EXERCISE 6

Determination of Minimal Quadrat Size for the Study of Herbaceous Vegetation in the College Campus by Species Area Curve Method

Structure

6.1 INTRODUCTION

Plant species are not evenly distributed in an area. They may be present in high numbers at some places and less in number at other places. The distribution of species in an area is referred to as frequency. The plant frequency can easily be measured using quadrat method. A quadrat is a sampling unit (it could be in the form of a frame) that marks specific area of the community. The quadrat is a sample plot or unit for a detailed analysis of vegetation. It is a plot of specific size used to study a population or a community. Quadrats are used to assess vegetation, measure parameters such as plant density, frequency and biomass. It is difficult to find frequency of plant species for large populations or extensive habitats. Frequency varies according to size and shape of the quadrats used. Quadrats may be square, rectangular or circular in shape. In case of rectangular quadrat, ratio of breadth and length is generally 1: 2 or 1: 4 or 1: 8. Phytosociological analysis can be carried out using quadrat method.

Community analysis is carried by measuring quadrats [10m X 10m (100sqm) size] randomly to study tree species and shrub species present in a given area. A single quadrat cannot sample a community adequately, hence repeated quadrat samples are taken. The herbaceous species was studied by

laying 50 quadrats of 1m X 1m (1 m^2) size randomly in each study site. For herbaceous vegetation quadrat size of $1m^2$ is used. The size of the quadrat depends on the layer or type of vegetation being sampled.

Vegetation	Dimensions	Area(m^2)
Mosses	10 x 10cm	0.01
Herbaceous	31.6 x 31.6cm	0.1
Forest floor herb	1x 1m	1
Shrub	3.16 x 3.16 m	10
Forest/tree	10 x 10m	100

The concept of quadrat or sample-plot method was given by **Clements** (1898). In the study of forest community quadrats of one-fifth acre are established to include maximum number of trees. In study of shrubs and grass covers usually small size quadrats are used. For grassland and low herbaceous community, the quadrats of one square meter size or 50 cm x 50 cm size or even 20 cm x 20 cm size are used.

The total basal area is measured at breast height (1.5m) and calculated using the formula πr^2. In case of herbaceous vegetation it is measured on the ground level by using calipers.

Types of Quadrats

Quadrats are named according to the use.

(i) List quadrats

When the organisms encountered in the sample plot are listed by their names, the quadrat is called list quadrat. It includes all the species botanically identified or otherwise. This quadrat gives floristic analysis of the community. This is used for studying the frequency of different species.

(ii) Count quadrat or list-count quadrat

In this type of quadrat, name and the number of individuals of each species present in an area are recorded. This type of quadrat is used for forest survey.

(iii) Cover quadrat

This quadrat records the ground area covered or shaded by vegetation.

(iv) Chart quadrat

Quadrats are mapped to scales to show the location of individuals of species. Individual plants are recorded on miniature quadrat on a graph paper. This is carried out with the help of instrument called pantograph. This measures long range vegetational changes.

Objective

After performing this practical exercise you will be able to:

- understand the use of quadrat in analysis of vegetation,
- describe the use of quadrat in determining the frequency, abundance and density of a species present in a given area, and
- determine the cover area for a species.

6.2 REQUIREMENTS

Measuring scale, nails, thread, hammer.

6.3 PROCEDURE

1. Visit any green area and lay down a series of horizontal and vertical grid lines in the area.
2. In each grid count the number of species present. Also note the total number of plant belonging to each species.
3. This can be repeated in plots of different sizes. Number of species are recorded for each plot.
4. The optimum quadrat size taken for the study of vegetation is 50 cm x 50 cm. The size is ascertained from the species-area curve analysis. The different parameters measured during the sampling include:
   - o Counts–number of individuals of a species
   - o Cover–the area (%) of the quadrat occupied by a plant species
   - o Density–number of individuals of a species per unit area.
   - o Frequency–number of quadrats in which the species is present
   - o The occurrence and numerical strength of each species in each quadrat gives assessment of frequency and density.
5. **Frequency :** The number of quadrats in which occurrence of a species is observed in relation to the total number of quadrats sampled gives the **frequency**. It indicates the number of times a plant species is present within a given number of sample quadrats. This term refers to the degree of dispersion of individual species in an area. The study area is randomly sampled at several places and the name of the species is recorded. It can be calculated using the formula

   Frequency (%) = (Number of sampling units in which the species occurs)/(Total number of sampling units employed for the study) X100
6. **Density :** The numerical strength of a species in present in definite unit space is called its density. It refers to the number of individuals of a

particular species per unit area. The number of individuals of a species in all quadrats, expressed as the fraction of number of total quadrats sampled gives the density of that species. Variation in distribution is caused by several factors like soil conditions, vegetative propagation, quantity and dispersal of seeds, grazing or other biotic activities and predation by insects or diseases.

