# PREFACE

In a bid to standardize higher education in the country, the University Grants Commission (UGC) has introduced Choice Based Credit System (CBCS) based on five types of courses viz. *core, discipline specific, generic elective, ability and skill enhancement* for graduate students of all programmes at Honours level. This brings in the semester pattern, which finds efficacy in sync with credit system, credit tranafer, comprehensive continuous assessments and a graded pattern of evaluation. The objective is to offer learners ample flexibility to choose from a wide gamut of courses, as also to provide them lateral mobility between various educational institutions in the country where they can carry their acquired credits. I am happy to note that the University has been recently accredited by National Assessment and Accreditation Council of India (NAAC) with grade "A".

UGC (Open and Distance Learning Programmes and Online Programmes) Regulations, 2020 have mandated compliance with CBCS for U. G. programmes for all the HEIs in this mode. Welcoming this paradigm shift in higher education, Netaji Subhas Open University (NSOU) has resolved to adopt CBCS from the academic session 2021-22 at the Under Graduate Degree Programme level. The present syllabus, framed in the spirit of syllabi recommended by UGC, lays due stress on all aspects envisaged in the curricular framework of the apex body on higher education. It will be imparted to learners over the six semesters of the Programme.

Self Learning Materials (SLMs) are the mainstay of Student Support Services (SSS) of an Open University. From a logistic point of view, NSOU has embarked upon CBCS presently with SLMs in English/Bengali. Eventually, the English version SLMs will be translated into Bengali too, for the benefit of learners. As always, all of our teaching faculties contributed in this process. In addition to this we have also requisitioned the services of best academics in each domain in preparation of the new SLMs. I am sure they will be of commendable academic support. We look forward to proactive feedback from all stakeholders who will participate in the teaching-learning based on these study materials. It has been a very challenging task well executed, and I congratulate all concerned in the preparation of these SLMs.

I wish the venture a grand success.

**Professor (Dr.) Subha Sankar Sarkar**

Vice-Chancellor

# Netaji Subhas Open University

**Under Graduate Degree Programme**
**Choice Based Credit System (CBCS)**
**Subject : Honours in Geography (HGR)**
**Course Code : CC-GR-06**
**Course : Remote Sensing, GIS Laboratory and Research Methodology, Field work Laboratory**

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## Notification

**Netaji Subhas Open University**

**UG : Geography (HGR)**

**Remote Sensing & GIS Laboratory and Research Methodology & Field work Laboratory**

# Module - 1 : Remote Sensing & GIS Laboratory

## Module - 2 : Research Methodology & Field work Laboratory

# Module – 1

## Remote Sensing & GIS Laboratory

# Unit - 1 ❑ Principles of Remote Sensing (RS) : Types of RS Satellites and Sensors

**Structures**



## 1.0 Introduction

Remote sensing may be defined as the art, science and technology of obtaining reliable information about physical objects of the earth environment, through the process of recording, measuring and interpreting imagery and digital representation of energy patterns derived from non-contact sensor systems. According to National Remote Sensing Centre

(NRSC) "Remote sensing is the technique of acquiring information about objects on the earth's surface without physically coming into contact with them".

Remote sensing may be defined...into contact with them. It has been observed that normal human eyes are sensitive to visible spectrum which ranges between .4 – .7 μm. But other energies like x-ray, ultra-violate, infra red, microwave, etc. exist within electromagnetic spectrum.

There are three types of orbits for remote sensing purposes, viz. geostationary, equatorial and Sun synchronous. Different types of sensors are attached to the satelite system., which are categorized as passive vs. active and imaging vs. non-imaging.

## 1.1 Learning Objective

This unit will helps to understand :

- Principles of remote sensing
- Orbital characteristics of different types of artificial satellite system
- Types of Remote Sensing Satellites and Sensors

## 1.2 Principles of Remote sensing

### 1.2.1 Electromagnetic Radiation :

The earth receives the solar energy in the form of insolation and again radiates it back to the atmosphere. An object can be visualised because of the existence of light. When there is no light, i.e. in complete darkness, nothing can be visualised. Due to illumination and casting of shadow, information regarding object's size, shape and texture can be recognised. On the other hand, object's brightness and colour can be distinguished due to reflection and absorption of light as acted upon.

### 1.2.2 Electromagnetic Energy :

Each photon, i.e. quantum of electromagnetic energy, has a unique pair of electrical and magnetic field. They vibrate at right angles to each other to the direction in which they travel (*Figure 1.1*). The vibration can be recognised by means of wave length or frequency. Wave length stands for the distance between two successive peaks in the electromagnetic fluctuations, whereas frequency means the number of wave that pass a point in a particular time span. Thus shorter the wave length, higher the frequency or vice versa.

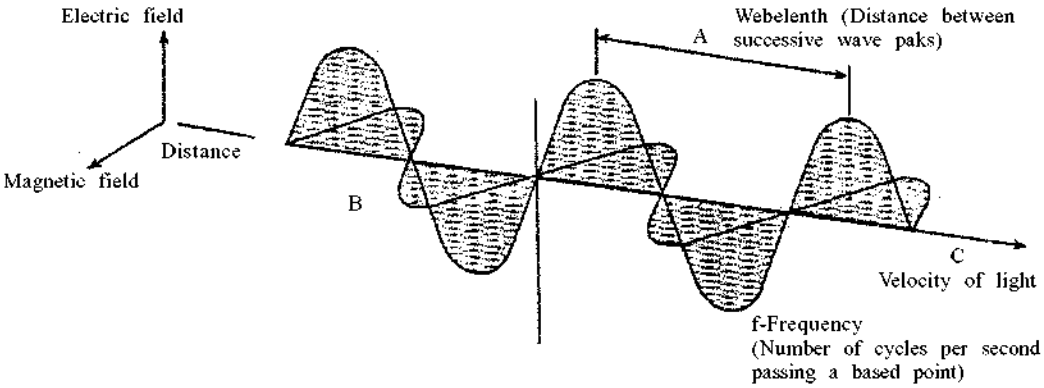


**Figure 1.1 : The Electromagnetic Wave**

Normal human eyes are sensitive to only some of the electromagnetic energy, emitted and reflected by objects. The visible spectrum is confined within the wavelength ranging between 0.4-0.7 μm, which is almost equally divided into blue (0.4-0.5 μm), green (0.5-0.6 μm) and red (0.6-0.7 μm) spectral ranges. By mixing these primary colours additively (i.e. by throwing beam of light), any other colour including white can be created. However, visible spectrum occupies only a very small part of the entire electromagnetic spectrum. Atom, gama ray, x ray, ultraviolet ray are shorter wave lengths compared with visible spectrum, whereas infra-red (which may either be divided into reflected infra-red and thermal infra-red or near infra-red, middle infra-red and far infra-red) thermal (heat), micro-wave, etc. are the much longer wave lengths (*Figure : 1.2*). All these energies are included within electromagnetic spectrum because they are basically similar in nature and radiate energy in accordance with the basic principle of wave theory. It may be mentioned here that electromagnetic energy travels in a harmonic, sinusoidal fashion at the velocity of light.

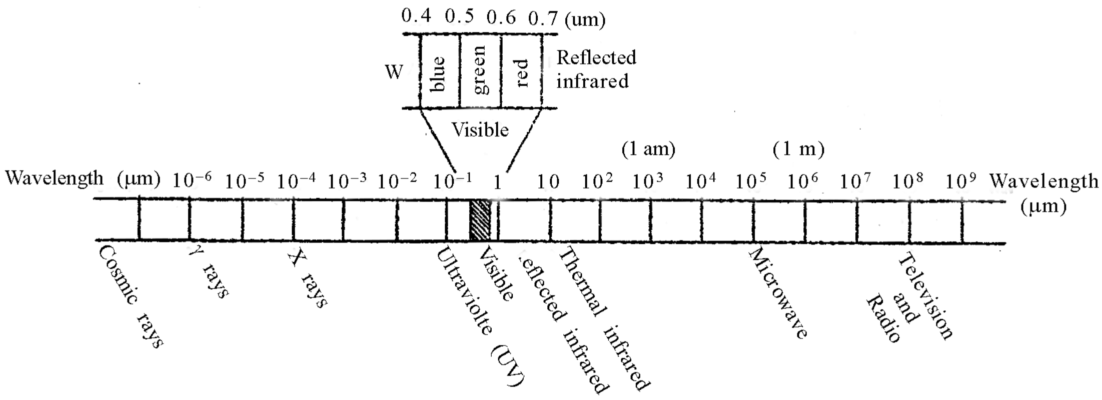


**Figure 1.2 : The Electromagnetic Spectrum**

### 1.2.3 Scattering and absorption of light in the atmosphere :

All materials at temperature above absolute zero (0° K = – 273° C) emit electromagnetic radiation. A hypothetical black body, which is an ideal radiator, that totally absorbs and re-emits all energy, is considered as standard to compare emittance of radiation *(Figure 1.3)*. But the amount of available energy may be affected due to various factors including atmospheric conditions causing scattering and absorption. Molecules and other tiny particles which are smaller in dimension than the wavelength of the interacting radiation cause Rayleigh scattering. It is one of the reasons for causing haze, which diminishes the contrast in the imagery. Mie scattering results due to existence of water vapour or dust in the atmosphere, the dimension of the particle size being equal to the energy wave lengths being sensed. Overcast is the result on the imagery. Non-selective scattering is caused due to existence of different sizes of particles like water droplets, the diameter being much larger than the energy wave length to be sensed. The resultant effect is fog or cloud which appear as white patch in the imagery.

On the other hand, different elements are responsible for atmospheric absorption resulting effective loss of energy to atmospheric constituents. Water vapour, carbon dioxide, ozone, ozone, etc. are the important absorbers of solar radiation.

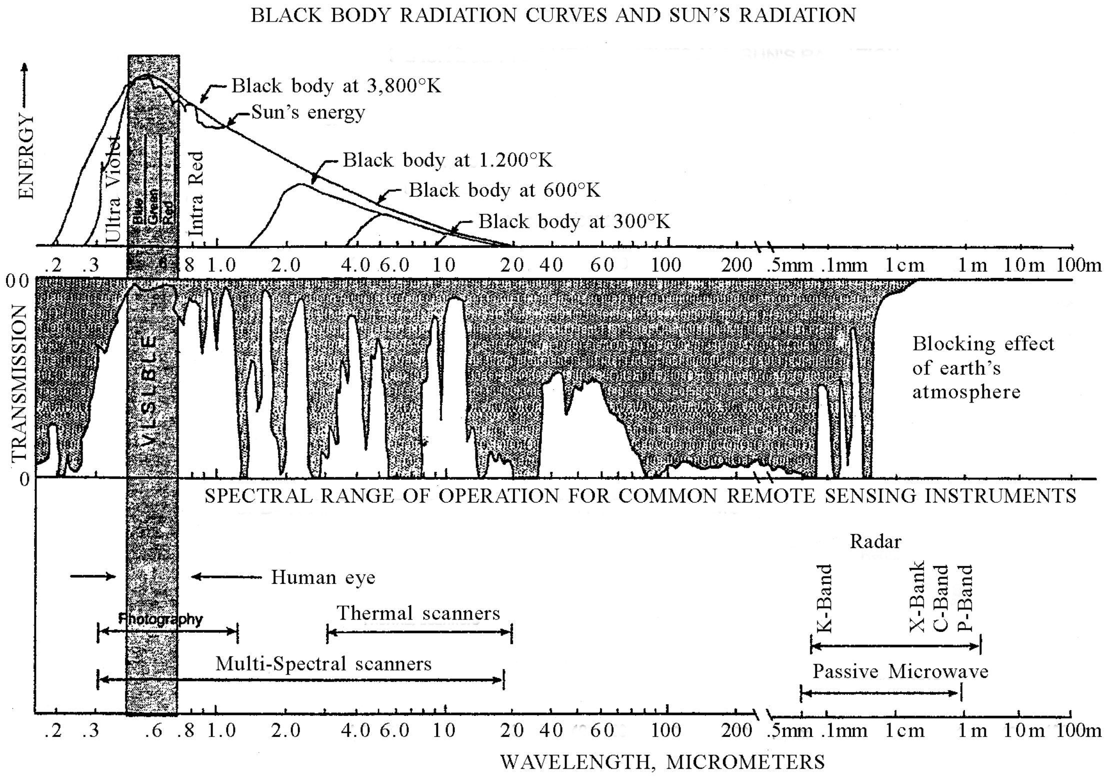


**Figure 1.3 : Energy process, Absorption and Atmospheric windows**

### 1.2.4 Atmospheric window :

Due to such blocking effects of the earth's atmosphere, it is not possible to use the entire electromagnetic spectrum for remote sensing purposes. Actually the bands of the spectrum i.e. the wavelength ranges, where the atmospheric attenuation is slight, are known as Windows. These are the regions used for remote sensing purposes.

### 1.2.5 Use of spectral band :

Normal human eyes are sensitive to only a small portion of the entire electromagnetic spectrum which ranges from 0.4 to 0.7 μm. Gama rays and x rays are very short, the length dimensions being around 0.2 μm. Ultraviolet sensitive emulsions react within the range of 0.3 to 0.4 μm of the electromagnetic spectrum. Infra-red emulsions extend sensing possibilities up to 1.2 μm. Thus photographs are in a position to record wavelengths from 0.2 to 1.2 μm, i.e. three times more than the range of the normal human eyes can visualise. However, to sense wavelengths longer than 1.2 μm, instruments other than photographic cameras are in use.

## 1.3 Types of Remote Sensing (RS) Satellites and Sensors

### 1.3.1 Orbiting satellites

Satellites can be classified by their orbital geometry and timing. Three orbits commonly used for remote sensing satellites are geostationary, equatorial and Sun synchronous. A geostationary satellite (*Figure 1.4*) has a period of rotation equal to that of Earth (24 hours) so the satellite always stays over the same location on Earth. In other words, Geostationary orbit means an orbit at an altitude of 36,000 / 40,000 km above the surface of the earth in the direction of the earth's rotation, which matches the speed so that a satellite remains over a fixed point on the earth's surface. Communications and weather satellites often use geostationary orbits with many of them located over the equator. INSAT is an example of Geostationary satellite.

In an equatorial orbit, such a satellite circles Earth at a low inclination (the angle between the orbital plane and the equatorial plane). The Space Shuttle uses an equatorial orbit with an inclination of 57 degrees.

Sun synchronous satellites (*Figure 1.4*) have orbits with high inclination angles, passing nearly over the poles. Orbits are timed so that the satellite always passes over the equator at the same local sun time. In this way the satellites maintain the same relative position with the sun for all of its orbits. Many remote sensing satellites are Sun

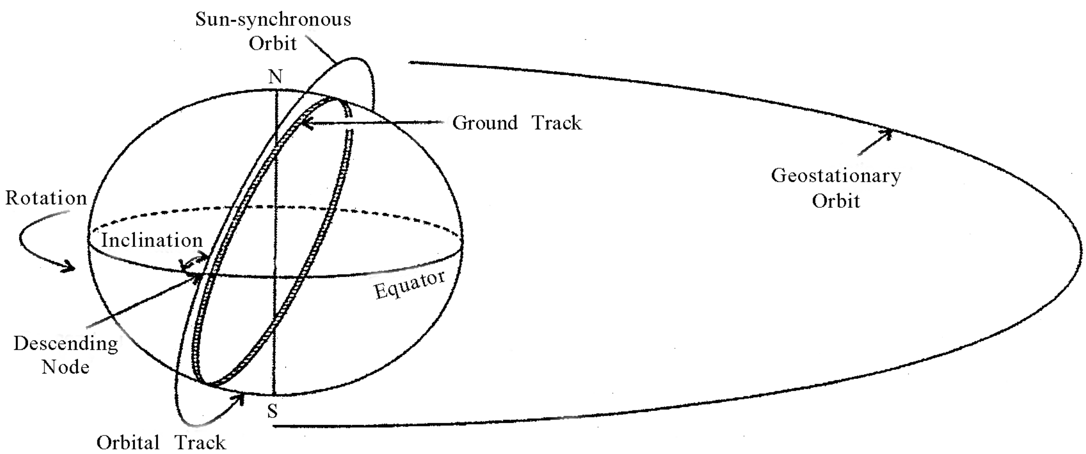


**Figure 1.4 : Satellite Orbit**

synchronous which ensures repeatable sun illumination conditions during specific seasons. Because a Sun synchronous orbit does not pass directly over the poles, it is not always possible to acquire data for the extreme polar regions. The frequency at which a satellite sensor can acquire data of the entire Earth depends on sensor and orbital characteristics. For most remote sensing satellites the total coverage frequency ranges from twice a day to once every 16 days. These satellites are placed at an altitude ranging from 600 to 800 kilometres. LANDSAT, SPOT, IRS, etc. are examples of sun synchronous satellite.

Another orbital characteristic is altitude. The Space Shuttle has a low orbital altitude of 300 km whereas other common remote sensing satellites typically maintain higher orbits ranging from 600 to 1000 km.

### 1.3.2 Types sensors :

Sensor means the sensing or recording device. There are several broad categories of basic sensor system types such as passive vs. active, and imaging vs. Non imaging. Passive vs. active refers to the illumination source of the system; imaging vs. Non imaging refers to the form of the data. A variety of different sensors fit in these categories, which are not mutually exclusive.

***Passive vs. active sensors***—Passive sensors measure light reflected or emitted naturally from surfaces and objects. Such instruments merely observe, and depend primarily on solar energy as the ultimate radiation source illuminating surfaces and objects. Active sensors (such as radar and lidar systems) first emit energy (supplied by their own energy source) and then measure the return of that energy after it has interacted with a surface. Use of data collected by passive sensors often requires accurate measurements of solar radiation reaching the surface at the time the observations were made. This information allows for the correction of "atmospheric effects" and results in data or images that are more representative of actual surface characteristics.

***Imaging vs. Non imaging sensors***—Remote sensing data are the recorded representation of radiation reflected or emitted from an area or object. When measuring the reflected or emitted energy, either imaging or non imaging sensors can be used. Data from imaging sensors can be processed to produce an image of an area, within which smaller parts of the sensor's whole view are resolved visually. Non imaging sensors usually are hand held devices that register only a single response value, with no finer resolution than the whole area viewed by the sensor, and therefore no image can be made from the data. These single values can be referred to as a type of "point" data, however some small area is typically involved depending on the sensor's spatial resolution.

Image and non image data each have particular uses. Non-image data give information for one specific (usually small) area or surface cover type, and can be used to characterize the reflectance of various materials occurring in a larger scene and to learn more about the interactions of electromagnetic energy and objects. Image data provide an opportunity to look at spatial relationships, object shapes, and to estimate physical sizes based on the data's spatial resolution and sampling. Image data are desirable when spatial information (such as mapped output) is needed.

Images produced from remote sensing data can be either analog (such as a photograph) or digital (a multidimensional array or grid of numbers). Digital data can be analyzed by studying the values using calculations performed on a computer, or processed to produce an image for visual interpretation. Image interpretation is used to decipher information in a scene. In the past, image interpretation was done largely using subjective visual techniques, but with the development and ongoing advancement of computer technology, numeric or digital processing has become a powerful and common interpretation tool.

In many cases, image interpretation involves the combination of both visual and digital techniques. These techniques utilize a number of image features including tone and color, texture, shape, size, patterns, and associations of objects. The human eye and brain are generally thought to more easily process the spatial characteristics of an image, such as shape, patterns and how objects are associated with one another. Computers usually are better suited for rapid analysis of the spectral elements of an image such as tone and color. Sophisticated computer software that can perform like the human eye and brain may be more commonly available in the future.

## 1.4 Summary

Remote sensing is the Science and Art of obtaining information about an object, area or phenomenon through the analysis of data acquired by a device that is not in

contact with the object, area of phenomenon under investigation. Normal human eyes are sensitive to only a small portion of the entire electromagnetic spectrum which ranges from 0.4 and 0.7 μm. Photographs are in a position to record wavelength from 0.2 to 1.2 μm, i.e. three times more than the range of the normal human eyes can visualize. However, to sense wavelengths longer than 1.2 μm, instruments other than photographic cameras are in use. Now a days recording devices attached to orbiting artificial satelites are collecting data from various bands of electromagnetic spectrum. These satellites are orbiting the earth either in sum-synchronous, equatorial or geostationary orbits. Different types of sensors are attached to these satellites, which may either be passive or active otherwise they may be imaging or non imaging sensors.

## 1.5 Keywords

Electromagnetic Radiation (EMR), Atmospheric window, Sun Synchronous orbit, Geo stationary orbit

## 1.6 Model Questions

1. Define Remote Sensing. Distinguish Geostationary and Sun Synchronous satelite system. Illustrate your answer with nearly drawn diagram. Give example and applications of each type of these satellite system.
2. Distinguish between :

   (a) Passive vs. active sensor

   (b) Imaging vs. non imaging sensor

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# Unit - 2 ❑ Sensor Resolutions and their Applications

**Structures**



## 2.0 Introduction

In broad sense, resolution means the resolving power of the sensor. Actually, resolution is a system which refers to the ability to record and display fine details by the sensor. In remote sensing we deal with four types of resolutions viz. spatial, spectral, radiometric and temporal resolution. It may be noted that different spectral band of satellite sensor has specific application.

