GEOGRAPHIC DATA REPRESENTATION and TECHNIQUES of THEMATIC MAPPING

What is geographic data?

Data is a set of observation concerned with a set of individuals and usually expressed in text or numerical form.

Geography is a discipline of *facts and figures related to space*.

Geographic data are all those sort of data related to the space and characteristics of objects on that space. It may be spatial or non-spatial.

Needs of Representation of data?

- *to describe the space and communicate the knowledge of spatial information,*
- *to describe the characteristics of space,*
- *to visualise the data, explore the data and checking of data,*
- *to explaining the characteristics of phenomena or objects for which the data is represented.*
- *To identify and classify real world objects,*
- *To perceive relationships between objects*

Methods of geographic data representation

Geographic data are represented in a variety of way based on the nature of data and the purpose of representation. Fundamentally there are three ways of representing geographic data.

a. **Textual** (by means of different texts)
b. **Tabular** (organised and classified manner in a table with rows and colums)
c. **Graphical form** (the most useful way to represent geographic data)
    i. Graphs,
    ii. Diagrams,
    iii. Maps

What is Graph?

A *Graph* is the representation of statistical data in which a series of

points are plotted by means of coordinates (x, y / r, θ) on a reference frame of a chosen origin. It may be biaxial, tri-axial or multi-axial.

Types of graphs?

There are several types of graphs based on number of axes used.

1. **Bi-axial graph:** two mutually orthogonal axes.
   - i. **Open line graphs**: (time series data are suitably represented)
     - a. **Simple line graph** (one element at a time. e.g. population, production etc.)
     - b. **Poly graph** (several elements of same time frame. e.g. population of different countries, birth and death rate, production of different crops)
     - c. **Band graph** (several components of a single object. e.g. rural, urban population; male, female population, types of workers etc.)
   - ii. L**og graphs:** (when logarithm is used on the axis/ axes of simple graph. When the elements shown on the graph changes rapidly i.e. ratio progress, log is used.)
     - a. **log-log**: Both axes have logarithm scale
     - b. **semi log:** Any one axis has logarithm scale
   - iii. **Closed line graphs**: (these are bi-axial closed graph)
   - a. **Climographs**: Used for representing climatic data, like temperature, precipitation, humidity etc. (USDA-type- dry-bulb and wet-bulb temperature, Froster type- temperature and precipitation, Taylor type- relative humidity and wet-bulb temperature, Hythergraph- rainfall and temperature.)

2. **Tri-axial graphs:** three axes graph (x, y and z) representing three parts of an element.
   - i. **Ternary graphs**: Triangular graph formed by an equilateral triangle.
   - ii. **3-D surfaces:** this is also a three axes graph, where a third component is represented on the z- axis of a two dimensional area.

   Example: topography, land price etc.
3. **Multi-axial graphs**: more than three axes.

i. **Star graphs**, also called vector graphs: Used for representing several properties of an element. Like wind direction by wind rose diagram.

4. **Special graphs**: these are special type of graphs drawn on bi-axial or tri-axial graphs to represent specific geographic data.
   - i. **Hypsometric curve**: (Area- height relation by graph. It represents percentage area with respect to height.)
   - ii. **Relative temperature graph:** (Relative temperature of Koppen is plotted with respect to month)
   - iii. **Ombrothermic graph:** (monthly temperature and rainfall are plotted by two line graphs superimposed on single frame)
   - iv. **Water balance graph:** (monthly evapotranspiration and rainfall are plotted by two line graphs superimposed on single frame)
   - v. **Hydrograph:** (shows flow rate/ discharge of stream with respect to time points)
   - vi. **Rating curve:** (Shows discharge of river with respect to stage/ gauge height)
   - vii. **Lorenz curve:** (Represents income or wealth or demographic attributes with respect to population)
   - viii. **Rank-size curve:** (represents relationship between rank of city and its population size)
   - ix. **Ergograph:** (It is a composite graph where monthly rainfall, temperature and crop seasons are plotted)

Besides, Histogram, Frequency polygon and Curve etc. are another set of graphs.

What is Diagram?

Diagram is the representation of statistical data/spatial data by means of graphs or geometric figures and curves. When diagrams are drawn by curves on axial frame, these are graphs. Graphs become diagrams when they give visual description of elements. This is extremely useful and effective for quick representation of a limited amount of information.

Diagrams can be drawn on a plain graph or on a base map.
Diagrams give both **qualitative** as well as **quantitative information** and serve as a tool for further analysis of geographic contents and **preparation of thematic mapping**.

Types of diagrams: (Techniques of thematic mapping)

1. Dimension less Diagrams:

i. **Dots-** Dots are used as point symbol and it is quantitative in construction as each dot represents certain quantity.

Generally dots of uniform size are used. Here quantity is proportional to the number of dots. Dots are placed on the location of variables, thus depicts spatial distribution. Dots are plotted within the spatial units; generally administrative units.

