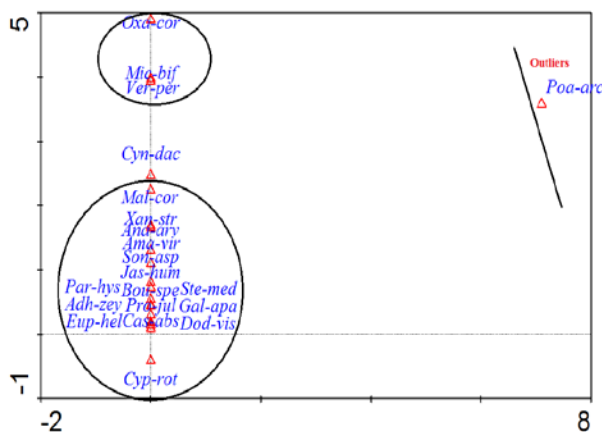


Figure 2: DCA scatter plot of species along Simly Lake

Referring to the dominance curve *Cynodon dactylon* obtained the first rank in the dominance curve with 23 % frequency while *Anagallis arvensis* showed the second number in the frequency i.e 19% while *Parthenium hysterophorus* was the third most frequent specie with the frequency of 19% and *Malvestrum coromendilinum* stood fourth most frequent specie with the frequency of 10%.

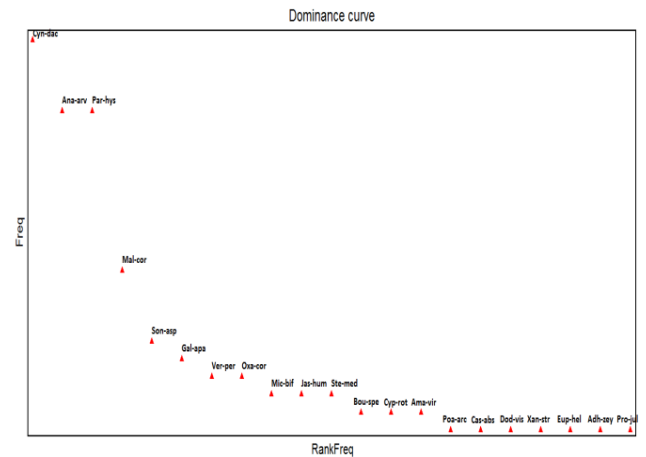


Figure 3: Dominance curve of species along Simly Lake

Response curve is a graphical representation that exhibits the magnitude of the response given against any stimulus. One of the most important tasks of ecology is determination of response of species on the basis of certain gradient that are under study.

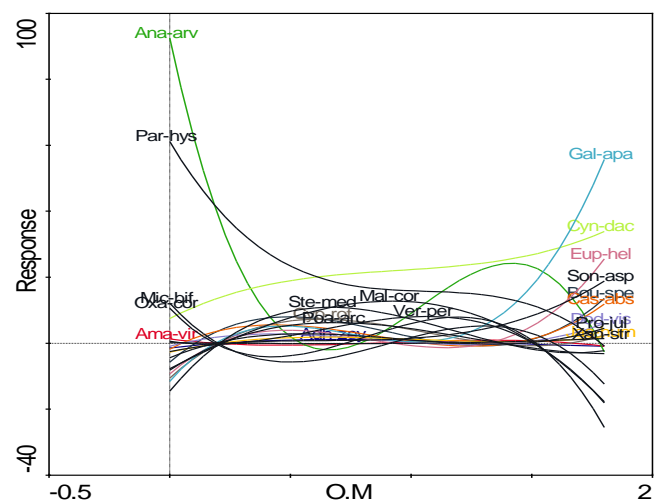


Figure 4: Response curve of species along Simly Lake

Response curve makes possible to estimate the species optimum, tolerance, identifies the specialist and generalist's specie. Response curve of O.M showed that *Cynodon Dactylon* was at the

top of all species in the response curve. According to all these 3 variables it was the most abundant species as it had the upper quartile of 40 and lower quartile 0 while median was also 0. *Parthenium hysterophorus* held the second highest position. It had upper quartile of 30 and lower quartile of 0 and its median was also 0 and the third most abundant species was *Anagallis arvensis* with upper quartile of 20 and lower quartile and median. Other species came under stress and did not respond well to these 3 variables.

#### 4 CONCLUSIONS

The purpose of this study was to classify the herbaceous vegetation present along Simly Lake. A total of 21 species belonging to 19 families were recorded from 50 quadrats. Vegetation along the lake is extremely important because it serves many functions including prevention of soil erosion, trapping pollutants, providing cover for wild life and maintaining the natural beauty of lake. In order to maintain quality resource, sound management is necessary for the protection and preservation of a healthy vegetative buffer. Land around the lake should be left in its natural state i.e. any kind of construction should be prohibited.

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