## 2.1 Learning Objective

This unit will help you to understand :

- Different types of sensor resolution

- Application of different spectral bands of remote sensing satellites
- Application of different sensor resolution

## 2.2 Sensor Resolution

### 2.2.1 Spatial Resolution :

The details visible in an image is dependent on the spatial resolution of the sensor and refers to the size of the smallest possible feature that can be detected. In other words the spatial resolution is a measure of sensors ability to image (record) closely spaced objects so that they are distinguishable as separate objects. A sensor with a 1m resolution can reproduce finer details compared to a sensor with a 10m resolution.

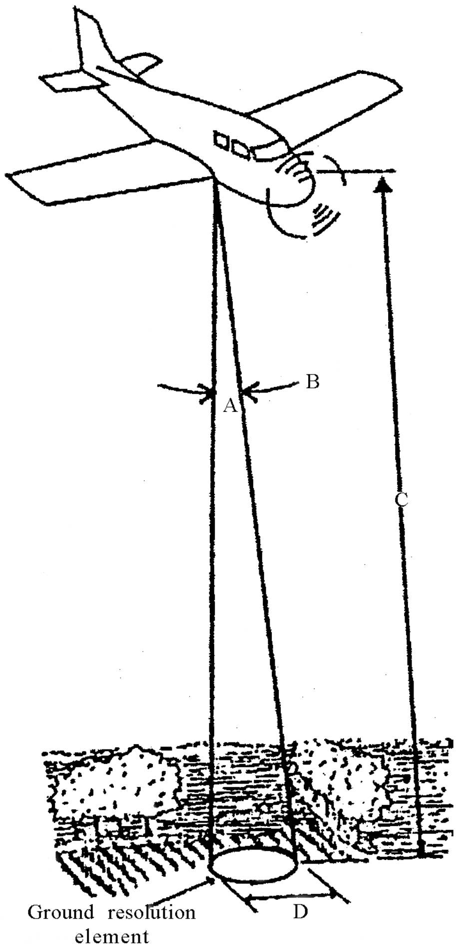


**Figure 2.1 : Instantaneous Field of View (IFOV) of a sensor**

It is the ground area sensed at any instant time. It is dependent on the Instantaneous Field of View (IFOV) of the sensor (*Figure 2.1*). The IFOV may be described as the angular cone of the sensor (A), which determines the area on the surface of the earth as viewed from a given altitude (B). The size of the field recorded is determined by multiplying the IFOV by the distance from the ground to the sensor (C). Images where only large features are visible are said to have low resolution, where as in high resolution images, small objects can be detected.

Images where only large features are visible are said to have low resolution. Where as in case of high resolution images, small objects can be detected. Military sensors for example, are designed to view as much detail as possible, and therefore have very fine resolution. Commercial satellites provide imagery with resolution varying from a few metres to several kilometers. Generally the finer the resolution, the less total ground area can be seen.

### 2.2.2 Spectral Resolution :

Spectral resolution describes the ability of a sensor to define fine wavelength intervals. The finer the spectral resolution, the narrower the wavelength ranges for a particular channel or band. The spectral ranges of Landsat MSS and TM are shown in the following table :

**Table : 2.1 Spectral range of different bands of Landsat MSS and TM**

| **Landsat—I(MSS)** | | | **Landsat —4(TM)** | | |
|---|---|---|---|---|---|
| **Band Code** | **Spectral range (μ)** | | **Band Code** | **Spectral range (m)** | |
| 4 | 0.5-0.6 | Blue | 1 | 0.45-0.52 | Blue |
| 5 | 0.6-0.7 | Green | 2 | 0.52-0.60 | Green |
| 6 | 0.7-0.8 | Red | 3 | 0.63-0.69 | Red |
| 7 | 0.8-1.1 | Near Infrared | 4 | 0.76-0.90 | Near Infrared |
| | | | 5 | 1.55-1.75 | Mid Infrared |
| | | | 6 | 10.4-12.50 | Thermal Infrared |
| | | | 7 | 2.08-2.35 | Mid Infrared |

(Source : NASA)

### 2.2.3 Radiometric Resolution :

While the arrangement of pixels describes the spatial structure of an image, the radiometric characteristics describe the actual information content in an image. Every time an image is acquired on film or by a sensor, its sensitivity to the magnitude of the electromagnetic energy determines the radiometric resolution. The radiometric resolution of an imaging system describes its ability to discriminate very slight differences in energy. The finer the radiometric resolution of a sensor, the more sensitive it is to detecting small differences in reflected or emitted energy.

Imagery data are represented by positive digital numbers which vary from 0 to (one less than) a selected power of 2. This range corresponds to the number of bits used for coding numbers in binary format. Each bit records an exponent of power 2 (e.g. 1 bit = 21 = 2). The maximum number of brightness levels available depends on the number of bits used in representing the energy recorded. Thus, if a sensor used 8 bits to record the data, there would be 28 = 256 digital values available, ranging from 0 to 255. However, if only 4 bits were used, then only 24 = 16 values ranging from 0 to 15 would be available. Thus, the radiometric resolution would be much less. Image data are generally displayed in a range of grey tones, with black representing a digital number of 0 and white representing the maximum value (for example, quantization range of 256 digital numbers in 8 bit data / DN value). (IKONOS 11 bit / 2048 gray level data).

### 2.2.4 Temporal Resolution :

Temporal resolution refers to the frequency of obtaining data over a given area. It is related to revisit period, which refers to the length of time it takes for a satellite to complete one entire orbit cycle. The revisit period of a satellite sensor is usually several days. Therefore the absolute temporal resolution of a remote sensing system to image the exact same area at the same viewing angle a second time is equal to this period. The actual temporal resolution of a sensor depends on a variety of factors, including the satellite/sensor capabilities, the swath overlap, and latitude, etc.

## 2.3 Application of different spectral band

**Table : 2.2 Spectral band of Landsat-1 MSS image and relative applications**

| Band | Wavelength (Micrometer) | Nominal Spectral location | Principal Applications |
|---|---|---|---|
| 4 | 0.5-0.6 | Blue | Water penetration, determination of turbidity in water bodies, to distinguish ureen veueunion from other surface cover, and to identify geological features. |
| 5 | 0.6-0.7 | Green | Useful for defining cultural and topographic features, for classifying different types of vegetation with full ground cover and turbidity variations in water bodies. |
| 6 | 0.7-0.8 | Red | Surface water mapping to differentiate conifer from deciduous forest cover, and determination of green biomass in vegetation. |
| 7 | 0.8-1.1 | Near Infrared | Effeelive for land/water boundary delineations, soil-crop contrasts, discrimination of open water bodies from wet soil, useful for detecting crop stress due to disease and pest attack. |

(Source : NASA)

**Table : 2.3 Spectral band of Landsat-4 TM image and relative applications**

| **Band** | **Wavelength (Micrometer)** | **Nominal Spectral location** | **Principal Applications** |
|---|---|---|---|
| 1 | 0.45-0.52 | Blue | Designed for water body penetration, making it useful for coastal water mapping. Also useful for soil/vegetation discrimination, forest type mapping, and cultural feature identification. |
| 2 | 0.52-0.60 | Green | Designed to measure green reflectance peak of vegeialion for vegetation discrimination and vigor assessment. Also useful for cultural feature identification |
| 3 | 0.63-0.69 | Red | Designed to sense in a chlorophyll absorption region aiding in plant species differentiation. Also useful for cultural feature identification. |
| 4 | 0.76-0.90 | Near Infrared (NIR) | Useful for determining vegetation types, vigor, and hiomass content, for delineating water bodies and for soil moisture discrimination. |
| 5. | 1.55-1.75 | Mid Infrared | Indicative of vegetation moisture content and soil moisture. Also useful for differentiation of snow from clouds. |
| 6 | 10.4-12.5 | Thermal Infrared | Useful in vegetation stress auahsis. soil moisture discrimination and thermal mapping applications. |
| 7 | 2.08-2.35 | Mid Infrared | Useful for discrimination of mineral and rock types. Also sensitive to vegetation moisture content and for hydro-thermal mapping. |

(Source : NASA)

**Table 2.4 : Spectral band of IRS LISS III and relative applications**

| Band | Wavelength (Micrometer) | Nominal Spectral location | Principal Applications |
|---|---|---|---|
| 1 | 0.45-0.52 | Blue | Coastal cmironmenlal studies. Soil/ vegetation differentiation. Coniferous/ deciduous vegetation discrimination. |
| 2 | 0.52-0.59 | Green | Vegetation vigor assessment. Rock/soil discrimination. Studies in turbidity and bathymetry in shallow water |
| 3 | 0.62-0.68 | Red | Strong chlorophyll absorption leading to discrimination of plant species. |
| 4. | 0.77-0.86 | Near Infrared (NIR) | Delineation of water features. Landform/ geomorphie studies. |

(Source : NNRMS, 1991)

## 2.4 Application of different sensor resolution

Different sensors are having different resolution. Some sensor has inferior or low resolution, whereas some sensor has superior or high resolution. Different applications are governed by quality of resolution. For example, in case of detail study of urban area or city mapping, it better to use Pan data of IRS or the Cartosat data. On the other hand for study of forest resources or water bodies, use of WiFS data would suffice the purpose.

## 2.5 Summary

Resolution means resolving power of satellite sensors. There are four types of resolution, spatial, spectral, radiometric and temporal. Object details are collected from particular band of electromagnetic spectrum which have specific application.

## 2.6 Keywords

Spatial resolution, Spectral resolution, Radiometric resolution, Temporal resolution, IFOV

## 2.7 Model Questions

1. What do you mean by resolution of satellite image? What are the different types of resolution? Distinguish between spatial and spectral resolution.
2. What are the principal applications of Band 4 of Landsat-1 MSS?
3. What are the uses of IRS WiFS data?

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# Unit - 3 ❑ Preparation of False Colour Composites from IRS LISS-3 & Landsat TM Data

**Structures**



## 3.0 Introduction

Three band satellite data are used to generate colour composites. The channel selection is restricted to three additive primary light beams i.e. blue, green and red. True colour representation for visual display of an image can be made by using three band satellite data representing blue, green and red channels. In such a case blue band is projected in blue, green band is projected in green and red band is projected in red for preparation of the output image. But such true colour composites are having some constrains in terms of inadequate contrast, clarity problem, interpretability problem, etc. Hence images are generated in terms of False Colour Composite or FCC (*Figure: 3.1*).

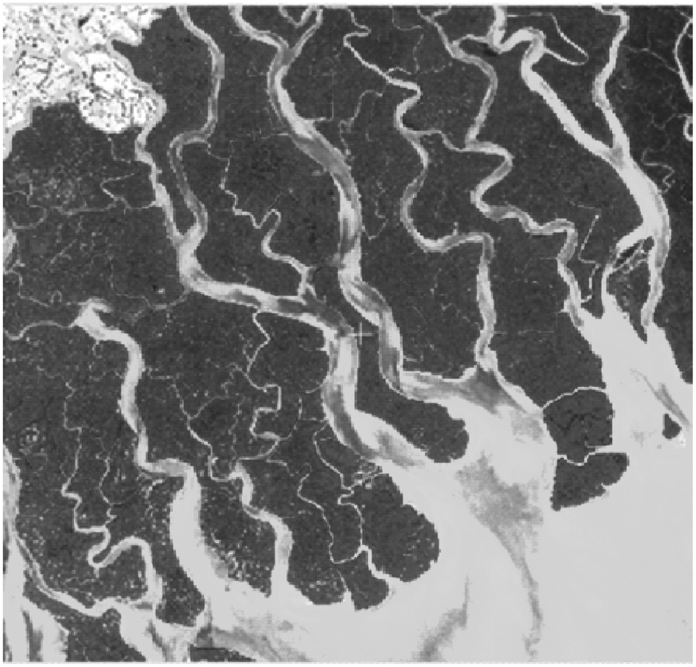

**Figure 3.1 : False colour composite (FCC)**

## 3.1 Learning Objective

This unit will help you to understand :

- Need for preparation of FCC
- How to prepare FCC using different bands of satelite data

## 3.2 Preparation of False Colour Composite

Any combination of bands not representing the true colour of the objects in the output image is termed as FCC. They are generated with the purpose of better interpretation of the multi-band satellite data.

In case of standard false colour composite, the combination of bands and the respective colour assignments are well defined. Hence they are known as standard FCC. The most commonly seen standard false colour images display the very near infrared as red, red as green and green as blue.

In case of IRS LISS-III, the following band combinations are used for preparation of standard FCC :

**Table : 3.1 Preparation of FCC from IRS LISS III data**

| Band | Spectral range (μ) | | Additive Primary Colour (Light Beam) |
|---|---|---|---|
| 2 | 0.52-0.59 | Green | Blue |
| 3 | 0.62-0.68 | Red | Green |
| 4 | 0.77-0.86 | Near Infrared | Red |

On the other hand, in case of Landsat TM, the following band combinations are used for preparation of standard FCC:

**Table: 3.2 Preparation of FCC from Landsat TM data**

| Band | Spectral range (μ) | | Additive Primary Colour (Light Beam) |
|---|---|---|---|
| 2 | 0.52-0.60 | Green | Blue |
| 3 | 0.63-0.69 | Red | Green |
| 4 | 0.76-0.90 | Near Infrared | Red |

## 3.3 Summary

False color refers to a group of colour rendering methods used to display images in color which were recorded in the visible or non-visible parts of the electromagnetic spectrum. A false-color image is an image that depicts and object in colours that differ from those a photograph would show. In this image, colors have been assigned to three different wavelengths that our eyes cannot normally sec. FCC can be prepared using three band data from IRS LISS-3 or Landsat sensors.

## 3.4 Keywords

False Colour Composite (FCC), Landsat, IRS, TM, LISS III

## 3.5 Model Questions

1. What are the different additive primary colours? What do you mean by FCC? How to prepare Standard False Colour Composite? Prepare a FCC with the help of three band data provided with you.

## 3.6 References

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# Unit - 4 ❑ Principles of Image Interpretation. Preparation of Inventories of Land Use and Land Cover (LULC) Features from Satellite Images

**Structures**



## 4.0 Introduction

By using different types of image characteristics, it is possible to identify different objects on the earth surface. They include tone, texture, pattern, shape size, shadow, situation and resolution. These clues have been used to prepare inventories of Land Use and Land Cover features from stellite images.

## 4.1 Learning Objective

This unit will help you to understand :

- Identification of different objects on the earth surface using various image characteristics
- How to prepare Land Use/Land Cover map from satellite image

## 4.2 Principles of image interpretation

The principles of image interpretation depends upon image characteristics in terms of tone, texture, size, shape, shadow, pattern, association and resolution image. They are routinely used when interpreting images. An experienced image interpreter uses many of these elements intuitively. However, a beginner may not only have to consciously evaluate an unknown object according to these elements, but also analyze each element's significance in relation to the image's other objects and phenomena. In the following paragraphs detail discussion about these elements are made with appropriate illustrations.

### 4.2.1 Tone

Tone means the black and white range (i.e. grey scale variation) of a (panchromatic) photograph. The grey tone of a particular object depends on how much light is reflected from it into the camera, and thus onto the film. The more light that is reflected, the lighter the tone on the photograph. Some of the clues are as follows :

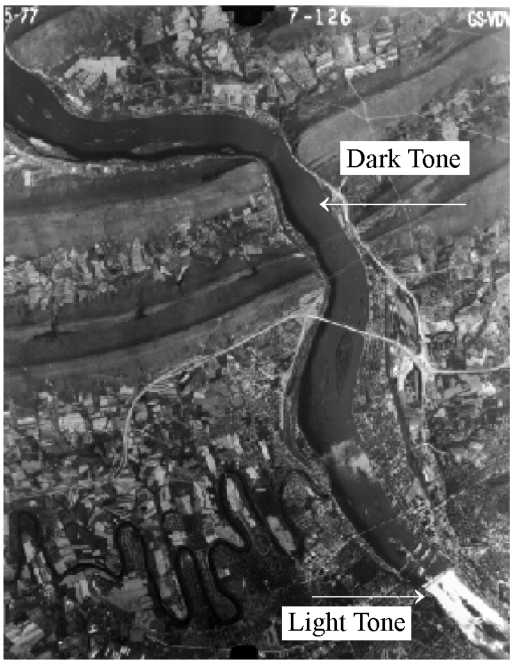



**Figure 4.1 : Tone**

Water surfaces usually have a fairly dark tone (*Figure 4.1*), but if the water contains much sediment, the tone becomes more light.

Un-vegetated dry sand is usually light Figure.

Surfaced roads are generally light.

Railways are normally dark

It may be noted here that generally these are the examples – there will always be exceptions. Moreover, different prints of one photograph are not always identical to another in tonal density, due to differences in film processing and printing.

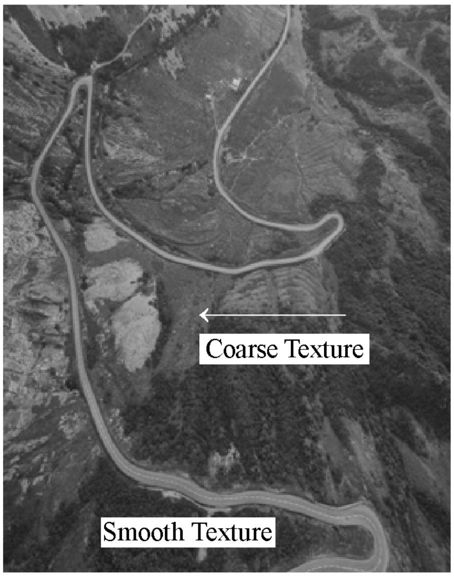



**Figure 4.2 : Texture**

### 4.2.2 Texture

Texture may be defined as the product of an aggregates of uniform features which are too small to be clearly discerned individually. Texture will be depicted as a repetition of tonal changes. Forest is the best example in this regard, e.g., in large scale photographs the big trees appear in a coarse texture, whereas in case of small scale photographs they appear as fine texture (*Figure 4.2*).

### 4.2.3 Pattern

Pattern stands for the spatial arrangement of objects in a repeated sequence and / or in a characteristics order. Examples are : orchards, where trees are planted in lines (*Figure 4.3*) or drainage patterns like dendritic, radial, etc.


**Figure 4.3 : Pattern**

### 4.2.4 Shape

Shape is defined as the form or topographic expression of an object as can be observed in the two-dimensional photo-image. Rectangular shaped houses, circular shaped water tank, typical shape of stadium (*Figure 4.4*) are best examples in this regard.

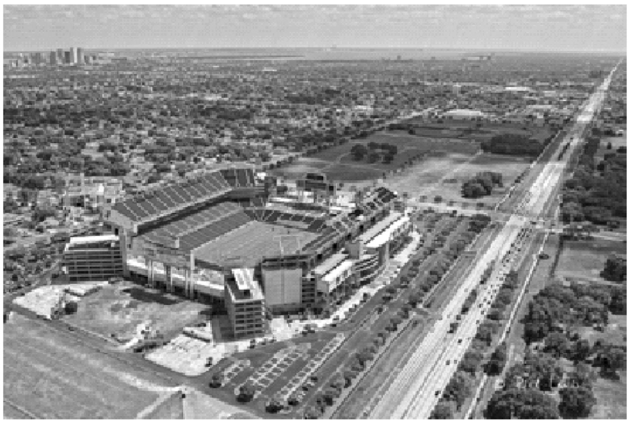


**Figure 4.4 : Shape**

### 4.2.5 Size

Size means the volume dimension of an object as may be observed in the three-dimensional (stereo) photo-model. Dwelling houses, school, factory, office building, etc. can be identified in terms of size differences (*Figure 4.5*).

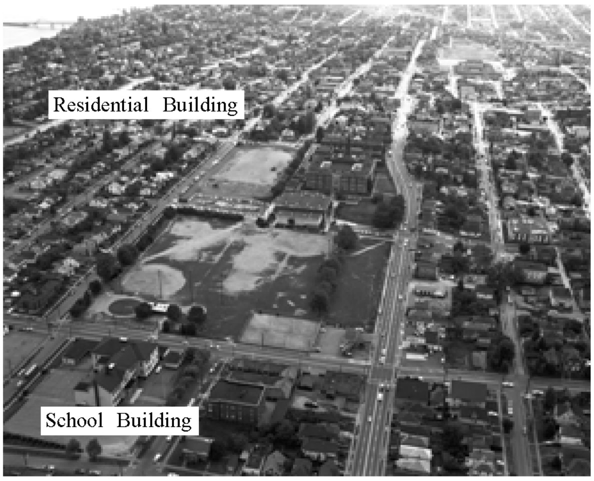



**Figure 4.5 : Size**

### 4.2.6 Shadow

Shadow is the obscurity within an area from which direct rays, from a source of light, are excluded by an interposed opaque body. Shadow can be very important to the interpreter by giving clues as to the profile or shape of an object (e.g. a building or tree) through the shadow it casts on the ground (*Figure 4.6*).