The dots are size less and generally pointed as a small point of 1 to 1.5 mm in diameter.

Example: distribution of rural population, cattle distribution etc.

i. **Multiple Dots-** Here dots with variable size are used to represent variable quantity and do similar job as the dots do *i.e.* the spatial distribution of geographic phenomena.

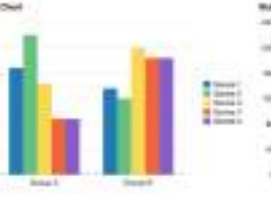
1-Dimensional Diagrams:

i. **Bar Diagram**- It is the column or bar by which quantities are represented and length of bar is proportional to the quantities, they represent. The width of each bar is fixed according to convenience. They are called *bar diagram*, or *bar graphs* or *columnar diagram*. Bar can be *horizontal* or *vertical*.

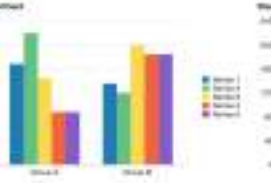
This diagram is easy to draw and easy to comprehend. The quantities are easily compared by this diagram. When the bars are prepared on a base map, it produces a thematic map.

The bar diagrams are of three types:

a. *Simple-* A simple bar diagram consists of a series of bars each of which shows total quantity of only one variable.
Example: population of different states in India for a census year by simple bar diagram.

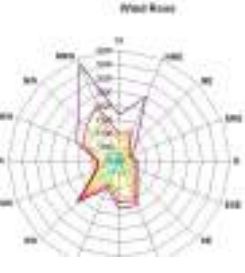


b. *Compound-* This diagram consists of a series of bars representing total quantities as well as the quantities of components of the total quantity and lengths of each is proportional to the quantity, they represent.
Example: male and female population to total population by compound bar diagram.



c. *Multiple-* It is also called *comparative bar diagram*. This diagram consists of a series of simple bars representing quantities of the same category by set of two or more different adjacent bars.
Example: annual production of wheat, paddy, pulses and oil seeds of different states of India.

d. Pyramidal diagram- when pairs of horizontal bars are drawn for the age groups one by one, it looks like a pyramid. Thus called pyramidal diagram.



ii. **Star diagram-** a star diagram appears like a star. Lines representing various quantities are drawn radiating from a point on a map. Point marks the location of the station of which the data is represented. Length of line is proportional to the quantity it represents. When it is drawn on a base map, produces thematic map.
Example: a *wind rose* shows the number of wind flow from eight

directions.

ii. **Flow line-** This is a typical line diagram, usually represents flow of traffic, passenger or information. Several lines (each line represents certain quantity) or a single line (width of line is proportional to the volume of flow) is drawn to represent the quantity of flow.

One example is **traffic flow cartogram**. This cartogram shows the nature or degree of concentration of traffic *i.e.* goods, vehicles, passengers, information etc. along different lines of communication.

The traffic movement may be in totality, traffic density per unit time, traffic in different time points, different types of vehicles etc.

Use: This diagram represents the importance of roads, streets and helps us to understand the pressure on routes as well as the types of vehicles move on a road at different time points. This information helps to set necessary plan for improving the traffic movement.

2. **2-Dimensional Diagrams: (Areal Diagram)**

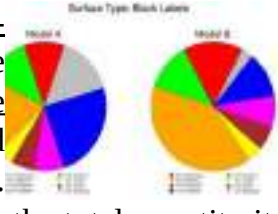
i. **Circular Diagram-** Circles are used to represent the quantities. These are called areal diagram, the area of circles are proportional to the quantities they represent.

a. **Proportional circles**- this diagram consists of a series of circles, area of which are proportional to the quantities they represent. This is also called graduated circles. They are placed at the points where the locations of the quantities are marked on map. It

is easier to draw circles and thus quite commonly used to compare quantities. Example: COVID-19 positive numbers.

COVID-19 Infection by Proportional Circles

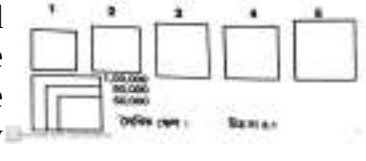
b. **Divided circle/Pie-diagram**- A pie-diagram is a circle divided into sectors, the area of which is proportional to the quantity it represents. It is commonly used to represent a quantity and its components.



If Circle is drawn proportionately based on the total quantity it is called **proportional divided circle.**

Example: data on occupational categories of any area.

ii. **Square Diagram**- Squares are used to represent the quantities. These are also areal diagram, area of squares are proportional to the quantities they represent.

