BOT-A-CC-4-8-P: Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components

The plant community usually is the largest visible part of an ecosystem. A community has been defined as 'an aggregate of living plants having mutual relations among themselves and to the environment'(Oosting, 1956) or as 'a collection of plant populations found in one habitat type in one area, and integrated to a degree by competition, complementarity and dependence' (Grubb, 1987).The key points about communities are the collections of species which occur together in some common environment or habitat and that the organisms making up the community. In a plant community, the individuals of species are not evenly distributed. Individuals of some species grow widely spaced while those of some other species are found in clumps or mats.

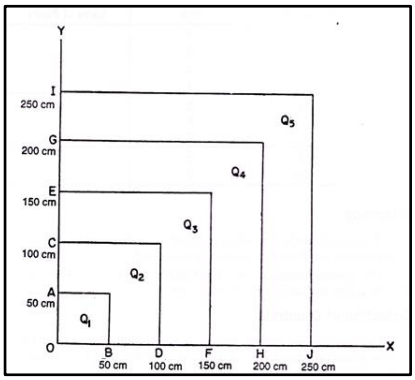
To understand the complex mesh of interactions an ecologist has to unravel the associations and events which are important in the community. The easiest way to start an investigation of a community is not to ask 'why?' or 'how?' but to ask 'what?' like 'What is the structure of a community?'.

Quadrat Method:

The quadrat is a sample area of varying size marked-off in the plant community for the purpose of detailed study. They may be square, rectangular or circular and is a tool to record the abundance or density of a particular species in a study area. Generally a number of quadrats are studied to acquire reasonably faithful data to realise different analytic and synthetic characters of the plant community. It can be used in any kind of vegetation to quantify the plant community.

Aim.1. Minimal size of the quadrat

The size of quadrats to be used in a given community is determined by constructing a species area curve. This is done by sampling the vegetation with nested quadrat method. Nested quadrats (**Fig.1**) are a series of quadrats, laid one over the other with gradually increasing size. The size of a quadrat depends on the type of vegetation being sampled and can vary from 0.25cmX0.25cm upto 100mX100m.



Requirements: Long thread, hooks or long nails, measuring tape, graph paper, pencil, pen, GPS.

Fig.1. Nested Quadrat

If the total number of species in every Quadrat (**Table 1**) are plotted on a graph paper against the area and number, respectively, for OX and OY axes, it will yield a sigmoid curve which is known as **'Species area curve'** (**Fig.2**).

Table 1. Quadrat Table

Quadrat No.s	SL. No. of Plants	Plant's name	Family
I	**1.** **2.** **3.** **4.**		
II	**5.** **6.** **7.** **8.**		
III	**9.** **10.**		

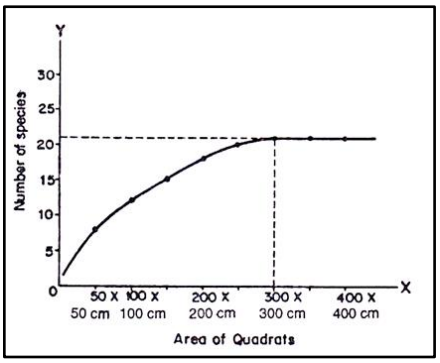


Fig.2. Species area Curve

The size of the Quadrat which recorded the highest number of species should be selected as the **size of Quadrat** for sampling the community under study. The minimum size for quadrat can be determined via species area curve. The point where the curve flattens out (300 cm^2, Fig.2) indicates the **minimum quadrat size**. The number of quadrats should ensure that approximately 2% of the total area of study site is sampled.

Quantitative analysis of vegetation

For quantitative analysis, the study area can be divided into several sites based on the altitudinal gradient or as per requirement. Within the minimum size of quadrat all the vegetation layers like trees, saplings, shrubs, herbs will be studied through standard quadrat method (Misra, 1968). The diversity index and dominance index can be calculated, Shannon and Weiner (1963) and Simpson (1949) respectively.

Aim.2. Frequency, density and abundance of components

i. Frequency: In a community the individuals of all the species are not evenly distributed. The distribution pattern of individuals of different species indicate their reproductive capacity as well as the environment. Frequency refers to the degree of dispersion in terms of percentage occurrence

Frequency= Total no. of quadrats in which the species occur/ Total no. of quadrats studied X 100

There are five frequency classes:

- Class A -- 1 to 20% frequency
- Class B -- 21 to 40% frequency
- Class C -- 41 to 60% frequency
- Class D -- 61 to 80% frequency
- Class E -- 81 to 100% frequency

ii. Density

Numerical strength of a species in relation to a definite unit space is called it's density. The crude density refers to the number of individuals of a particular species per unit area.

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.

iii. Abundance

The estimated number of individuals of a species per unit area is referred to as abundance. To determine abundance the sampling is done by quadrats or other methods at random at many places and the number of individuals of a species is added for all the quadrat studies.

The abundance is determined by following formula:

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

The abundance is usually expressed by assigning the species to one of the following abundance classes (**Fig.3**):

Classes	Stalks per square metre quadrat
Rare	1 to 4
Occasional	5 to 14
Frequent	15 to 29
Abundant	30 to 90
Very abundant	100 +

Fig.3. Abundance classes

Observation: Table 3

Sl No.	Plant Species	No of individuals per quadrat I	II	III	IV	Total no. of individuals in all the quadrats studied (N)	Total no. of quadrats in which each sp. occurred (A)	Total no of quadrats studied (B)	Population Density (N/B)	Frequency % (A/B) × 100	Abundance (N/A)
1.	Oxalis corniculata	19	36	66	106	106	4	4	26.5	100%	26.5
2.	Macardonia procumbens	8	9	9	10	10	3	4	2.5	75%	3.33
3.	Oldenlandia corymbosa	5	17	20	24	24	4	4	6	100%	6
4.	Mikania micrantha	1	1	1	1	1	1	4	0.25	25%	1
5.	Rorripa indica	4	12	27	67	67	4	4	16.75	100%	16.75
6.	Kyllinga sp.	5	12	27	39	39	4	4	9.75	100%	9.75
7.	Chrysopogon sp.	1	1	1	1	1	1	4	0.25	25%	1
8.	Panicum sp.	6	6	7	7	7	2	4	1.75	50%	3.5
9.	Pouzolzia zeylanica		6	12	12	12	2	4	3	50%	6
10.	Nicotiana plumbaginifolia		3	9	11	11	3	4	2.75	75%	3.66
11.	Solanum nigrum		1	1	1	1	1	4	0.25	25%	1
12.	Coccinia indica			1	3	3	2	4	0.75	50%	1.5
13.	Sonchus sp.				2	2	1	4	0.5	25%	2

Latitude and Longitude…., Place…..., Soil……, Date……., Month……,Season…

Comment:

The studied area (**Table 3**) is highly populated with shrubs and herbs. 200cm X 200 cm is the minimum quadrat area. *Oxalis conrniculata*, *Oldenlandia corymbosa*, *Mikania micrantha* and *Rorripa indica* are present in higher amount (frequency=100%) followed by *Macardonia procumbens* and *Nicotiana plumbaginifolia* (frequency=75%). *Oxalis conrniculata* have highest population density (26.5) and abundance (26.5).

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