**Figure 4.6 : Shadow**

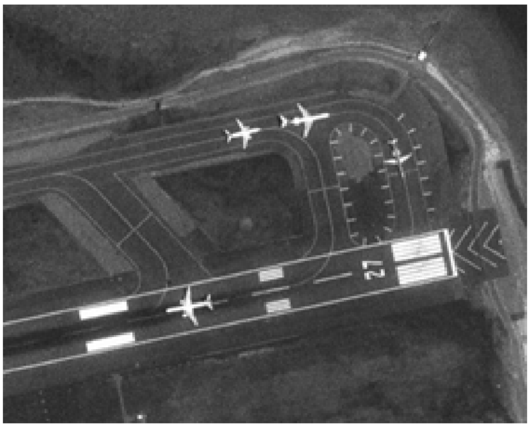


Figure 4.7 : Situation

### 4.2.7 Situation

Situation means the location of one place, relative to the location of other places, e.g. building beside a railway line is generally the railway station. The runway and standing aircrafts signifies the airport (*Figure 4.7*).

### 4.2.8 Resolution

Resolution or resolving power refers to the sharpness of detail afforded by the combination of film quality and the camera lens system. It is subjective measure of the image "sharpness", expressed as the maximum number of lines per millimetre that can be resolved or seen as individual lines. The net effect of a low resolving power is a loss of detail. Small objects cannot be distinguished individually anymore.

## 4.3 Preparation of Inventories of Land Use and Land Cover (LULC) Features from Satellite Images

The satellite imagery under investigation is a typical geo-coded image (*Figure 4.8*) which has been generated matching with Survey of India topographical Map No. 73M/7. It is a merged data of SPOT (PAN) and Landsat-5 TM where high degree of spatial resolution of SPOT (PAN) has been merged with Landsat TM's colour mode, thus different object's spatial detail can be visualized in false colours. Here it may be mentioned that Landsat TM's Band 2, 3, and 4 have been viewed with the help of blue, green and red colours respectively.

The data was acquired on 8 November, 1991, whereas the image was generated by NRSA on 4 May, 1992. By applying different rules of image characteristics, various features within the area under investigation could be identified. Here it may be noted that SOI toposheet No. 73 M/7 has been used as reference data for extraction of information related to annotation, etc. Ultimately the Land use/Land cover Map (*Figure*

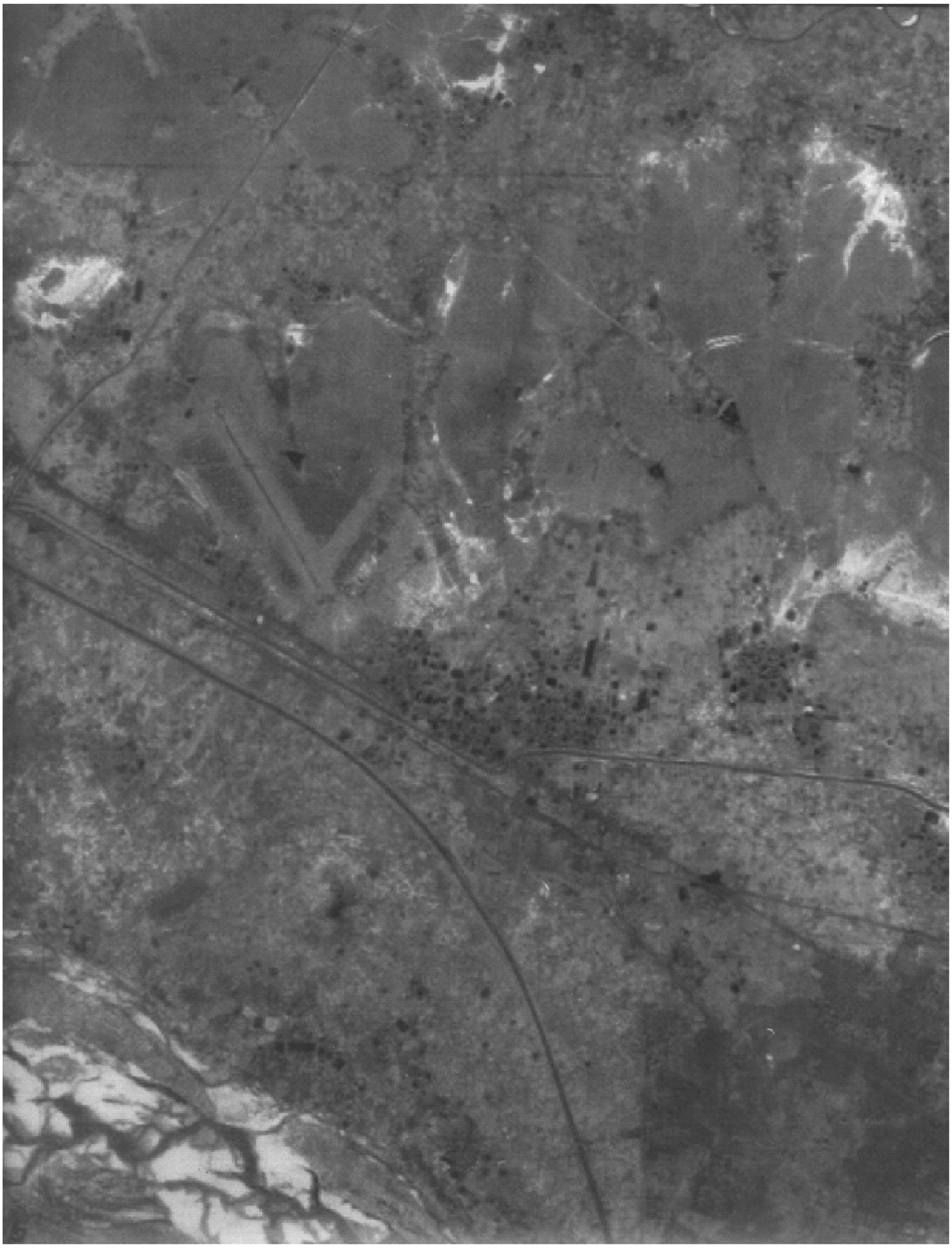


**Figure 4.8 : Satellite Image**

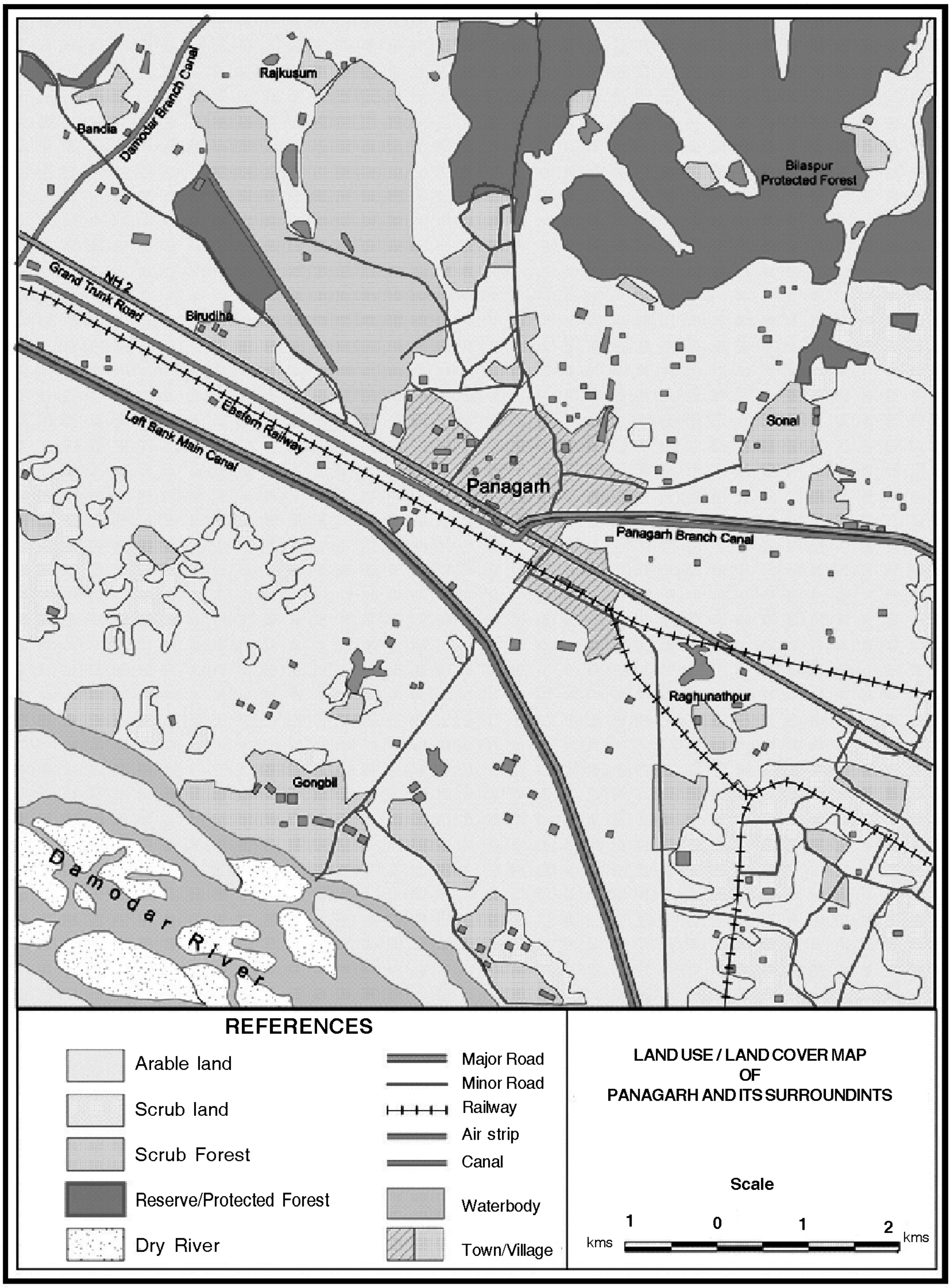



**Figure 4.9 : Landuse/Land Cover Map of Panagarh and its Surroundings**

*4.9*) has been prepared by interpreting the geo-coded hard copy out put. Here land use refers to man made features like road, railway, arable land, settlement, etc., whereas land cover denotes natural features like forest cover, scrub areas, river system, wet land, etc.

Due to good amount of chlorophyll content, healthy vegetation absorbs energy strongly and appears as deep red in FCC. Bilaspur protected forest, situated at the north eastern corner of the image is a typical examples in this regard. At places, forest areas have been degraded and they appear in terms of lighter tone. These are typical examples of fairly dense scrub (scrub forest) areas. Otherwise small patches of scrub lands are scattered, particularly to the western part of the area under investigation.

Water bodies appear either as deep blue/blackish or powder blue in colour depending upon depth/clearness of water. In case of deep/clear water, absorption of light is more, hence the apparent colour is blue/blackish blue. On the other hand in case of turbid/ shallow water, the reflection of light is more and the appearance of the object is powder blue. To the south-western corner, Damodar River can easily be identified. The channel of the river is characterized by braided nature with numerous bars and spits. The water is mostly sediment laden and the apparent colour is powder blue. Sand deposits within the course of the river reflect more light, hence they appear in terms of light tone/white colour. Due to sediment deposit, even an island has been formed inside the river, where crops are grown. However, in the present image, the DVC Left Bank Main Canal enters the region from the west and passes through the central part and curves towards the south. At the extreme western part of the image, Damodar Branch Canal originates from DVC Left Bank Main Canal and moves northward. Panagarh Branch Canal branches off from Damodar Branch Canal and runs in between the railway line and the Grand Trunk Road. Actually several linear features, viz. DVC Left Bank Main Canal, Eastern Railway Main Line and Grand Trunk Road run parallel to each other from north-west to south-east. The canal, if contains water, can be recognized with the help of dark blue colour, fine texture and also the typical geometric shape. Generally speaking, the tonal expressions of railway lines and road ways are darker and lighter respectively. Moreover, unlike road, railway takes typical curvature at the turning point and tries to avoid rural settlements. On the other hand roads link up different settlements and can take any type of turning. Both sides of highways are generally associated with trees. All these factors provide clues to recognize different types of linear features. However, these are the general rules, and exceptions are there, depending upon the real world situation and also quality of the hard copy output.

Good or moderately good agricultural lands are wide spread within the area under investigation, which appear as light pink colour with fine or medium texture. In case of poor agricultural land the appearance is in terms of whitish gray with coarse texture. Rural settlements are associated with water bodies and vegetation cover and they are represented in terms of dark blue with fine to medium texture. Sonal and Gopalpur are two examples of rural settlements, which are easily identifiable to the east-central and north-western parts of the image. On the other hand, in case of urban areas, due to Rayleigh scattering blue or gray cast appear on the image. Panagarh, located at the center of the map is an example of urban settlement, although gray/blue casting is not that prominent for this urban area.

## 4.4 Summary

Image characteristics like tone, texture, pattern, shape, size etc helps the interpreter to identify different feathers. In the next phase it has been taught how to prepare a land use/land cover map.

## 4.5 Keywords

Tone, texture, pattern, shape, size, situation, resolution, LULC

## 4.6 Model Questions

1. Write notes on :

   Tone, texture, pattern, shape, size, situation, resolution,

2. Prepare a Land use/Land cover map from the satellite image provided with you.

## 4.7 References

Sarkar, Asit Kumar, Study Material : UG Geography : Paper-5, Group B. Preparation of Thematic Maps, Map Interpretation and Field Technique, Netaji Subhas Open University, Kolkata, 2008

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-9, Group B. Remote Sensing & Geographic Information System, Netaji Subhas Open University, Kolkata, 2018

# Unit - 5 ❑ GIS Data Structure : Types (Spatial and Non Spatial), Raster and Vector

**Structures :**



## 5.0 Introduction

GIS data are of two types, spatial data and non-spatial or attribute data. On the other hand GIS works with two different types of data models, Raster model and Vector model.

## 5.1 Learning Objective

This unit will help you to understand :

- Difference between spatial and non-spatial data types
- Different between Raster and Vector data format

## 5.2 Spatial and Non-Spatial Data

GIS data are of two types, spatial data and no-spatial or attribute data. When the data is about some geographical space, it is known as spatial data. When we digitize line features to denote a river, railway line or a road, polygons to represent water body or forest area or village boundary, point symbols to represent post office or market place, all these features are considered as spatial data. On the other hand when we attach data like name of the river, name of the forest, status of the forest, population of a village, etc. for specific line, polygon or point feature already digitized, they are considered as non-spatial or attribute data

The following Table lists examples of attributes that might be associated with a given point, line or area feature :

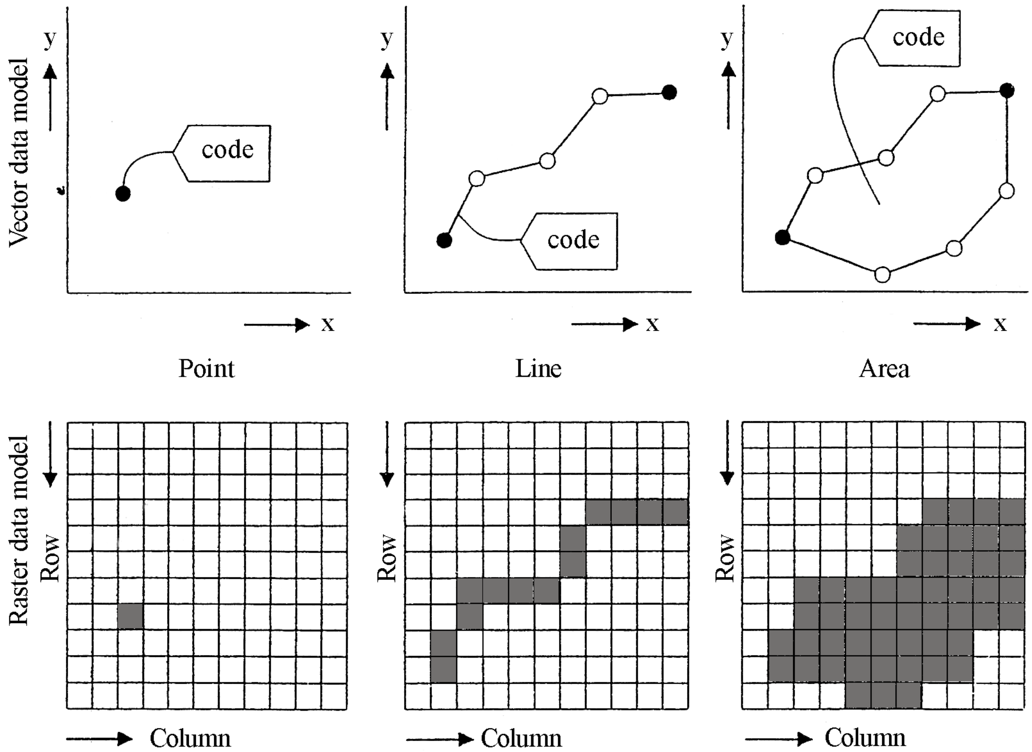
**Table 5.1 : GIS Data Structure : Spatial and Non-spatial**

| Geographical Feature | Type of attached Attribute |
|---|---|
| Point feature | Pond (depth, area, use) |
| Line feature | Railway line (gauge width. electrified or not. single line or double line, jurisdiction of the route |
| Area feature | Forest (name, status, species) |

## 5.3 Raster and Vector Data Format

Geographic information systems work with two fundamentally different types of geographic models – the vector model and the raster model (*Figure: 5.1*). In the vector model, information about points, lines, and polygons is encoded and stored as a collection of x, y coordinates. The location of a point feature, such as a tube well, can be described by a single x, y coordinate. Linear features, such as roads and rivers, can be stored as a collection of point coordinates. Polygon features, such as forest and river basin, can be stored as a closed loop of coordinates.

The vector model is extremely useful for describing discrete features, but less useful for describing continuously varying features such as soil type or accessibility costs for hospitals. The raster model has evolved to model such continuous features. A raster image comprises a collection of grid cells rather like a scanned map or picture. Both the vector and raster models for storing geographic data have unique advantages and disadvantages. Modern GIS is able to handle both models.




Key for the vector models : ○ intermediate point

● node

Vector and raster representation of points, lines and areas. The code of a feature is either a class name, an ID, or a value.

**Figure 5.1 : Vector and Raster Data Format**

## 5.4 Summary

GIS is a perfect blend of geographical information and computer technology. Spatial data available from various sources including satellite images are used in this system. Spatial data may either be in raster, i.e. grid or cell format or vector i.e. x, y coordinate format.

## 5.5 Keywords

GIS, Spatial data, attribute data, Raster Format, Vector Format

## 5.6 Model Questions

1. Distinguish between

   (a) Spatial and attribute data structure;

   (b) Raster and Vector data structure.

## 5.7 References

Burrough, P. A., Principles of Geographical Information Systems for Land Resources Assessment, Clarendon Press, Oxford, 1986

De By Rolf, A. ed. Principles of Geographical Information Systems, International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, 2000

Kraak, Menno-Jan & Ormeling Ferjan, Cartography, Visualization of Geospatial Data, First Indian Reprint, Pearson Education, Delhi, 2004

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-9, Group B. Remote Sensing & Geographic Information System, Netaji Subhas Open University, Kolkata, 2018

Sarkar, Asit Kumar, Study Material : PG Geography: Paper-IX, Part-II, Module-18, Geographical Information System and Remote Sensing. Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2013

# Unit - 6 ❑ Principles of GNSS Positioning and way Point Collection

**Structures**



## 6.0 Introduction

GNSS (Global Navigation Satellite System) is a satellite system that is used to pinpoint the geographic location of a user's receiver anywhere in the world. As of October 2018, the United States' Global Positioning System (GPS) and Russia's GLONASS are fully operational GNSSs, with China's BeiDou Navigation Satellite System and the European Union's Galileo scheduled to be fully operational by 2020. India, France and Japan are in the process of developing regional navigation and augmentation systems as well. It may me mentioned here that (IRNSS-1A) is the first satellite in the Indian Regional Navigation Satellite System which has been placed in the orbit on 1st July, 2013. It is one of the seven satellites constituting the IRNSS space segment.

## 6.1 Learning Objective

This unit will help you to understand :

- Principles of GPS operation
- Different segments of GPS
- Method of way point collection

## 6.2 Measurement

The basis of GPS is "triangulation" from satellites. A GPS receiver measures distance by measuring the transmission time of radio signals and determines the position of satellites with distance. It is a measurement of high orbit and precision positioning. Suppose we measure our distance from a satellite and find it to be 11,000 miles. First, we draw a circle with the satellite as the center, and we are on any point of the surface of a sphere that is centered on this satellite and has a radius of 11,000 miles.

Next, say we measure our distance to a second satellite and find out that it is 12,000 miles away, and we're somewhere on the circle where these two spheres intersect. If we then make a measurement from a third satellite and find that we are 13,000 miles from that one. It narrows our position down even further, to the 2 points where the 13,000 mile sphere cuts through the circle that is the intersection of the first 2 spheres. So by ranging from 3 satellites we can narrow our position to just 2 points in space (*Figure 6.1*).