Density of a species per unit area = Total number of individuals of a species in all the sample plots/Total No. of sample plots studied

7. **Abundance :** Abundance refers actually to density of population in those quadrats in which a given species occurs. To determine abundance, the sampling is done by quadrat or other methods at random at many places. In grasslands abundance can be recorded by uprooting the plants. It is the study of the number of individuals of different species in the community per unit area. The number of individuals of each species was summed up for all the quadrats divided by the total number of quadrats in which the species occurred. It is calculated using the formula

   Abundance of a species = Total number of individuals of the species in all quadrats /Total number of quadrats in which the species occurred

8. **Cover :** The cover implies the area covered or occupied by the leaves, stems and flowers, as viewed from the top. The coverage is studied at the canopy level and the basal region. In forest, each layer of vegetation is considered separately for measuring the coverage. Basal cover is the basal area covered by crowns or stems penetrating the soil. Basal area in grasslands refers to the coverage of ground one inch above the ground surface by stems and leaves. It is also called herbage cover. The coverage can be measured by quadrat method, transect method and point method of sampling.

   A table provided by **Daubenmire** given various cover classes for categorization of species.

Cover class	Range of coverage (%)
1	0-5
2	5-25
3	25-50
4	50-75
5	75-95
6	95-100

6.4 OBSERVATIONS AND RESULTS

The number of plants of each species present in each grid and the quadrat is counted. Similarly note down the observations for at least 10 such quadrats.

The data obtained is used for calculating the frequency, density abundance of the vegetation using the formulae provided.

The numbers of species found in the plots of different sizes are plotted on vertical axis (Y axis) against sample plot sizes plotted on the horizontal axis (X axis). A graph is drawn with size of the quadrat on X axis and number of species on the Y axis. A sigmoid curve will be obtained. This is called species-area curve. The point at which the curve starts flattening up is the minimum size of the quadrat required sampling that field.

Number of quadrat	Number of species
1	---
2	----
3	----
4	----
5	----

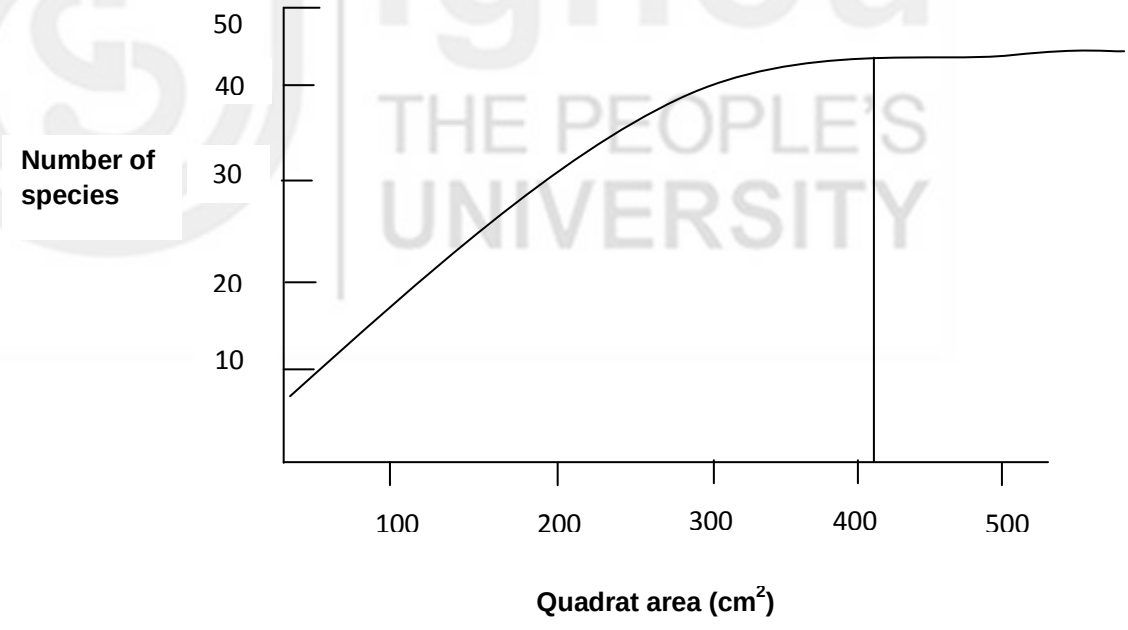

Table 6.1: Measurement of plant frequency in a given size quadrat.

Name of the species	Quadrats					Number of quadrats in which species occur	Total number of quadrats studied	Frequency (%)
	1	2	3	4	5			

Table 6.2: Measurement of plant density in a given size quadrat.

Name of the species	Quadrats					Number of species in all the quadrats	Total number of quadrats studied	Density
	1	2	3	4	5			

Table 6.3: Measurement of Plant abundance in a given size quadrat.

Name of the species	Quadrats					Total number of individuals of the species in all quadrats	Number of quadrats in which species occur	Abundance
	1	2	3	4	5			

Precautions

The quadrat should be of such small size so that it can cover maximum number of species.

Suggested readings

Baxter J. (2014) Vegetation Sampling Using the Quadrat Method. In: Methods in EEC (BIO221B) Dept. of Biological Sciences.