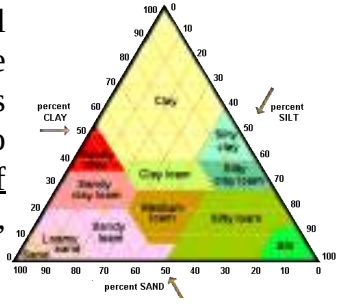


a. **Proportional Squares**- same as proportional circle. Squares are used instead of circles.

b. **Divided squares**- squares are sometimes divided to represent the components of the quantities they represent just like pie diagram. It is used rarely.

iii. **Triangular Diagram**- sometimes triangles are used to represent quantities. Area of a triangle is proportional to the quantity it represents.

iv. **Ternary Diagram-** It is a tri-lateral diagram that graphically depicts the ratios of the three variables as positions in an equilateral triangle. It is used to show many things, like functions of towns, soil texture, composition of sand, silt and clay stone etc.



3. **3-Dmensional Diagrams: (Volume Diagram)**

i. **Sphere Diagram**- These are also called *proportional* or *graduated sphere*. A sphere is a three dimensional figure. The volumes of spheres are proportional to the quantities they represent.

ii. **Cube Diagram**- a cube is a three dimensional solid body. The volumes of cubes are proportional to the quantities they represent.

4. **Directional Diagrams:**

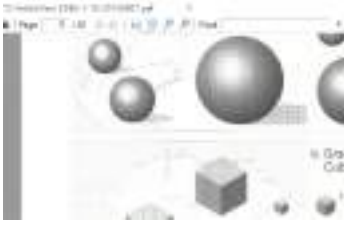
iii. **Star diagram**- (See previous section)

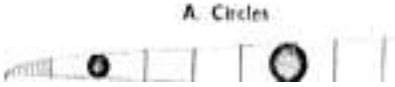
iv. **Traffic flow Diagram**- (See previous section)

5. **Special Diagrams**: A set of diagrams are used to represent specific type of data and for specific purposes.

These are:

i. **Rainfall dispersion Diagram by box plot-** (one dimensional graph showing the quartiles and range of the data. Used in data





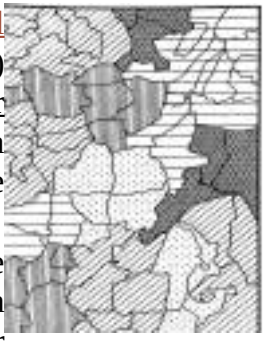
processing. Rainfall dispersion can be shown.)

ii. **Hyetograph-** (one dimensional graph showing the measurements of mean and standard deviation. Can be used to measure the dispersion of values from mean.)

6. Distribution Maps:

I. **Quantitative distribution map**- These are those maps which show the variation in the spatial distribution of quantity by **symbols** such as dots, shades, isopleths, choropleths and **figures** such as circles, spheres, cubes, squares etc.

i. **Choropleths-** These are quantitative areal maps (***'choro' = area and 'plethos' = multitude***) show the spatial distribution of density or intensity on any element with the help of a system of graded shading or colour on the administrative boundaries.



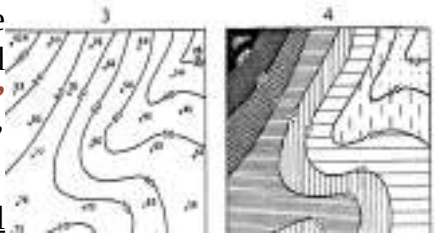
Shading is directly proportional to the intensity of the quantity. The values of each spatial unit represent the average value per unit area.

Average values of the all spatial units are taken together to form group based on class interval. Classes are chosen by a variety of ways.

These are: *arithmetic progression* (e.g. 10, 20, 30, 40, and 50 etc.), *geometric progression* (e. g. 10, 100, 200, 400 and 800 etc.), *quartile method, percentile method, Standard deviation*

method etc.

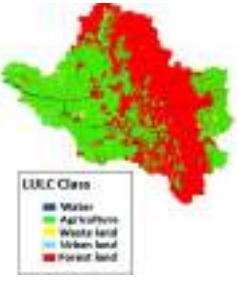
v. **Isopleths-** These are quantitative areal maps derived from Greek words '***isos'*** meaning *equal* and '***plethorn***' meaning *measure* or *multitude*.



The *isopleths* are lines of equal value in the form of quantity, intensity or density. The isopleths are drawn on maps as iso lines with selected interval. The pairs of lines show the changes or variation and the spacing of isopleths represents the magnitude of variation or change. Closer the spacing means sharper rate of change and vice versa.

vi. **Dots Map**- (See previous section)

II. **Non-quantitative distribution maps**



i. **Chorochromatic Map**- non quantitative spatial data, such as land use is represented by variety of colours in the map. Area covered by each land use category is shaded by a colour.

ii. **Choroschematic Maps**- these are distributional maps of non-quantitative data by means of a variety of symbols. Symbols are put on the location where the item located.

For example, distribution of various minerals on map is represented by choroschematic map.