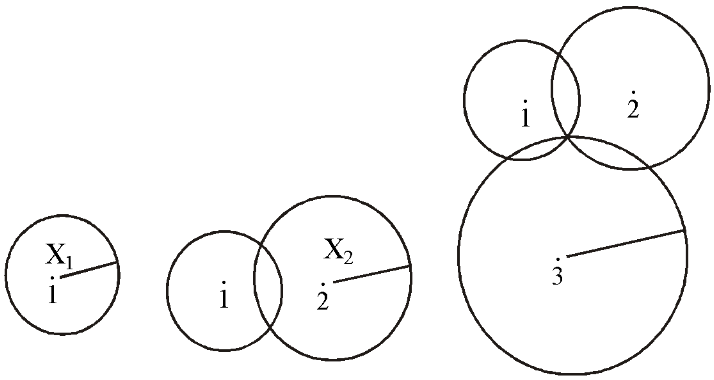



**Figure 6.1 : Principles of GPS operation (Courtesy : George Joseph)**

We need to measure the distance from a fourth satellite to decide on which one is our true location. From the viewpoint of Physics, the product of signal transmission time x speed will be the distance between the satellite and us. This distance is known as the virtual distance. In GPS measurement, we are measuring radio signals travel at quasi light speed, i.e. 186,000 miles/sec. It is too fast that sometimes it takes only 0.06 second. Therefore, we need 2 timers: one on the satellite to record the signal sending time, another one on the receiver to record the signal receiving time. Though the speed is fast, the signal sending/receiving time is not synchronous. Suppose both the satellite and receiver alarm us at the same time, we will hear 2 different sounds because there is time delay when signals are sending to us from 11,000 miles away. Therefore, we can calculate the distance: delay time x speed. The product will be the true distance between the satellite and the receiver. This is the basic theory of triangulation.

## 6.3 Different Segments of GPS

The current GPS consists of three major segments. These are the space segment, a control segment, and a user segment. The U.S. Air Force develops, maintains, and operates the space and control segments. GPS satellites broadcast signals from space, and each GPS receiver uses these signals to calculate its three-dimensional location (latitude, longitude, and altitude) and the current time.

The space segment (SS) is composed of 24 to 32 satellites in medium Earth orbit and also includes the payload adapters to the boosters required to launch them into orbit. The space segment (SS) is composed of the orbiting GPS satellites, or Space Vehicles (SV) in GPS parlance. The GPS design originally called for 24 SVs, eight each in three approximately circular orbits, but this was modified to six orbital planes with four satellites each. The orbits are arranged so that at least six satellites are always within line of sight from everywhere on the Earth's surface.

As of February 2016, there are 32 satellites in the GPS constellation, 31 of which are in use. The additional satellites improve the precision of GPS receiver calculations by providing redundant measurements. With the increased number of satellites, the constellation was changed to a nonuniform arrangement. Such an arrangement was shown to improve reliability and availability of the system, relative to a uniform system, when multiple satellites fail. About nine satellites are visible from any point on the ground at any one time, ensuring considerable redundancy over the minimum four satellites needed for a position.

The control segment (CS) is composed of :

1. A master control station (MCS),
2. An alternative master control station,
3. Four dedicated ground antennas, and
4. Six dedicated monitor stations.

The MCS can also access U.S. Air Force Satellite Control Network (AFSCN) ground antennas (for additional command and control capability) and NGA (National Geospatial-Intelligence Agency) monitor stations. The flight paths of the satellites are tracked by dedicated U.S. Air Force monitoring stations in Hawaii, Kwajalein Atoll, Ascension Island, Diego Garcia, Colorado Springs, Colorado and Cape Canaveral, along with shared NGA monitor stations operated in England, Argentina, Ecuador, Bahrain, Australia and Washington DC.

The user segment (US) is composed of hundreds of thousands of U.S. and allied military users of the secure GPS Precise Positioning Service, and tens of millions of civil, commercial and scientific users of the Standard Positioning Service. In general, GPS receivers are composed of an antenna, tuned to the frequencies transmitted by the satellites, receiver-processors, and a highly stable clock. They may also include a display for providing location and speed information to the user.

## 6.4 Way Points Collection

To know about collection of way points using GPS hand set, one should know key function of a typical handheld GPS instrument. In the present context, the example has been illustrated with Garmin eTrex Vista HCx handset (*Figure 6.2*).


**Figure 6.2 : Handheld GPS Instrument**

**Key functions of GARMIN eTrex Vista HCx handset**

**Power/ Backlight :** Press and hold to turn on or off.

Press and release for backlighting or to view time, date and battery capacity.

**Menu/Find :** Press and release to view the Options Menu for the current page.

Press and hold to display the Find Menu.

**Enter/Rocker :** Rock up, down, right, or left, to move through lists; highlight fields, on-screen buttons, or icons; move the map panning arrow.

Press in and release to enter highlighted options and data or confirm on-screen messages.

Press in and hold at any time to mark the current location as a waypoint.

**In/Out Zoom :** From Map page, press to zoom the map in or out.

From any other page, press to scroll up or down a list or move a highlighted slider.

**Quit /Page :** Press to cycle through the main pages.

Press and hold to turn the compass on or off.

## 6.5 Operation of GARMIN eTrex Vista HCx handset for waypoint collection

To switch on the handset, press Power key (long press).

Acquiring satellite message will appear on the screen.

Wait till appropriate number of satellite signals are available (solid bar means available satellite).

Press Menu/Find key (long press) → Main MenuSatellite.

Select SatellitePress Enter key (long press) → Mark Waypoint.

The Waypoint of the present location will be available on the screen.

Note down Northing/Easting value, i.e. latitude and longitude, in the field book.

Move to the new location → Press OK to save the previous way point.

Press Enter for selecting the next Waypoint.

Repeat the procedure for collection of Northing / Easting values for all other locations as Waypoints.

Actually waypoints are locations or landmarks you record and store in your GPS. You can add waypoints to routes and even create a Go To directly to the selected waypoint.

You can create waypoints using three methods.

(1) Press ENTER while at a location,

(2) Create a waypoint on the Map page, or

(3) Enter coordinates for a waypoint manually (as per example given above).

**Marking your current location**

Press in and hold the Rocker to quickly mark your current location creating a new waypoint. You must have a valid position fix to mark your current location

## 6.6 Summary

GNSS helps us to determine specific geographical location of any part of earth surface. There are three segments of GPS, space segment, control segment and user segment. In this unit it has been taught how to operate a hand held GPS set.

## 6.7 Keywords

GNSS, Way point

## 6.8 Model Questions

1. What do you mean by GNSS?
2. What are the different segments of GPS?

## 6.9 Reference

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-IX, Part-II, Module-18, Geographical Information System and Remote Sensing, Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2014

# Unit - 7 ❑ Transferring of waypoint to GIS

**Structures**



## 7.0 Introduction

As we collect way points with the help of a hand help GPS receiver, we are to transfer the data to a computer system. Subsequently necessary plotting is to be done with the help of data collected as way points.

## 7.1 Learning Objective

This unit will help you to understand :

- How o transfer data from GPS hand held set to a computer

## 7.2 Data transfer from GPS hand set to a computer

Connect your eTrex to your computer using the PC/USB connector cable.

- Lift the USB port protective cover from the back of the eTrex, and insert the smaller connector on the USB cable into the matching port.

- Connect the remaining cable end to your computer's USB port.

Transferring Tracks or Waypoints from the eTrex to Map Source on your Computer

Tracks and waypoints saved on your etrex can be saved and viewed in Germin Mapsource.

## 7.3 To transfer

- Be sure that Garmin Map Source Trip and Waypoint Manager is installed on your computer and open.
- Click "Receive from Drive" from the Transfer menu or click the "Receive from Device" icon at the top of the screen.

It is to be mentioned here that as we collect way point information with the help of a GPS instrument, the same may be opened in Map Source, which may be viewed in Google earth, similar to a GIS environment. In Map Source, the File needs to be saved as Text. When opened in Excel, change the Excel to text file. Focus → File → Utility

Import ASCII Table point

Data Type → Integer

X → Easting; Y → Northing

Subsequently necessary plotting is to be done to represent way points collected so far.

## 7.4 Summary

In this unit necessary procedures have been taught to transfer collect way points from the field to a computer system.

## 7.5 Keywords

USP port, ASCII

## 7.6 Model Questions

1. How to transfer waypoint data to GIS?
2. Collect 10 way points along a road with marked locations and transfer them to your computer system.

## 7.7 References

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-IX, Part-II, Module-18, Geographical Information System and Remote Sensing, Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2014.

# Unit - 8 ❑ Area and Length Calculations from GNSS Data

**Structures**



## 8.0 Introduction

Once data collected with the help of a GPS receiver, it is possible to calculate area, length, etc.

## 8.1 Learning Objective

This unit will help you to understand :

- How to calculate area from GPS data
- How to calculate length from GPS data

From the data available at Table 8.1, (also *Figure 8.1*) an attempt has been made to calculate area and length by using calculation method available in coordinate geometry.

**Table 8.1 : GPS Survey**

| Way Point | UTM Zone | Easting (m) | Northing (m) |
|---|---|---|---|
| W1 | | 635224 | 2487506 |
| W2 | 45Q | 635239 | 2487506 |
| W3 | | 635246 | 2487515 |
| W4 | | 635235 | 2487517 |

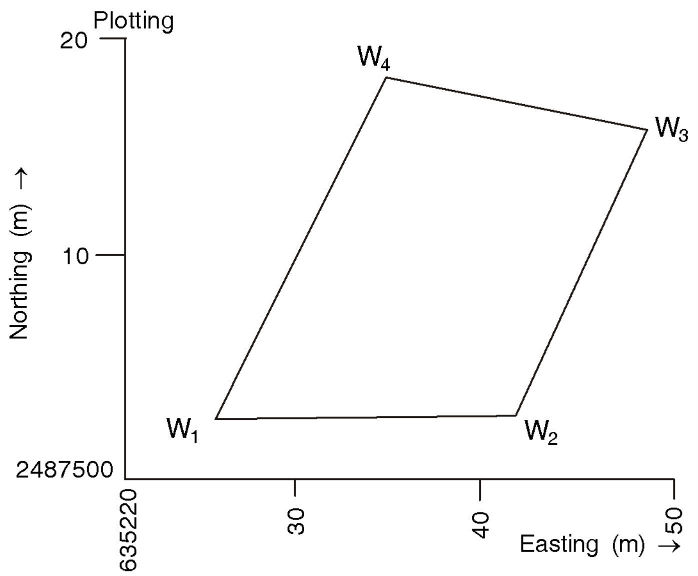



**Figure 8.1 : GPS Survey around a park**

## 8.2 Area Calculation

Area calculation equation :

Area in sq. m

½ {(E1 × N2 + E2 × N3 + E3 × N4 + E4 × N1) (N1 × E2 + N2 E3 + N3 × E4 + N4 + E1)}

= ½ (24 × 6 + 39 × 15 + 46 × 17 + 35 × 6) – (6 × 39 + 6 × 46 + 15 × 35 + 17 × 24)

= ½ 1721 = 1443 = 139 sq.m.

## 8.3 Length Calculation

Length calculation equation :

$$\sqrt{(E1-E2)^2+(N1-N2)^2}$$

Length in m.

$$W1 - W2 = \sqrt{(24-39)^2+(6-6)^2} = 15.00 \text{ m}$$

$$W2 - W3 = \sqrt{(39-46)^2+(6-15)^2} = 11.40 \text{ m}$$

$$W3 - W4 = \sqrt{(46-35)^2+(15-17)^2} = 11.18 \text{ m}$$

$$W4 - W1 = \sqrt{(35-24)^2+(17-6)^2} = 15.56 \text{ m}$$

## 8.4 Summary

In this unit it has been taught how to calculate area, length, etc. from GNSS data. These information may be transferred to a GIS system. Data collected with the help of a GPS system may be used for length or area calculation.

## 8.5 Keywords

UTM Zone, area and length calculation

## 8.6 Model Questions

1. Calcuate area from the way point data collected from the field.
2. Calculate the length of the road with the help of the data collected from the field.

## 8.7 References

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-IX, Part-II, Module-18, Geographic Information System and Remote Sensing, Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2014.

# Unit - 9 ❑ Georeferencing of Maps and Images

**Structures**



## 9.0 Introduction

A Project File, comprising one exercise each is to be submitted by each student. They may use any available software (preferably free/open software) for preparation of the project. However, following exercises are presented to guide them how to prepare such projects. Please note that the algorithm and command would vary depending upon the available software and also the particular version of the software.

To start with the job, you are to Georeference the particular map/image you would work on. If it is a satellite image, you are to get the image georeferenced with the help of another image / map of the same area which has already been georeferenced. Likewise you are to georeference or register a map with the help of available control points of the raster image which you got by scanning the map. Do not forget to make equally distributed control points (minimum four in number) in terms of latitude / longitude in your map before getting the same scanned.

## 9.1 Learning Objective

This unit will help you to understand :

- How to prepare a project file
- How to georeference a satellite image and also a map

## 9.2 Concept

Now a days analog cartography has been transformed into digital cartography. In case of modern map making technique, the traditional manual drawing has been replaced by clicking of the mouse attached to the computer to transform geographical information into graphical format. But to start with the job, one needs a hardcopy analog base map which should be made compatible as input information to the computer system. Hence such a map is scanned with the help of a scanner and this raster image (*Figure 9.1*) is used as an input file to initiate the digital mapping job. Sometimes the raster image contains various noises, which needs to be cleaned with the help of available soft ware (e.g. Adobe Photoshop). In addition to removal of noise, such a software is in a position to insert information in the raster image, if necessary. It may be noted here that appropriate number of registration marks in terms of latitudinal and longitudinal values should be inserted in the base map, so that the scanned image may be transformed into a registered image, thus matching with the real world coordinate system.

To open a raster image (in our case the scanned base map) in Mapinfo software, we are to opt for 'register' option. Ultimately all the control points are registered with the help of available graticule values, followed by projecting the image with appropriate projection system. By moving the cursor, one can identify latitudinal and longitudinal value at any place of the registered image. Likewise satellite images are also georeferenced with the help of available registered images/maps for converting them to real world coordinate systems.

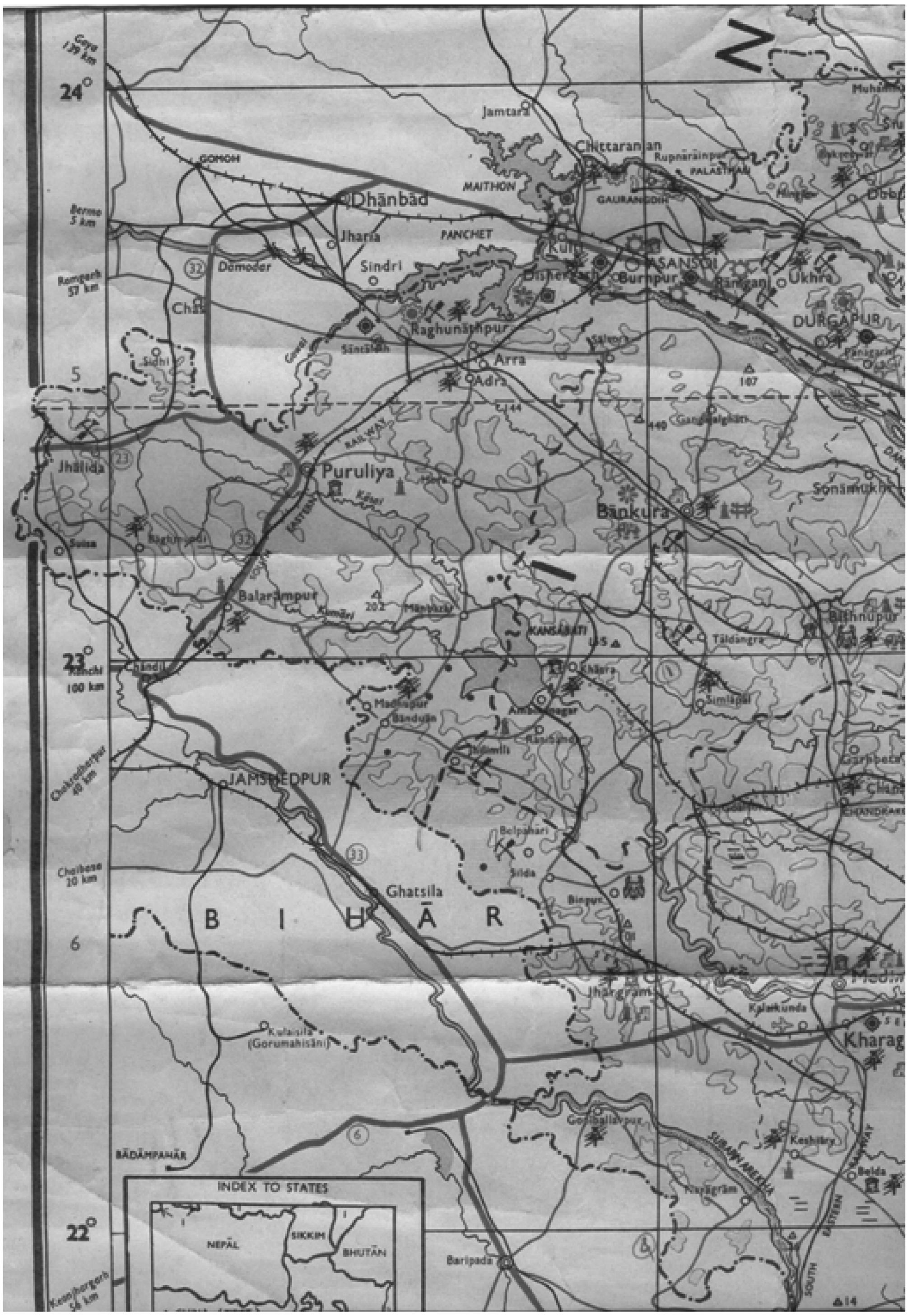



**Figure 9.1 Raster image of Puruliya Districts**

## 9.3 Geo-referencing with MapInfo software (For map)

To register a map in MapInfo software, the following instructions are to be given :

File

Open Table

File Name (select a raster file, for example : Puruliya)

File of Type : Raster image

Open

Register

New

Select point 1

Label → Pt 1

Map X → 86 deg

Tab → Map Y → 24 deg

OK

New

Select point 2

Label → Pt 2

Map X → 87 deg

Tab → Map Y → 24 deg

OK

New

Select point 3

Label → Pt 3

Map X → 87 deg

Tab → Map Y → 23 deg

OK

New

Select point 4

Label → Pt 4

Map X → 86 deg

Tab → Map Y → 23 deg

OK

(It is desirable that the error is less than 5)

ProjectionLongitude/Latitude

OK

OK

N.B. : X → Longitude; Y → Latitude

## 9.4 Georeferencing with Geomatica software (For satellite imagery)

Open OrthoEngine

OrthoEngine > File > New

Project information dialogue box comes

Browse to give a file name (example : Georeference_map2.prj) for Ortho Engine project

Choose Polynomial math model

Click OK

Set Projection dialogue box comes

On the output projection click the drop down arrow and choose Lat/Long projection

Click Earth Model. Earth Model dialogue box comes

Click Datum tab and choose for example D076 datum

Put for example 0°00 00.1900 as output pixel spacing

Click Set GCP Projection Based on output projection

Click OK

Set Projection dialogue box closed and OrthoEngine main panel comes.

Ortho Engine > File > Save

From the drop down list in the Processing Step, choose GCP Collection

Click the first tool (i.e. open a new or existing image). Open image dialogue box will come

Click New Image and browse to choose map2.tiff file.

Click open in the file selection window.

The map2.tiff file will come on the Open image dialogue box

Select the map1.tiff file. Now the open tool is active. Click Quick Open & Close.

Image viewer opened with map2.tiff file. Enhance the file if the file is not properly visible

In the Ortho Engine main panel, click 2nd tool (i.e. collect GCP manually)

GCP collection panel will come

In the image viewer locate the point where, (for example) Longitude is 88°34′00″ E and Latitude is 22°54′00″ N

Click Use Point

First GCP id (G0001) will appear on the image viewer

Come to the GCP Collection panel and put the longitude and latitude in the appropriate place

Accept

You have collected the first GCP

In the same way you have to collect at least 4 GCPs

Save the project in the Ortho Engine main panel

Close the image viewer and GCP collection panel

In the processing step from the drop down menu choose Geometric Correction

Click 3rd tool to open Geometric Correction dialogue box

On the available image click over the file (map 2 : No Ortho)

Click on the arrow to take the file to image to process box.

In the uncorrected image keep everything default

In the Corrected image browse to give an output file name (Corrected_map2.pix)

Set Sampling Interval as 1

Keep all others default

Click Correct Images

Geometric correction progress window will come with task bar

On completion of the Geometric correction the Geometric correction dialogue box will come again

Geometric Correction has been completed

Save the project in the OrthoEngine main panel and close OrthoEngine

Open the Corrected_map2.pix file on the focus viewer to check the georeference.

## 9.5 Summary

To transfer a map into digital environment, the user needs to georerefence or register the same with known coordinates. In this unit that procedure has been taught, both for maps and also satellite images.

## 9.6 Keywords

Georeferening, GIS software

## 9.7 Model Questions

1. Georerefence the map provided with you.
2. Georeference the satellite image provided with you.

## 9.8 References

PCI Geomatics : Geomatica 10 : Focus User Guide : Richmond Hill, Canada 2005.

PCI Geomatics : Geomatica 10 : Ortho Engine User Guide : Richmond Hill, Canada 2005

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-IX, Part-II, Module-18, Geographical Information System and Remote Sensing, Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2014

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-9, Group B. Remote Sensing & Geographic Information System, Netaji Subhas Open University, Kolkata, 2018

# Unit - 10 ❑ Image Classification, Post Classification, Analysis and Editing

**Structures**



## 10.0 Introduction

In the real world the human being is used to categorize all the objects on the earth's surface by labels describing them for example forest, agriculture field, river, residential building, etc. We are not used to calling areas by numbers as is the case in digital images.

Digital image classification is the process of assigning pixels to classes. Each pixel in a digital image is treated as an individual unit having different wavelength region or spectral band. By comparing pixels to one another and to those of known identity, it is possible to group pixels of similar classes of interest to user. These classes are represented by suitable colours assigned by the user.

Actually, digital image classification, also known as spectral pattern recognition, uses the spectral information for each pixel in an image file to group pixels into common spectral themes. Classified images are, in effect, thematic maps containing a mosaic of pixels belonging to different classes.

The objective of the classification process is to assign all pixels in an image to a finite number of categories, or classes of data, based on their data file values. If a pixel satisfies a certain set of criteria, then it is assigned to the class that corresponds to that criteria.

There are two different image classification methods: unsupervised and supervised.

## 10.1 Learning Objective

This unit will help you to understand :

- How to prepare unsupervised classification
- How to prepare supervised classification
- How to make post classification analysis
- How to make class editing

## 10.2 Unsupervised Classification

This is a highly computer-automated procedure. It allows the user to specify parameters that the computer uses as guidelines to uncover statistical patterns in the data. In an unsupervised classification the software automatically divides the range of spectral values, contained in an image file, into classes or clusters. These natural clusters are then related to actual land use/ land cover categories after a very careful ground truthing. With Focus of Geomatica, the user can choose the number of classes the data is divided into. The classified results report the proportions of spectral values in the image and can therefore indicate the prevalence of specific ground covers.

In Geometica, the following steps are involved to get the result through unsupervised classification :

File → Open → Desktop → (e.g.) Sundarban.pix Open

Right click Sundarban.pix 1, 2, 3 → Image classification → Unsupervised

New session

Description box → Type → (any name) unsuper

Input channel → check 1, 2, 3

Add Layer → Add 2 number of 8 bit channel → Add

Output Channel → Check Empty channel → OK → OK

In the Unsupervised Classification dialog, put the following information :

Algorithm : K-Means

Max Class : 4

Keep all other field default.

The end result would be the unsupervised classified image.

## 10.3 Supervised Classification

Supervised classification is more closely controlled by the supervisor than unsupervised classification. In this process, the user, i.e. the supervisor select recognizable regions within an image, with the help of other sources, to create sample area called training sites. These training sites are then used to train the computer system to identify pixels with similar characteristics.

Knowledge of the data, the class desired, and the algorithm to be used, is required before the user begin selecting the training sites. By setting priorities to the classes, the user supervise the classification of pixels as they are assigned to a class value. If classification is accurate, each resulting class corresponds to a pattern that the user originally identified.

Typical supervised classification involves three stages :

- The training stage, wherein the multi-spectral parameters are extracted for various classes from training sites identified in the image
- The classification stage, wherein each pixel is assigned to a class to which it probably belongs.

- The output stage, where the presentation of the data is in the form of maps, tables, graphs, etc.

In geomatica, the following steps are involved to prepare supervised classification

Open → Sundarban.pix

Right click Sundarban.pix → Image classification → Supervised

New session

Description → Type super → Add Layer → Add 3 number of 8 bit channel

Add

Input channel → Check 1,2,3

Training channel → Check (v) Empty channel

Output channel → Check Empty channel

Ok

Class → New → (class-1 = New Mangrove → Change colour → New shape poly → digitize New Mangrove

Class → New → (class-2 = Old Mangrove → Change colour → New shape poly → digitize Old Mangrove

Class → New → (class-3 = Salt Deposition → Change colour → New shape poly → digitize Salt Deposition

Class → New → (class-4 = Settlement with Vegetation → Change colour → New shape poly → digitize Settlement with Vegetation

Class → New → (class-5 = Water → Change colour → New shape poly → digitize Water

Class → New → (class-6 = Arable Land → Change colour → New shape poly → digitize Arable Land

Right click classification Metal layer → Run classification → Minimum Distance

Classify

The end result would be the supervised classification image (*Figure 10.1*).

**SUPERVISED CLASSIFICATION**
**SUNDARBAN AREA (PART) 2005**

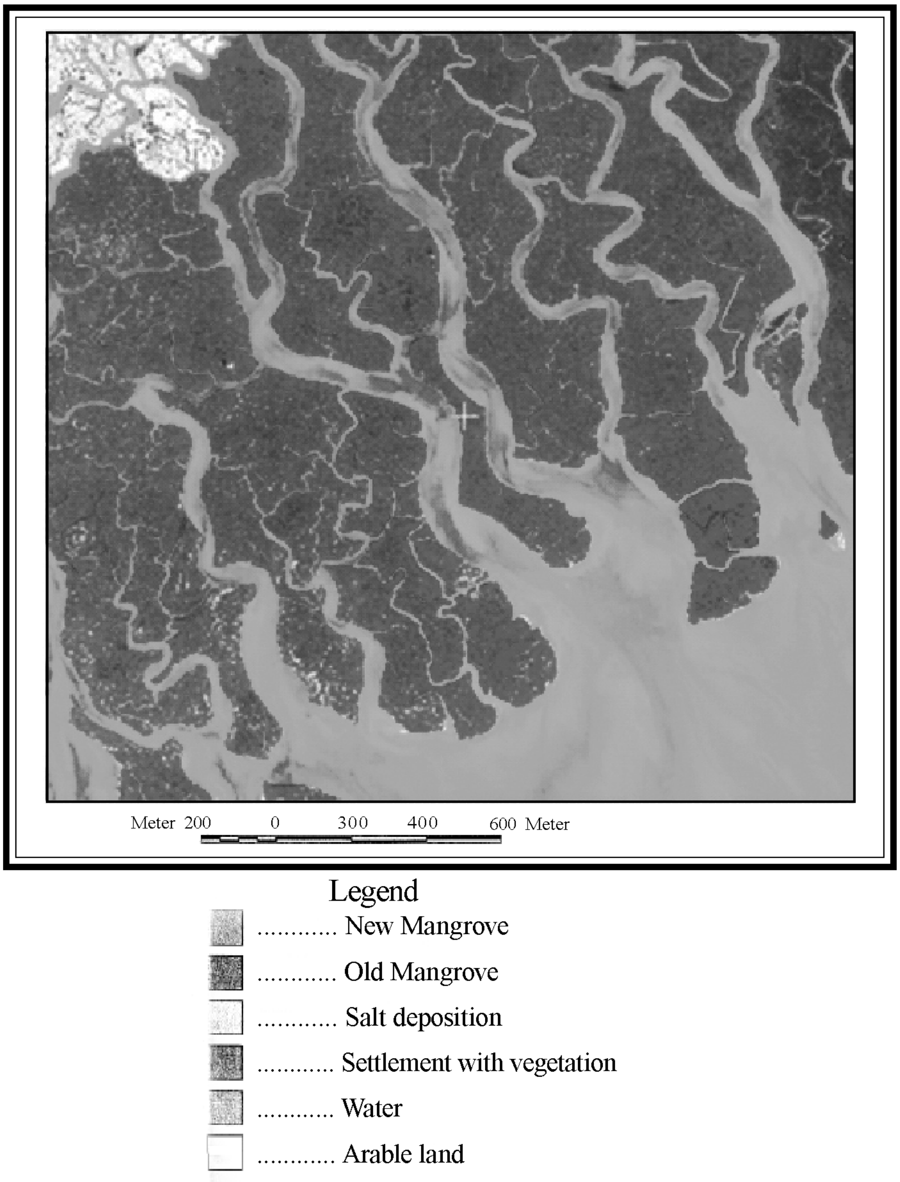



**Figure 10.1 : Supervised Classification**

## 10.4 Post Classification Analysis

The following steps are to be followed for Post Classification Analysis (Aggregation) in Geometica :

Open Sundarban pix file in the Focus.

Focus → Analysis → Image Classification → Post Classification Analysis → Aggregation. Channel set up dialogue box comes up.

Select the Classified Channel (Channel 4 for this case) on the Channel Available box.

Select an Empty channel (Channel 5 for this case) on the Output Channel box

OK

Aggregate dialogue box comes up

In the Viewing Control area, select Normal.

Come to Input Classes area and select Class-03 & Class–04 holding down SHIFT key. The classes will appear highlighted with a red outline.

Click New in the Aggregate Classes area. This creates a new but empty aggregate class (Class-05 for this case)

You may change the colour and name of new class (Class-05 for this case).

Click Add

The input classes (Classes 03 & 04 will be aggregated to the new class (Class-05 for this case). Result will be displayed in the Focus.

Click Apply to Output Channel.

## 10.5 Class Editing

You can combine several classes once you have edited your classification. Like the aggregation process, class editing combines several classes; however, instead of combining classes throughout an image, you can combine the classes for all pixels under a bitmap mask.

**To initialize post-classification editing :**

1. In the Map tree, right-click Classification MetalLayer and click Post –classification Analysis and then click Class Editing.
2. In the Class Editing dialog box, click Image and then click Select Classified Image.
3. In the Select Classified Image dialog box, choose the output channel you selected when you initialize the classification from the channels available list.
4. Click OK.
5. In the Class Editing dialog box, click Image and then click Select Reference Image.
6. In the Load Reference Image list, locate and select the Red, Green, and Blue channels.

   You must use the same reference image to perform class editing.

   As you select a channel, its number is added to the R, G, and B boxes.
7. Click OK.

## 10.6 Summary

It is possible to classify an image in terms of unsupervised or supervised classification. In case of unsupervised classification, the system itself classifies the image into appropriate classes based on DN values. On the other hand, in case of supervised classification, classification depend upon the supervisor's skill and faithfulness.

## 10.7 Keywords

Supervised classification, Unsupervised classification, class editing

## 10.8 Model Questions

1. Classify the given digital satellite image using any of the unsupervised or supervised classifier. Use minimum distance algorithm for this purpose. Generate a classification report of the classified image.

## 10.9 References

PCI Geomatics : Geomatica 10 : Focus User Guide : Richmond Hill, Canada 2005.

PCI Geomatics : Geomatica 10 : Ortho Engine User Guide : Richmond Hill, Canada 2005

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-IX, Part-II, Module-18, Geographical Information System and Remote Sensing, Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2014

Sarkar, Asit Kumar, Study Material : PG Geography : Paper-9, Group B. Remote Sensing & Geographic Information System, Netaji Subhas Open University, Kolkata, 2018

# Unit - 11 ❑ Digitization of Features, Data Attachment, Overlay and Preparation of Thematic Map

**Structures**



## 11.0 Introduction

Many GIS database consists of sets of information called layers. Each layer represents a particular type of geographic data. For example, one layer may include information on communication network. Another layer may contain information about land use pattern, while another records drainage system. The GIS can combine these layers into one image, showing how the communication network, drainage system and land use pattern relate to one another. A GIS database can include hundreds of such layers. Thus with the help of registered image, one can create as many thematic layers as one desires. In digital cartography, different types of geographical information are represented in terms of line, point and area (polygon) symbols. Generally each layer contains a particular thematic information. Sometimes separate text layers are also generated.

Before geographic data can be used in a GIS mode, the data must be converted into a suitable digital format. The process of converting data from paper map into computer files is called digitization or vectorization. In the present exercise, with the help of available drawing tools, different features have been digitized using MapInfo application software.

## 11.1 Learning Objective

This unit will help you to understand :

- How to digitize line symbol, polygon symbol and point symbol
- How to attach data is tabular format
- How to make overlay analysis
- How to prepare thematic maps incorporating Bar graph and pie graph
- How to prepare choropleth maps

## 11.2 To Digitize Line Symbol (for Example : River)

1. Open Puruliya.tab and River.tab.
2. Make sure that the River.tab is Editable at Layer Control window.
3. Zoom to a particular area to digitize.
4. Click on Polyline tool from Drawing toolbar.
5. Try to digitize River with Polyline tool.
6. Move the pointer to where you want to start the drawing and click the button once.
7. Move the pointer to next point, you want to draw. Click once.
8. After taking the entire node double click on the last end point.
9. Press "S" key from keyboard to enable snap.

10. Repeat the process until digitize all polylines.

In the same way digitize another layer Boundary to show State, District and Block boundaries.

Digitize another layer water body in polygon mode. (Steps to be followed to digitize in polygon mode would be discussed in next paragraph)

The end product is (*Figure 11.1*) titled DIGITIZED MAP OF PURULIYA DISTRICT SHOWING DRAINAGE NETWORK.

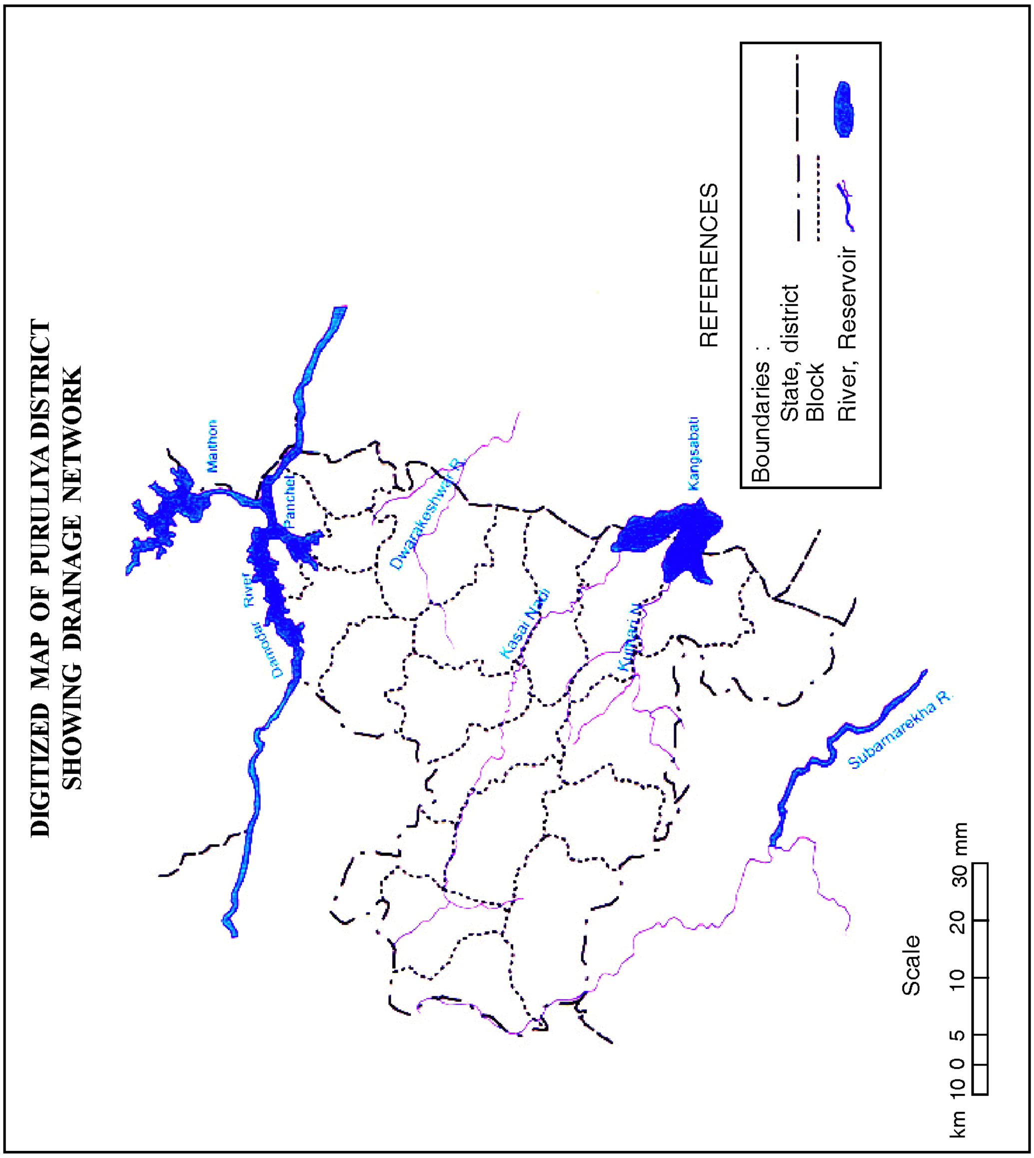



**Figure 11.1 : Digitized Map of Puruliya District Showing Drainage Network**

## 11.3 To Digitize Polygon Symbol (for Example : Forest)

1. Open Puruliya.tab and Forest.tab.
2. Make sure that the Forest.tab is Editable at Layer Control window.
3. Zoom to a particular area to digitize.
4. Click on Polylgon tool from Drawing toolbar.
5. Try to digitize forest areas with Polygon tool.
6. Move the pointer to where you want to start the drawing and click the button once.
7. Move the pointer to next point, you want to draw. Click once.
8. After taking the entire node double click on the last end point.
9. Press "S" key from keyboard to enable snap.
10. Repeat the process until digitize all polygons.

In the same way digitize another layer Arable land to show arable land areas.

Include River and Boundary layers which have already been digitized. Digitize Road and Rail layers in polyline mode. Include all these layers to get the output as (*Figure 11.2*) titled LAND USE MAP OF PURULIYA DISTRICT.

## 11.4 To Digitize Point Symbol (for example : District/Block Headquarters)

1. Open Puruliya.tab and Headquarters.tab.
2. Make sure that the Headquarters.tab is Editable at Layer Control window.
3. Zoom to a particular area to digitize.
4. Click on Symbol tool from Drawing toolbar.
5. Click on the map where you want to place the point symbol. The point symbol will appear at that location.
6. Repeat the process untill digitize all points.

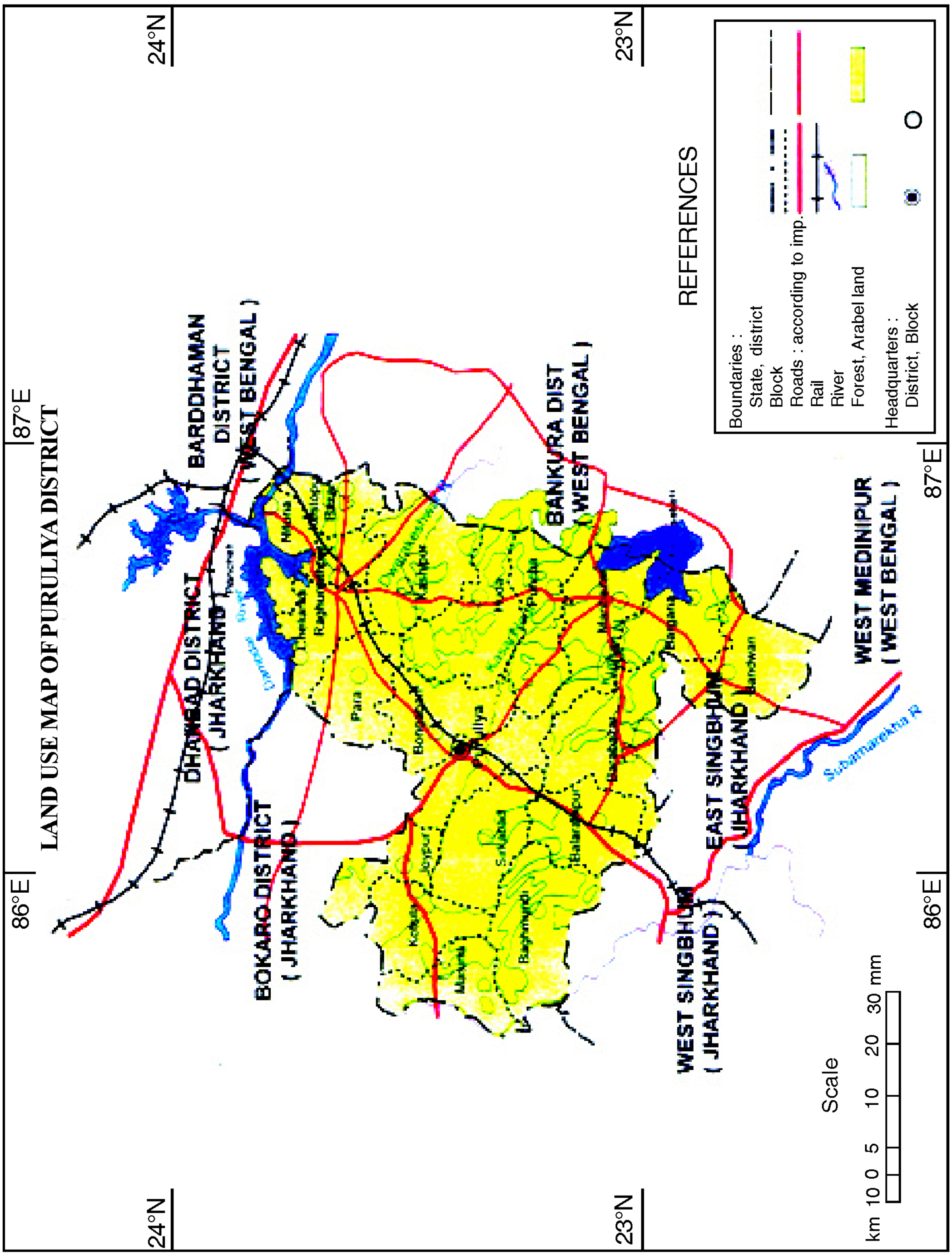



**Figure 11.2 : Land use Map of Puruliya District**

N.B. Use separate symbols for District and Block Headquarters. Include Boundary, Road, Rail and River and also Water body layers to get the output as (*Figure 11.3*) Titled DIGITIZED MAP OF PURULIYA DISTRICT SHOWING COMMUNICATION & HEADQUARTERS

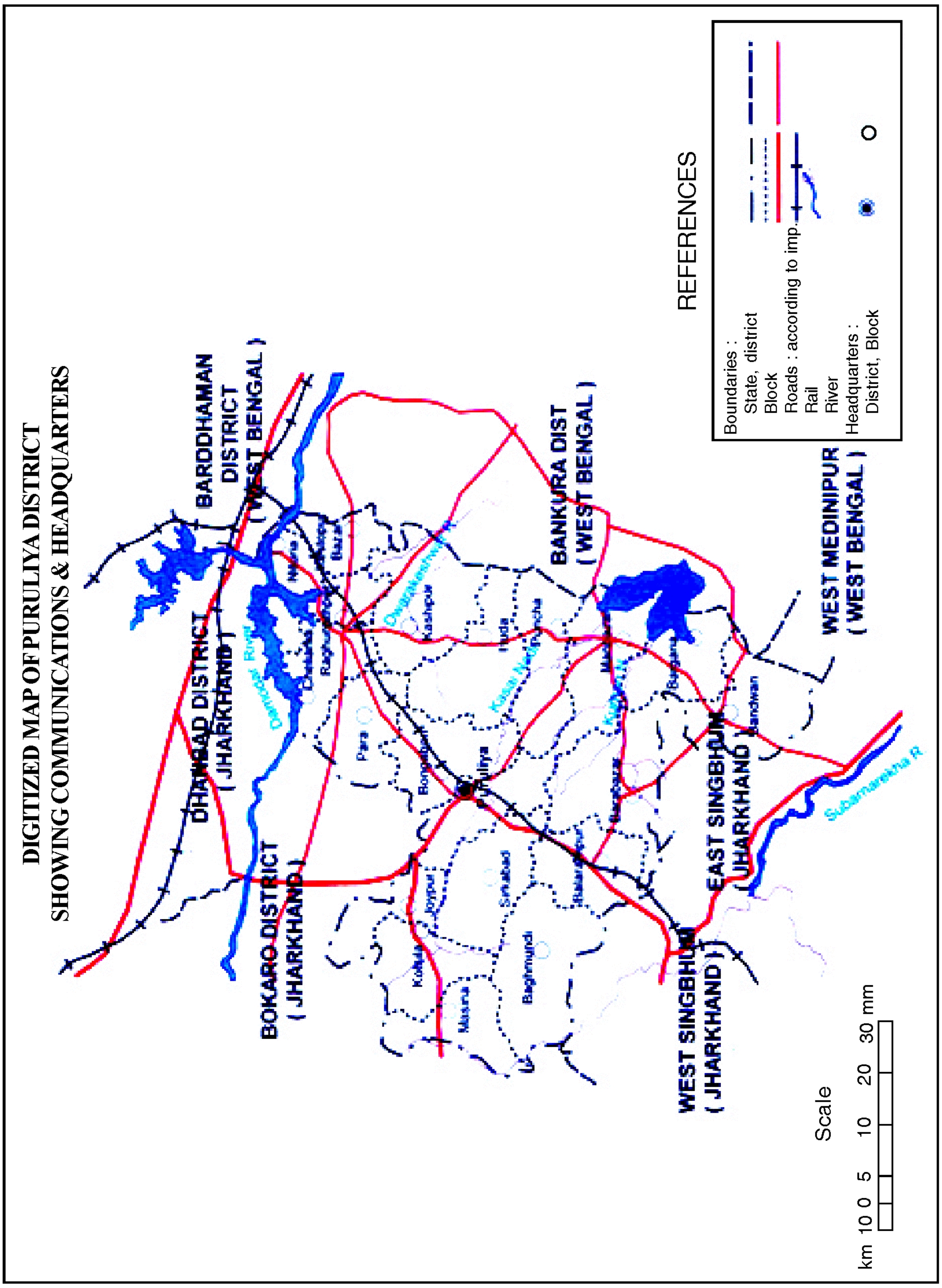



Figure. 11.3 : Digitized Map of Puruliya District Showing Communication and Head quarters

**To save as workspace**

File Save → Workspace (give a name, e.g. Puruliya_ws)

File name : Type → Puruliya_ws → Save

Thus you can save all the layers in a single workspace. As you open the particular workspace, all the layers would be opened in a single go.

## 11.5 Data Attachment

A map may contain spatial as well as non spatial or attribute data. In Geographic Information System, variety of attribute data may be attached to spatial data. For example in case of an agricultural plot, attribute information like owner of the plot, tax imposed there on, crops grown, whether the plot is irrigated or not, etc. may be attached. For that purpose appropriate number of fields are to be opened and necessary data are to be attached there in. In MapInfo, the following steps are to be followed for attachment of attribute information for creation of data base. It is related to district wise population data of Sikkim (*Figure. 11.4*) as presented in Table 11.1.

**Table 11.1 Sikkim : District wise Population, 2011**

| District | Total Population | Male | Female | Literate | Illiterate |
|---|---|---|---|---|---|
| East | 283583 | 151435 | 132151 | 214329 | 69254 |
| West | 136435 | 70238 | 66197 | 93432 | 43003 |
| South | 146850 | 76670 | 70180 | 106741 | 40109 |
| North | 43709 | 24730 | 18979 | 30450 | 13259 |

Open the raster image Sikkim in MapInfo. Georeference the map with available graticule value. Digitize all the four districts in polygon mode. Attach the data in terms of Total Population, Male, Female, Literate and Illiterate as per following instructions :

Table → Maintenance → Table Structure

View/Modify Table Structure → District → OK

Modify Table Structure → Field Information : Name : Type Character → Add

Field → Male → Integer → Add Field → Female → Integer → Add Field → Literate

→ Add → Field → Illiterate → OK

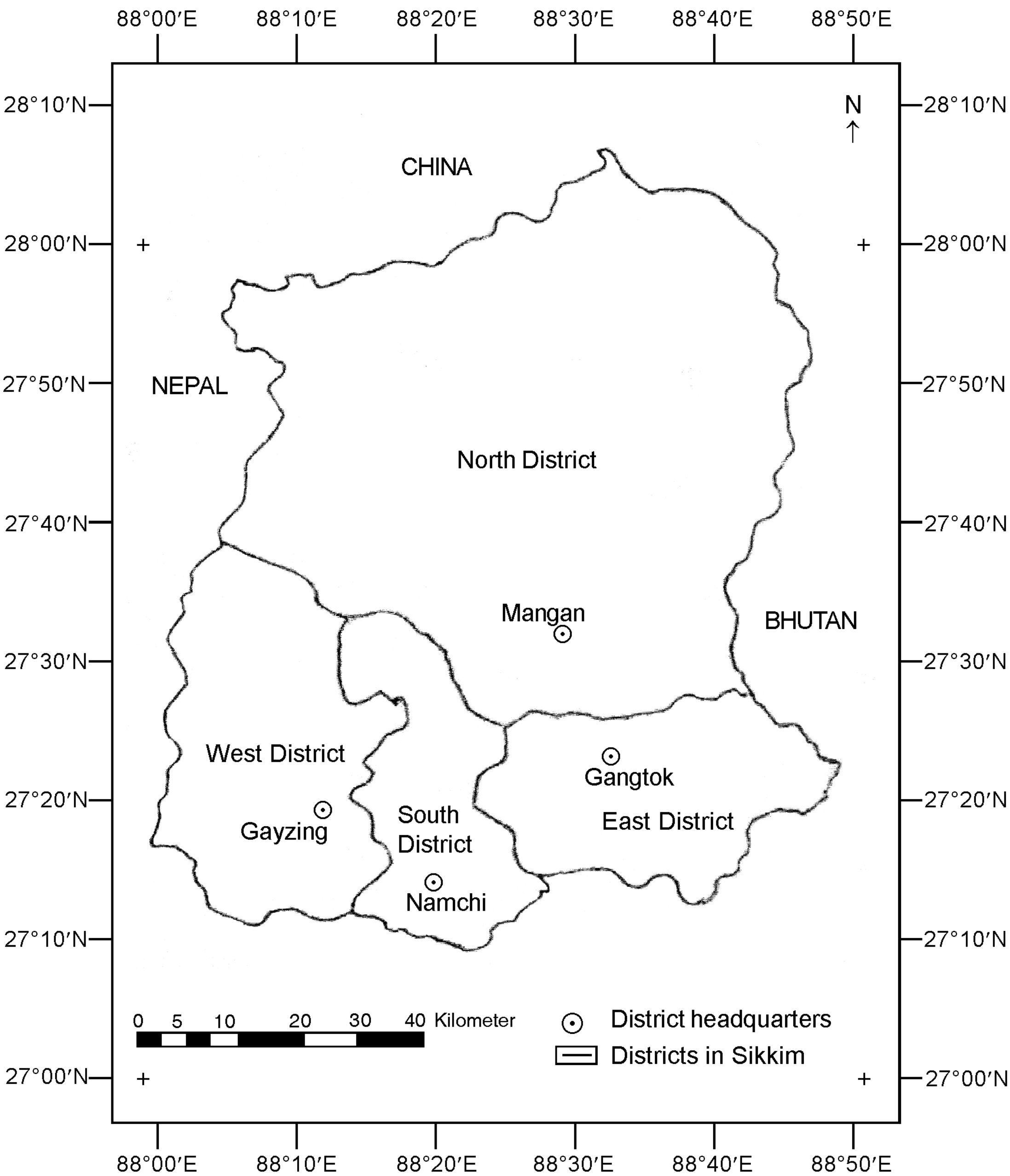



**Figure 11.4**

Thus the data in six fields would be available in the New Browser window. It is better to add another field 'id' for each polygon, so that you may view available data for each polygon in terms of the respectiveid.

## 11.6 Overlay Analysis

In Geometica, overlay analysis are of three types, Spatial, Statistical, and Suitability. However, following steps are to be followed to do the exercise of Spatial Overlay analysis in Geometica :

From the raster map of Puruliya, digitize three layers, viz. Purulia District, Road and River.

Open the Purulia.pix file in the viewer

Open Road and River vector layer from the file tree

Go to Analysis → Overlay → Spatial → Next

Select/ check Road and River vector layer

Next

Next

Select Union in the output field

Select Point from the drop down menu of output file type

Keep selected display

Finish

Task Bar comes

After completion of the process choose the appropriate symbol for block headquarters

Save the layer as Headquarters

## 11.7 Preparation of Thematic Map

Thematic map means a map that focuses on a specific theme or subject area. There a broad difference between topographical map and thematic map. In case of a topographical map, all topographical details like, contour line, spot height, drainage network, administrative boundaries, forest areas, landmarks like temple, church, mosque, market, ferry services, etc. are portrayed in a single map. On the other hand, in case of thematic map, a map is drawn concerning a particular theme or subject, for example administrative map, physiographic map, transport map, forest resource map, sex ratio map, literacy map, etc. In case of thematic map, to make comparative assessment of a particular theme, sometime the help of graphical representations in terms of pie, bar, etc. are also taken into consideration. However, different steps involved for drawing thematic maps in Mapinfo are given herein below. In this connection it may be noted that for preparation of Bar graph and Pie graph, the data is available in Table 11.1.

However, to draw thematic map, e.g. pie diagram or bar graph, the following commands are to be given:

### 11.7.1 Bar graph :

Open Sikkim.Tab

Go to Map → Create Thematic Map

Type → Bar Charts → Bar Chart Default → Next

Fields → Male → Add → Female → Next → OK

The output would be as per (*Figure 11.5*).

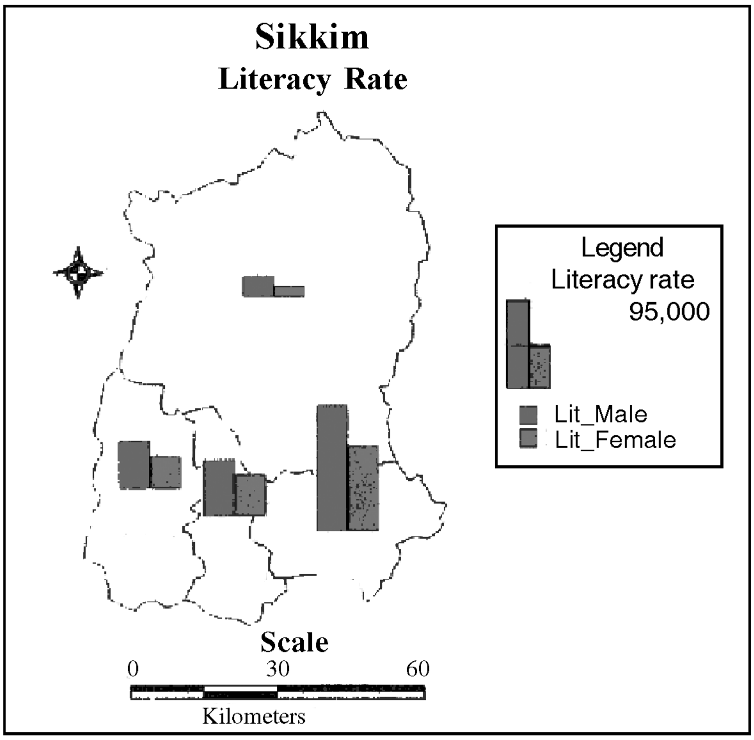



**Figure 11.5 Sikkim : Literacy rate (2011)**

### 11.7.2 Pie graph :

Open Sikkim.Tab

Go to Map → Create Thematic Map

Type → Pie Charts → Bar Chart Default → Next

Fields → Literate → Add → Illiterate → Next → OK

The output would be as per (*Figure 11.6*).

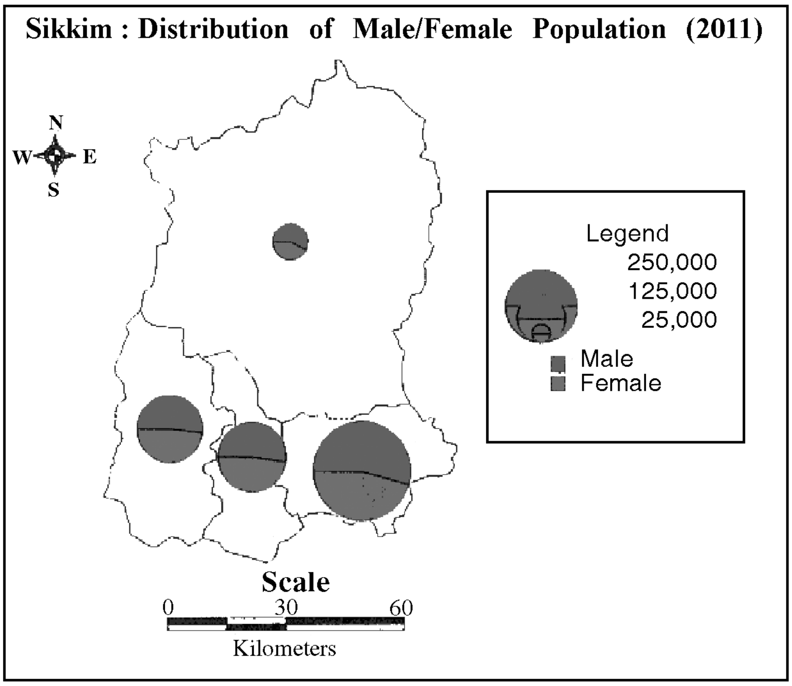



**Figure 11.6 Sikkim : Districtwise Distribution of Male/Famale Population (2011)**

### 11.7.3 Choropleth Map

Register map of Haora District (*Figure 11.7*) with available graticule value. Create a new Table "Block". Digitize all Blocks in polygon mode. Attach block wise area and population data as available in Table 11.2 Please note that to construct Density of Population Map, in addition to area and population data, one more column needs to be added in the table in terms of "Density". However to update column, the following instructions are to be followed :

Table → Update Column

Table to Update → Block

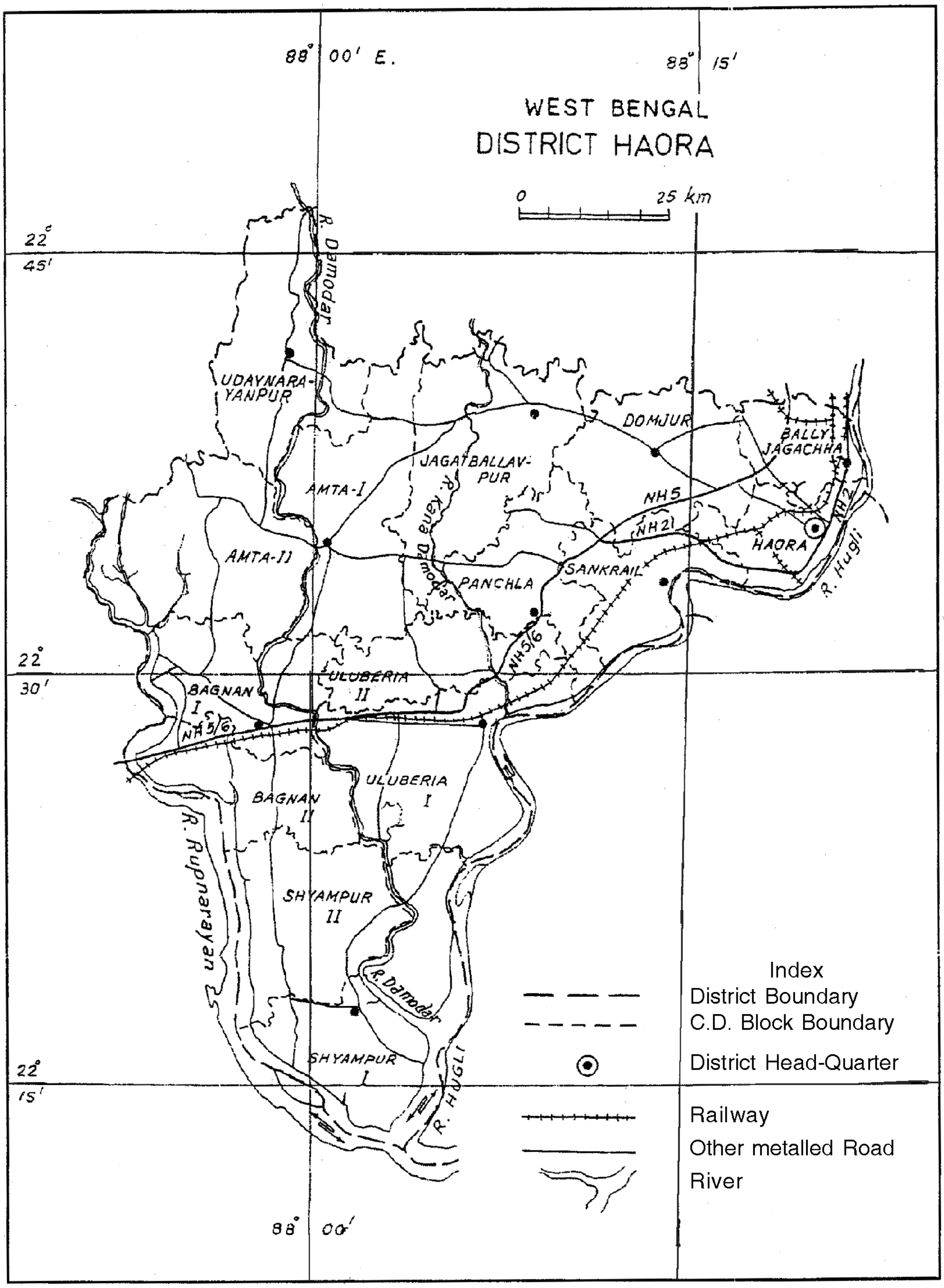

88° 00′ E.
88° 15′
WEST BENGAL
DISTRICT HAORA
0 25 km
22° 45′
22° 30′
22° 15′
88° 00′
R. Damodar
UDAYNARAYANPUR
AMTA-I
AMTA-II
JAGATBALLAVPUR
R. Kana Damodar
DOMJUR
BALLY JAGACHHA
NH5
NH2
NH21
HAORA
R. Hugli
SANKRAIL
PANCHLA
NH5/6
ULUBERIA II
BAGNAN I
ULUBERIA I
BAGNAN II
R. Rupnarayan
SHYAMPUR II
R. Damodar
SHYAMPUR I
R. HUGLI
Index
District Boundary
C.D. Block Boundary
District Head-Quarter
Railway
Other metalled Road
River

Figure 11.7

Column to Update → Density

Get Value from Table → Block

Assist → Columns → Population → Operators → / Functions → Area → OK

The system will calculate the density data which would be updated in Density column.

Now finally to construct the Density of Population Map, following steps are to be followed :

Open Haora.Tab

Go to Map → Create Thematic Map

Type → Ranges → Region Ranges, Solid, Red, Dark-Light

Next →

Create Thematic Map →

Table : Block

Field : Density

Next → OK

**Table 11.2 Haora District : Blockwise Density of Population, 2011**

| Block | Area (Sq km) | Population (2011) | Density (pop/sq.km) |
|---|---|---|---|
| Udaynarayanpur | 111.25 | 190186 | 1709.42 |
| Amta-II | 138.67 | 208132 | 1500.90 |
| Amta-I | 123.56 | 223218 | 1806.42 |
| Jagatballavpur | 128.25 | 257941 | 2011.20 |
| Domjur | 96.12 | 377588 | 3927.99 |
| Bally-Jagachha | 45.03 | 209504 | 4652.40 |
| Sankrail | 67.26 | 330828 | 4918.20 |
| Panchla | 78.88 | 251930 | 3193.57 |
| Uluberia-II | 67.03 | 191599 | 2855.43 |
| Uluberia-I | 140.43 | 215392 | 1533.79 |
| Bagnan-I | 87.27 | 221500 | 2537.94 |

| Block | Area (Sq km) | Population (2011) | Density (pop/sq.km) |
|---|---|---|---|
| Bagnan-II | 83.38 | 164405 | 1971.61 |
| Shyampur-I | 152.23 | 205849 | 1352.16 |
| Shyampur-II | 106.89 | 196164 | 1835.08 |
| Haora | 52.48 | 469328 | 8940.15 |

The end product would be a Choropleth map showing Density of population as appears in (*Figure : 11.8*).

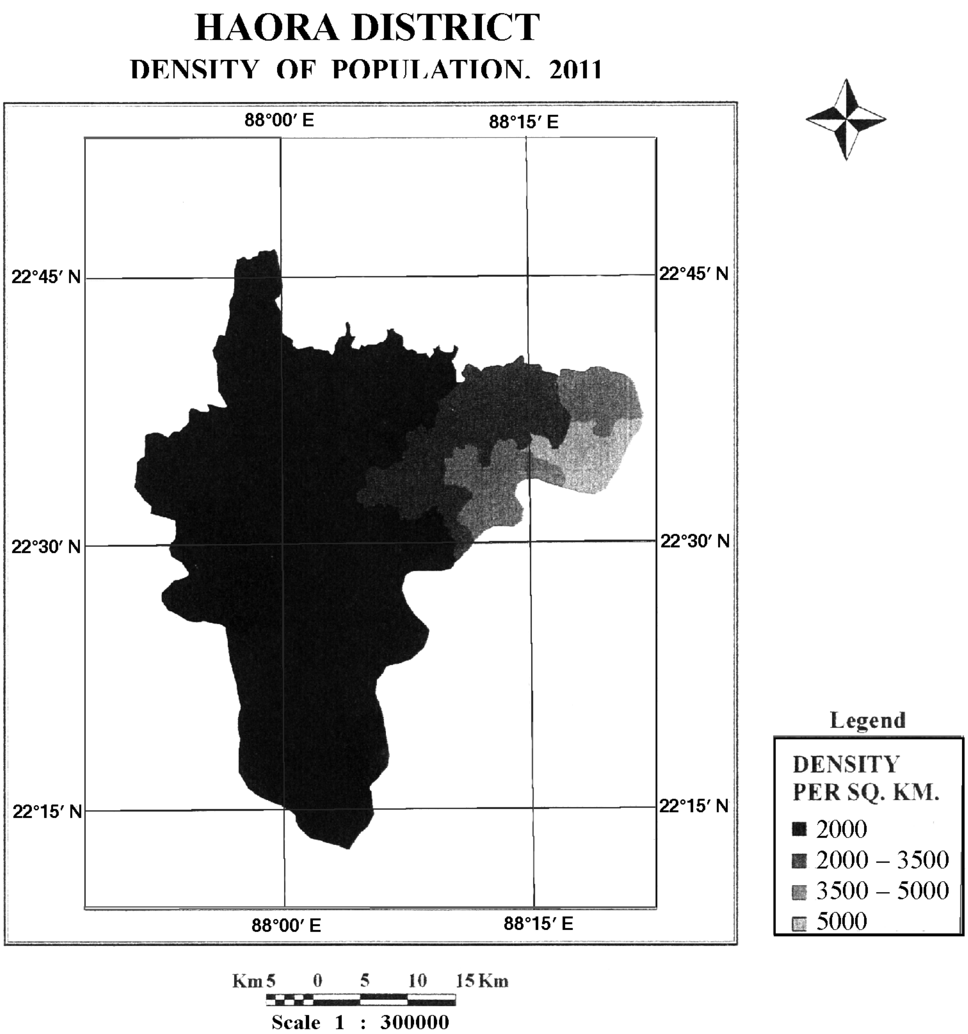



**Figure 11.8 : Haora District Density of Population (2011)**

## 11.8 Summary

In this unit students have been taught about digitization of different layers in GIS environment. It has also been taught regarding attachment of attribute data in tabular format from which thematic maps may be prepared.

## 11.9 Keywords

Digitization, data attachment, overlay analysis, thematic map

## 11.10 Model Questions

1. Digitize river, Road, railway line of Haora District with suitable line symbol. Digitize Block Head quarters of Haora District with suitable point symbol.
2. Digitize different blocks of Haora District and attach male, female and total population in specific table.
3. Prepare the following Thematic map / chart of Haora District:

   (a) Male and female population

   (b) Density of Population

## 11.11 References

1. PCI Geomatics : Geomatica 10 : Focus User Guide: Richmond Hill, Canada 2005
2. PCI Geomatics : Geomatica 10 : OrthoEngine User Guide: Richmond Hill, Canada 2005
3. Training Manual for MapInfo Professional

# Unit - 12 ❑ Collection and Plotting of way points by GPS

**Structures**



## 12.0 Introduction

It is to be noted that before starting collection of way points, one should make proper adjustment of the instrument. It is possible to configure the display unit as degree and minute and also degree, minute and second. The GPS receiver may also be configured to display ground position in Universal Transverse Mercator (UTM : Zone 45Q) projection and WGS-84 ellipsoid. It may be noted that UTM converts the latitude and longitude values into linear unit i.e. metres of northings and eastings, which helps length and area calculations as well as plotting of data.

## 12.1 Learning Objective

This unit will help you to understand :

- How to collect waypoints.
- How to plot waypoints.

## 12.2 Collection of waypoints

After switching the GPS unit on, the instrument takes a few minutes of time to get signals from the satellites. As soon as appropriate number satellite signals are available, way point collection should be initiated. Without switching the instrument off, the unit is to be moved from one point to the other. The information are to be stored in the instrument and also to be listed in the field book. (Table : 12.1)

**Table 12.1 : Field Book for GPS Survey in Barasat Area**

**Name of Surveyor ...... Place .......... Date ............... Instrument No ...........**

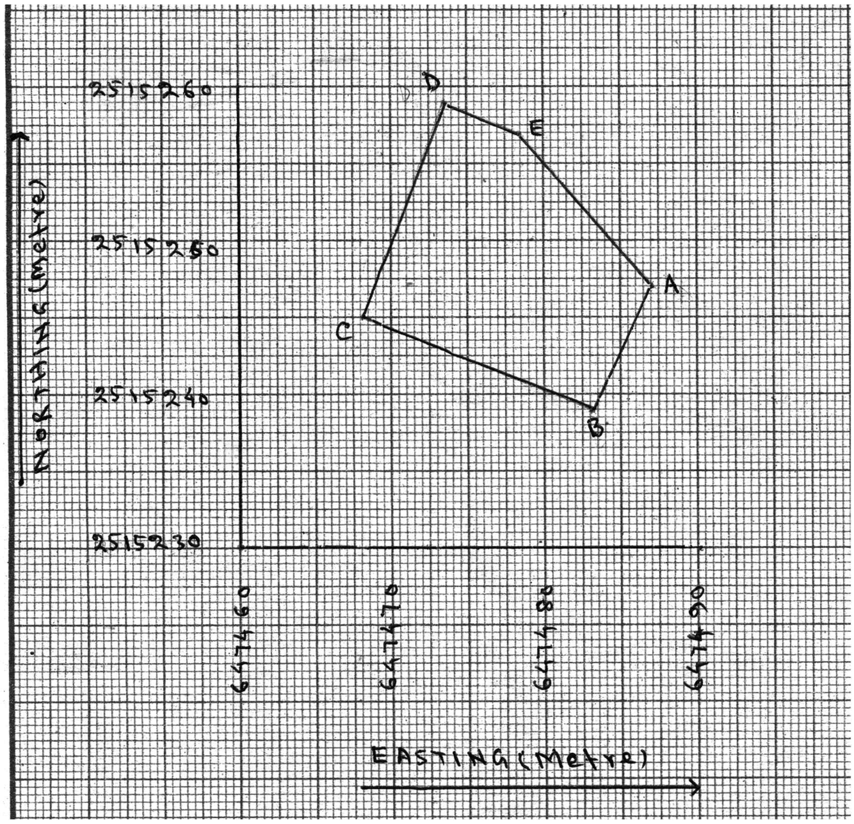
| Way Point | UTM Zone | Easting (m) | Northing (m) |
|---|---|---|---|
| W1 | 45Q | 647487 | 2515247 |
| W2 | | 647483 | 2515239 |
| W3 | | 647468 | 2515245 |
| W4 | | 647473 | 2515259 |
| W5 | | 647478 | 2515257 |

## 12.3 Poltting of waypoints

From the data collected with the help of GPS instrument and presented in the Field Book, plot the data on a plain paper or on a graph paper. Choose appropriate scale for that purpose. The x axis will represent Easting and y axis Northing. Make appropriate labeling and the end product would be as per (*Figure : 12.1*).

**GPS SURVEY AROUND A BUILDING**
**BARASAT AREA :** WGS - 84

**GPS SURVEY AROUND A BUILDING**
**BARASAT AREA :** WGS - 84




Instrument No.
16D502847
Date on. 01.01.2019

**Figure 12.1 : GPS survey around a Building**

## 12.4 Summary

In this unit it has been taught about collection of waypoints, preparation of field book and plotting of waypoints in a graph paper.

## 12.5 Keywords

UTM, WGS 84

## 12.6 Model Questions

1. Prepare a field book consisting of GPS data collected from a specific area.
2. Plot the data in a graph paper with appropriate labelling.

## 12.7 References

Sarkar, A. K., Study material : PG Geography : Paper-IX, Part-II, Module-18, GIS and Remote Sensing, Directorate of Distance Education, Rabindra Bharati University, Kolkata, 2014

# Module – 2

## Research Methodology
## &
## Field Work Laboratory

# Unit - 1 ❑ Field Study and Preparation of Field Study Report

**Structure**



## 1.0 Introduction about Field Survey Work

FIELD WORK is the most important part of the application of geographical knowledge to know the human activities within a defined space. As we all know that *'Geography is the study of earth surface as the space within which the human population live'* (Hagget, 1981), that's why 'Field Work' is the most perfect implementation of knowledge acquired by a geographer. A geographer must be a good observer. So, a good observation is the first law of success in 'Field Work'.

Field Work is a traditional means of data callection within geography, based on the assumption that reality is present in appearance and can therefore be directly apprehended through observation.

In quantitative (human) geography, fieldwork is largely about the implementation of sample questionnaire surveys of people's attributes, attitudes, actions, aspirations and motivations. Such surveys may be conducted in person or by post, and depend for success on a relatively high response rate from a random sample of households. This quantitative approach regards social data as analogous to the raw material of much of natural science: something which is discrete and stable and exists independently of the analyst, and which therefore yields findings which could be replicated and verified by others.

So, a good study gives a scope to share the experiences of the geographical research and even to discover a set of facts which is till unexplored and unexperienced. Once Greasley said field work is collecting information and a good field work is collecting information for a purpose. But there are many other motions about the philosophy of the field work. Field work is pre-occupied with the project of understanding and communication rather than with the goal of prediction and intervention.

**For the Geography Students :** They need to collect information for some identified reseasons for example to examine wheather an idea or hypothesis they have had is correct and to trace the answer it's a question they have asked as result of their observation and perception. They have to remember that all investigations are based on a spatio-temporal scale, so a detailed concern and involvement are necessary to achieve a good result.

## 1.1 Learning Objective

The study of a true 'FIELD STUDY' has changed considerably in recent years. A Good field study in the most original and significant examination for a geographer.

***After detail study of the module students shall be able to :***

- Understand the nature and distribution of human activity over the earth surface which remain the core of the geographic research.
- Understand the significance of primary and secondary observation to address a specific problem in a spatio-temporal context.
- Write a balanced and unbiased report with geographical language, content and justification.

## 1.2 Concept of Primary Data

Primary data is the most powerful part of a field survey. It is not only collected first hand but also collected by some sort of field work in order to investigate a hypothesis or to adderss many concerned geographical questions.

Remember primary data is firstly directly collected by students or teachers at the time of field work interviewing concerned people or addressing objects. But internet data or data contained in any books (geography or others) or data associated with Satellite Image, are not primary data. But all kind of the executives and administrative interviews or interactions (for example, Block Development Officer, Municipality Chairman, Panchayat Pradhan etc.) by students and teachers at the time of field work are very significant part of primary data, information, policy programme of your specific issue base or problem oriented field survey report.

### 1.2.1 Significance of Primary Data

It is 'the application of geographical knowledge and skills to the solution or resolution of problems within society'. In the present world of Remote Sensing and GIS, 'Ground Truthing' is the process of verifying that the information that we have derived from the remotely-sensed data actually agrees with what is happing. Reality check in the most important part of this internet and sattelite data age because machine does not measure many attributes properly or justifyingly. According to Dudly Stamp 'the relationship between man and his environment is discerned by survey in the field, and the gathering of facts systematically and objectively....'.

### 1.2.2 Questionnaire

An questionnaire conveys the purpose and objectivity of a 'Field Work'. It is an instrument used for the data collection segment of a survey analysis, comprising a carefully structured and ordered set of questions designed to obtain the needed information without either ambiguity or bias. Every respondent answers the same questions, asked in the same way and in the same sequence, which contrasts with the more open-ended formats used in INTERVIEW and other qualitative methods for obtaining information from individuals. The questionnaire may be administred by a trained person, preferably in a face to face meeting or if neccessary by other direct means like postal or social media.

Questionnaire are devised to obtain a variety of data. The simplest are the factual, ascertaining information such as age, place of birth, monthly income etc. Others are attitudinal, for which question are designed to probe people's values, attitudes and opinions. Such data may be obtained through open ended questions, with the free response recorded and later categorized, but more common are specially designed scaling instruments for measuring different types of attitude (personality, political ideology, etc.), some generally applicable but many are specific as a particular study, reflecting the local cultural situation and context.

So finally we must concentrate on the following three points :

(i) An questionnaire is prepared to follow the spatio-temporal scenario of the field work. For example, urban unit or rural unit or single urban enclave or a urban municipal ward or rural mouza etc. for spatial context and obviously the time phase. Both the scales should be definite by the object of the research.

(ii) An questionnaire must follows the present hypothesis of the researcher (student) but there must be some option to include alternative views.

(iii) The outcomes of an questionnaire's information are mostly represented by cartographic and statistical methods. So, a student always considers the compulsions of these techniques of the preparatory stage of an organized questionnaire.

### 1.2.3 Interviewing

Interviewing is a successful implementation an questionnaire which is very much important for an achievement in Field Work.

As a key means of data collection in household surveys, face to face interviewing forms a corner stone of the extensive cross—sectional, cohort and panel surveys that underpin large scale quantitative social science. The quality of the data can vary enormously from interviewer to interviewer, from study to study depending on the complexity and sensitivity of the questionnarire and on the character of target sample, from survey group to survey group, from place to place and from time to time. It is the most systematic task for a good student researcher.

There are various phases of interviewing. An individual interviews allow student researchers to study subjective meanings and motives alongside the more objectifiable attributes and aspirations that can be tapped by structured questionnaires.

The individual approach may also be appropriate where the subject of the research is highly sensitive or confidential. Wherever they are employed, qualitative interviews offer the subjects of the research much more scope to speak for themselves than do structured questionnaires. Secondly, group interviews take this commitment to the authenticity of everyday life and experience a step further, allowing participants not only to speak for themselves but also to begin to negotiate their own shared views.

So, far a interviewer, four questions are very much fundamental :

i. what

ii. how

iii. when

iv. where

These "problems" must be addressed in an interview wheather it is geographical or not. A researcher have to realise the fact that the interview is crucial beacause it is one of the most important part of *Primary 'Data-collection'*.

## 1.3 Concept of Secondary Data

Secondary data, by contrast, are collected by someone other than the user. General sources of secondary data for geography include censues, information acquired by governmental organizational records, internet sources, institutional documents and records that was originally processed for official or other research purposes.

It is commonly said that secondary data may already have been used in previous research or policy documentation making it easier to carry out further research analysis. Generally secondary data have an authentic level of validity and reliability because of repeated cross examination at public and semi-public platforms but this type of data may be out of time or bias or inaccurate. Also remember that there is a legal gap between published and unpublished administrative data. Students should aware about the data status before preparing references.

### 1.3.1 Sources of secondary data

Secondary data can be obtained from from government offices, like District Headquarters, Sub Divisional Offices, Block Development Offices, Municipalities, Panchayats, Agricultural departments, Irrigation departments, Tax records, Electoral statistics, Population enlistment (census) etc. Cencus is the most important source of secondary data. It is a procedure of systematically acquiring and recording information about the members of a given population. Internet searches is now the most common way to collect or access secondary data. The false statistics trap of Internet can be quiet damaging for the student's approach to a specific spatio temporal problem. Library, some how a better cosistent friend for data documentation.

### 1.3.2 A guideline for data collection

Data collection is the key word in a successful interpretation of the survey results. It is most important that the body of information collected is relevant and is capable of providing adequate evidence to the study. We already discussed two types of data collection-primary and secondary.

The primary data is obtained from the direct fieldwork through surveying or by a set of sampling sufficient to draw statistical inference according to the expected conclusion. This includes surveying of land, landuse, market, household, etc by questionnaires, photographs, field sketches, measurements and interviews, This is an integral part of field study.

The secondary data refers to those collected from secondary sources like maps, books, journals, Census handbooks, District Gazetteers, village directories, statistical obstracts, newspapers, television, radio etc. These information may not only be used as data for examination but also for comparison. But the specification of the Sources of the secondary data is compulsory at the time of representation.

A member of a survey team or a student have to realise the neccessity and importance of maximum collection and utilization of primary data for significant achievement in any survey result. Remember, honesty and hard working are the only two columns of success in the journey of data collection.

## 1.4 Hypothesis

Hypothesis is a proposition or postulate which is as yet unproven but which is tentatively accepted in order to test its accord with facts or relationships to be determined. A hypothesis specifies the direction and strength of the relationship between two or more variables and is amenable to empirical testing. The approach involves stating clearly the hypothesis that is to be tested. This hypothesis is known as the *null hypothesis* ($H_0$) and is expressed in such a form that there is no significant different between the variables being compared. This is thus the opposite of what the researcher would like to believe. An *alternative* or *research hypothesis* ($H_1$) is also set up which states that there is a significant difference between the values of the variables being compared.

## 1.5 Identification of spatial scale of an area

In Geography the concept of scale is closely related to the more accurate concept of areal extent. For example the term ***Spatial Scale*** is used for describing human activities or human living and suffering within its surrounding with approximation the extent or size of an area studied or described.

Remember in field work these divisions are somewhat arbitrary where macro refers to global scale, mesa refers to regional scale or micro refers to only local scale. Spatial identity is importal in our field work because of administrative boundary of the concerned area and associated secondary data applicable for statistical analysis. That's why the purpose of the study is now more problem oriented and the analysis and explanation of current problems (either physical or socio-economic) of concerned people have become much more important in geography.

### 1.5.1 Rural Area (Mouza)

Before the 20th century, the term 'mouza' referred to a revenue collection unit in a *pargana* or revenue district. During the Mughal period, the term was the geographical expression of a unit of landmass for revenue settlement and revenue collection, whereas, the village was a human settlement within a mouza with mostly equal social practices.

**Today it has become mostly synonymous with the village**. In India, however, several villages typically form a single mouza. Students should careful about that and they must verify the census information with the concern Panchayat at the time of field work.

### 1.5.2 Urban area (Municipal Ward)

In India a Municipal Ward is an administrative unit of a City/Town administration (Corporation or Municipality). It is a well defined local urban authority area, mainly used for electoral purposes. Word Councillor represents the people of the ward in local administration.

**Cadastral Map :** The International Federation of surveyors defines cadastre as follows : A cadastre is normally a parcel based, and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities). It is usually includes a geomatric description of land parcels linked to other records describing the nature of the interests, the ownership or control of those interests, and often the value of the percel and its improvements. The word forms the adjective cadastral (map) used in public administration, primarily for (map of) land ownership and area under tax.

### 1.5.3 Some consideration about spatio-temporal justification

- Avoid spatial overlapping : A field work must consider a single unit of mouza or municipal ward. Combined work is a kind of statistical or qualitative fallacy or misleading geographical orientation.

- Geographic perspectives is very important to delineate spatio-temporal context of a specific problem. Certainty of space or areal extent is very important for developing the idea of geographical perspective.
- Arm-chair geography was more about pre-scientific speculations and synthesis but field geography is more realistic (and humanistic) approach. Today, over dependency on internet data and computer manipulated mapping system can create nuinsance in spatio-temporal understanding of any geographical study.

## 1.6 Orientation of field base research report in Geography

Field report is considered a major component of the geo-spatial study and the task remains incomplete till the report has been presented. In any kind of research or field study all observations, calculations and findings are of little value unless they are effectively communicated to others. Field report is a kind of new knowledge domain.

There are some misconceptions and opinions that well oriented writing of report with photographic and cartographic representation is not very essential part of independent or group field base research work or study. Writing of well designed and proper structured report is the final step in a field study and requires a set of skills intense care. A student may seek the assistance and guidance of experts (teachers) for this purpose.

## 1.7 Significance of field study report publication

(Each students will prepare an individual report based on primary data collected from field survey and secondary data collected from different sources for either a rural area (mouza) or an urban area (municipal ward) based on cadastral or municipal maps to study specific problems.)

The significance of a field base research report is to communicate some important points to the teachers, examiners and experts like the methodology and the findings of the study. It is ultimately an understanding of the field process and confirmation of the validity as well as reality of the fundamental observations. ***Remember, a field report is a simple, readable and specific form of communication.***

Finally, a field report is a narrative as well as authoritative document on the outcome of field research effort; so a student himself or herself can reach his or her own conclusion with adequacy of the study and the validity of the fact-findings.

# Unit - 2 ❑ The duration of the field work

**Structure**



## 2.1 Field work planning and preparation

| | **Teachers** | **Students** |
|---|---|---|
| **Phase 1 : Pre-Field Work** | • Determine the proesses of fieldwork.<br>• Revise essential pre-requisite knowledge and skills.<br>• Follow all official requirements.<br>• Inform students and parents of purposes, costs, arrangements.<br>• Book site and transport.<br>• Visit site and plan activities. | • Be aware of the purposes of fieldwork (possibly contribute to their determination).<br>• Develop prerequisite knowledge and skills.<br>• Practice data collection techniques.<br>• Know group and personal responsibilities. |

| | Teachers | Students |
|---|---|---|
| | • Brief guest speakers.<br>• Complete risk analysis matrix.<br>• Compile a list of student names and emergency contact numbers. | • Be aware of arrangements and necessary materials and equipment.<br>• Understand safety requirements. |
| **Phase 2 : Field Work** | • General supervision.<br>• Provide assistance when required.<br>• Encourage students to be analytical by raising questions such as 'Why?' 'How?'. | • Make direct observations e.g. identifying, describing, constructing, measuring etc.<br>• Collect and record data.<br>• Use specific field techniques e.g. sketching, mapping, drawing a transect etc.<br>• Make initial analysis and interpretations.<br>• Be aware of their own and other people's perceptions. |
| **Phase 3 : Post-Field Work** | • Provide additional information as required.<br>• Direct students to other resources to confirm their findings.<br>• Evaluate the complete experience—including organisation and learning outcomes. | • Organising information collected.<br>• Check findings with others.<br>• Test hypotheses.<br>• Make generalisations.<br>• Discuss puzzling issues with others.<br>• Research unanswered questions.<br>• Prepare reports and presentations. |

Source : Adapted from Laws, K. (1989) Learning geography through fieldwork, in Fien, J., Gerber, R. and Wilson, P. (eds) *The Geography Teacher's Guide to the Classroom*, 2nd edition, Macmillan, Melbourne, p. 107

**Three Phases of Planning and preparation of Field Work**

### 2.1.1 Reconnaissance survey

This is the first step of field work on field. It is a kind of preliminary survey at the first day on field with all the students and teacher members to explore the site or rural mouza or urban area conditions observe land uses, human activities and availability of infrastructure in general. The results of reconnaissance survey is used to develop the plan of field work, which is helpful to identify physical and cultural resources.

> ''Reconnaissance is a mission to obtain information by visual observation or other detection methods, about the activities and resources of an enemy or potential enemy, or about the meteorologic, hydrographic, or geographic characteristics of a particular area.''—Reconnaissance (US Army FM 7-92; Chap. 4)

### 2.1.2 Mental Map of study area

Mental maps are an outcome of the field of behavioural geography. The imagined maps are considered one of the first studies that intersected geographical settings with human action. For instance, a person might be perceive a rural mouza to be nearly the size of a town, merely based on the amount of news information coverage that he or she is exposed to area on a regular basis. In field work, a mental map is a student's or teacher's point-of-view perception of their area of study or research.

## 2.2 Methodology

This is the second important task in any field work after selection of the objective and area. There are processes and steps by which a science (Geography) obtains knowledge. These normally include the identification of a problem; the formulation of a hypothesis to test; the collection of relevant data, their preparation and analysis against the hypothesis; and the interpretation of the results, i.e., the formulation of a conclusion with respect to the validity of the hypothesis. Results may form the basis for some generalization, and sufficient repetitions of the same patterns or tendencies may lead to the formulation of laws scientific method subsumes two main approaches : ***deduction and induction.***

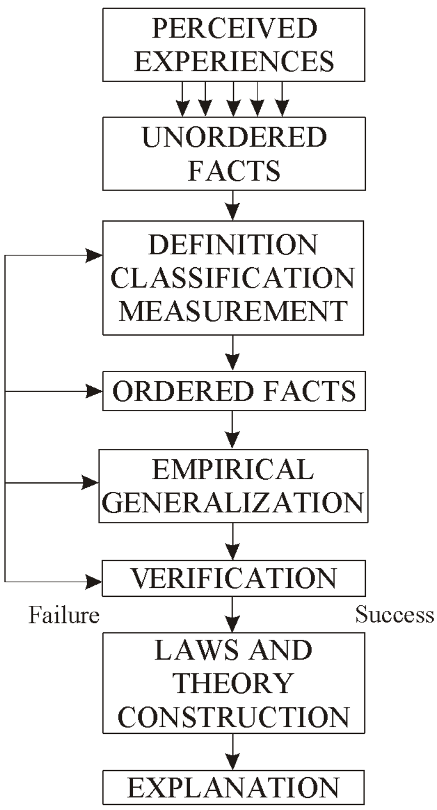
### Induct ion

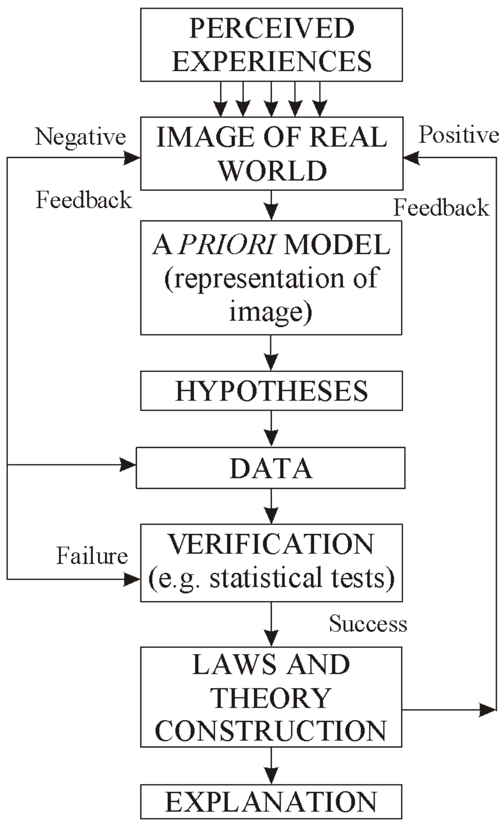
It is a method of reasoning from the part to the whole, i.e. from particular cases to general conclusions. Induction provides a method by which truths of scientific value are inferred but which are not directly deducible from principles already known. Inductive method begins by observing and recording specific cases and proceeds, via the ordering and classification of data, to reveal regularities which, being based on a large number of cases, have the status of *laws*, so allowing the construction of theory : **Fig. provides a summary of the inductive method.**

### Deduction

It is a method of reasoning from principles to facts, i.e. from the general to the particular. Deductive method begins by investigating the principal forces determining a given class of phenomenon and, via logical reasoning, demonstrates that from certain of the premises and propositions all other propositions must follow—it produces general *laws* and *theories* in accordance with with such penomena operate.

**Fig. provides a simple summary of the deductive method.**




**Source :** The Penguin dictionary of Human Geography; Book by Brian Goodall.

## 2.3 Design of Field work Report

A field survey must be presented in the form of a written report. This is a fundamental part of the field survey process. The general structure of a field report should consist of 3 main divisions

(A) Introductory Section

(B) Contributory Section

(C) Reference Section

(A) The Introductory Section should consist of the following :

- Title Page

(i) Acknowledgement

(ii) Approval certificate of the concerned teachers /department.

(iii) Contents

(iv) List of tables

(v) List of figures and diagrams

(B) The Contributory Section of the Report should consist of the following :

(1) Introduction

(a) Scope of the study

(b) Significance of the problem

(c) Area of the study/Location

(d) Assumptions and Limitations

(2) Review of related literatures (analysis of published documents, internet sources etc.)

(3) Design of the field study :

(a) Target population and Sample

(b) Sources of primary and secondary data

(c) Methods of data collection

(4) Presentation and Application of data

(a) Text formation and interviews

(b) Data tables

(c) Figures and Diagrams

(5) Summary and Conclusions :

(a) Brief statement of the problem and practice perceived by students

(b) Findings and recommendations

(c) Conclusions.

(C) Reference Section:

(1) Bibliography

(2) Appendix

---

**NOTE : COVER PAGE OF REPORT WITH INDIVIDUAL DESIGN AND HOLISTIC APPROACH**

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Each section of the field report should be as follows :

**(A) Introductory Section**

(i) Title page—*The first page of the field report should include :*

(a) Title of the research (written at the top of the page in block letters).

(b) Degree for which the report is presented.

(c) Name of the Institute / University and year.

(i) Acknowledgement page—The student acknowledges the teacher/s and assistance received in the development of the field study.

(ii) Approval certificate of the teacher supervisor/department along with signature.

(a) Contents — It should include the chapter headings and corresponding page number.

(b) List of tables and List of figures — The full title of tables and figures has to be are presented here.

(B) **Contributory Section** — The Contributory section of the field report should provide a complete outline along with all fact-findings.

1. Introduction : The purpose of introduction is to introduce the entire field report to the academic experts and examiners.

(a) Scope of the study—A statement and appraisal of the problem are needed to provide a clarity in the study.

(b) Significance of the problem—Justifying background is given to make clear to the examiner or academic experts.

(c) Area of the study-Clear statement of the area of the field study is need to provid here. Geographical details of the study area should defined properly.

(d) Assumptions and limitations—Assumptions behind the field study are to be clearly stated. All limitations are to be mentioned by students.

2. Review of related literatures : A brief summary of relevant published researches are to be stated in brief so that the present study can be viewed in that context. Internet sources and other media details are also indicated properly.

3. Design of the field study : This includes target population and sample, sources of all kind of data, research mechanism and methods of data collection. It gives an accurate and detailed description of the execution of the field report.

4. Presentation and Application of data : This forms the mother structure of the field report which consists texual discussion, interviews, tabular and grapic analysis of the data. The different statistical procedures of data analysis are frequencies, percentages and proportions. The data can also be graphically represented through bar, blocks, line charts and pie-diagrams.

5. Summary and Conclusions : Generally after a brief statement of the problem and a description of the procedures used in the field survey, the findings and conclusions are drawn. Major findings of the study, fundamental recommendations, conclusions with future orientation arrived at generalisations formulated are presented here.

(c) **Reference Section :** The bibliography and appendix are provided here :

(i) Bibliography : References of books, periodicals, reports, bulletins, etc arranged in an alphabetical order in bibliography.

The last name of the author is written first, followed by title of the book, name and place of publication, date of publication and finally concerned pages mentioned systematically. Internet sources are also mentioned in detail.

(ii) Appendix : Relevant supporting materials are presented here sequentially.

Finally the hand written Field Report in English must be checked for factual errors and grammatical mistakes. It should be on A4 size paper in students own words (within 5000 to 8000 words) excluding figures, diagrams, photographs, maps and references.

### 2.3.1 Field Report Organization : Rural Unit

**REPORT TITLE**

- Acknowledgement
- Content
- List of Maps and Diagrams
- List of Tables
- List of Pencil Sketches (if any)
- List of Photographs

(A) The Introductory Section
  Introduction
  Scope of Study
  Location
  Objectives
  Crieteria for the selection of the Area.
  Historical Background

(B) Methodology

(C) The Physical Geography of the study area
    General Physiography, (including Toposheet scenario) and Geomorphology
    Geology
    Hydrology
    Climate
    Soil and Natural Vegetation

(D) The Economic Geography of the study area
    Agriculture
    Occupational Structure
    Economic activities and its impact (including Banking Economy)

(E) The Human Geography of the study area
    Education
    Look on Society and Population
    Perception and Satisfaction Level - A sample study
    Cultural Practices
    Medical Facilities
    Settlement Patterns
    Communication
    Transport

(F) The Outcomes Section

Difficulties Faced at the time of investigation
Finding and recommendations
Conclusions

Bibliography

Appendix

### 2.3.2 Field Report Organization : Urban Unit

**REPORT TITLE**

- Acknowledgement
- Content
- List of Maps and Diagrams
- List of Tables
- List of Pencil Sketches (if any)
- List of Photographs

- Introduction
- Scope of the Study
- Location
- Objectives : Crieteria for the selection of the area
- Historical Background
- Methodology
- Mayor's / Chairman's Interview* (if any)
- The Municipality Area/Ward : At A Glance in Statistical Records
- Physiography and Sculpturing of the Town/City
- Climatological Scenario and Pollution Status of the Municipality/Town
- Underground Geology and Water Availability in the study area
- The Society—Influence of Migration
- Scope of economy and trace the suffering of Urban people
- Health factors and Services
- The Mosaic of Education and Culture
- Crime and Politics of the Society

- Urbanization Pattern and Settlement types
- Role of Transport and Communication in Urbanised Living
- Difficulties of Investigation
- Impact of Investigation : Future Planning of the Study Area
- The Conclusion
- Bibliogrpahy
- Appendix

## 2.4 Preparation of model questionnaire for primary survey

### 2.4.1 Sample questionnaire for Socio-economic Survey in Rural Unit

**HOUSEHOLD SURVEY**

1. Nane of the Head of the family :
2. No. of family members :

   ________________ Male ________________ Female

2.(a) Type of family ________________________________ (Joint/Individual)

3. Age of the family members :

| Male | Female |
|---|---|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |

3. (a) Language __________ (b) Religion __________ (c) Caste __________
4. No. of literates __________ Male __________ Female __________
5. No. of illiterates __________ Male __________ Female __________

6. Level of education :

   (a) Upto Class V (Primary),

   Male ____________ Female ____________

   (b) V – X,

   Male ____________ Female ____________

   (c) Secondary,

   Male ____________ Female ____________

   (d) Higher Secondary,

   Male ____________ Female ____________

   (e) Graduate,

   Male ____________ Female ____________

   (f) Post Graduate.

   Male ____________ Female ____________

   (g) Technical ________________________ (Mention the type)

   Male ____________ Female ____________

7. No. of workers ____________ Male ____________ Female __________

   No. of non-workers __________ Male ____________ Female __________

8. Type of economic activities :

   Male ____________ Female ____________

   Cultivators -

   Agricultural labour -

   Factory workers -

   Service -

   Business -

   Transport -

   Household industries -

   Others -

9. Monthly income :

   Less than Rs. 1000

   1000-5000

   5000-10000

   10000-15000

15000-20000

Greater than 20000

10. Type and amount of monthly expenditure :

Food -

Clothing -

Rent -

Transport -

Education -

Medical -

Others -

Savings (if any) -

Agriculture :

11. Size of farm :
12. Type of cultivator - Share Cropper/Barga/Marginal/Medium Cultivator/Big Cultivator.
13. (a) No. of agricultural labour employed-

    (b) When are they employed-
14. (a) Nature of farm - Mono crop/Double crops.

    (b) Irrigated area - Type of irrigation -
15. Type of crops' cultivated -

    Paddy/Wheat/Other food crops/Mustard/Other Oilseeds/Vagetables/Flowers.
16. Amount of crops cultivated/sold -

| | Amon | Aus | Boro |
|---|---|---|---|
| Paddy - | | | |
| Wheat - | | | |
| Other food crops - | | | |
| Mustard - | | | |
| Other oilseeds - | | | |
| Vagetables - | | | |
| Flowers - | | | |

17. Per unit price of the crop sold :

    Paddy - Wheat -

    Other Oilseeds - Mustard -

    Flowers - Vegetables -

18. No. of Domestic (farm) animals :

    Cow - Buffalo -

    Ducks and Geese - Fowl -

19. Amount of milk/eggs etc. obtained from the animals :

    Milk Cow Buffalo Goat

    Eggs Hen Geese

20. (a) Market price of the said commodity :

    Milk - Eggs -

    (b) Amount sold -

21. No. of rooms -

    Type of House - Kachha/Pakka No. of stores -

    Materials to use for making the House : Wall - Roof -

22. No. of Family members living outside the village -

23. Name of School/College where the children receive education -

    Distance from the house -

24. Name of nearest Market -

    Distance from the house -

25. Name of nearest Hospital/Health Centre with distance -

26. Problems -

27. Suggestions -

Place Signature of the Surveyor with Date

### 2.4.2 A Sample questionnaire (in TABLE format) for a Socio-economic Survey in URBAN UNIT

**HOUSEHOLD SURVEY**

| Name and address | No of family member (>60 age) | No. of Family Member | | | Literacy | | | | | | | | | | | | No. of school going children/ future dream of mother |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Male | | | | | | Female | | | | | | |
| | | | | | Level | | | Age | | | Level | | | Age | | | |
| | | Male | Female | Total | ClassX | H. S. | Gra/Tech | <20 | 20-45 | >45 | ClassX | H. S. | Gra/Tech | <20 | 20-45 | >45 | |
| | | | | | | | | | | | | | | | | | |

| Name and address | Occupation | | | | | | | | | | | | | | | Monthly income/ expenditure | House Type | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Working Member | | | Male | | | | | | Female | | | | | | | | | | |
| | | | | Level | | | Age | | | Level | | | Age | | | | | | | |
| | Male | Female | Total | Govt. Empl. | Pvt. Empl. | Others | <20 | 20-45 | >45 | Govt. Empl. | Pvt. Empl. | Others | <20 | 20-45 | >45 | | Own/Rental | Roof material | Wall material | No. of Floors |
| | | | | | | | | | | | | | | | | | | | | |

| Name and address | Entertainment Medium | | | Family Tranport | | | Medical | | | Religiou customs & caste cultures | Native /Migrating place | Problems facing in daily life |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T.V | Mobile | Other | Bicycle | Other Two-Wheeler | Car/others | Govt. facility | Pvt. facility | Others | | | |
| | | | | | | | | | | | | |

Place

Signature of the Surveyor
with Date

## 2.4.3 HOUSEHOLD QUESTIONNAIRE SURVEY

**(For B.Sc./M.Sc. Students Department of Geography, NSOU)**

1. Name of Place (Village/Town) :

   Address (P.O./P.S./Block etc.) :

2. Name of Respondent :

   Religion/Caste/Sub-Caste :

   Age :

   Sex : Maritas Status :

   No. of Family Members : Male : Female :

| Age | Education | Occupation | Income | Language |
|---|---|---|---|---|
| | | | | |

3. Age Group :

   Below 5 years ☐ 5-20 Years ☐ 20-30 Years ☐

   30-50 Years ☐ 50-65 Years ☐ Above 65 Years ☐

4. Language Spoken :

   Bengali ☐ Hindi ☐ English ☐ Other ☐ ________

5. Educational Status :

| Type | School Going Children | Person Educated Upto Class 12 | Graduate | Post Graduate | Other Degree |
|---|---|---|---|---|---|
| Male | | | | | |
| Female | | | | | |

6. Occupational Status of Family Members :

| | | |
|---|---|---|
| I. | Service | |
| II. | Business | |
| III. | Transport–Communication | |
| IV. | Others (Mention) | |

7. Monthly Income (Family) :

   a. < 5000 ☐ b. 5000-10000 ☐ c. 10000-15000 ☐ d. 15000-20000 ☐ e. >20000 ☐

8. Are They Migrant? Yes ☐ No ☐

9. If Yes -

   (a) Place of Origin

   (b) Do They Visit Place of Origin? Yes ☐ No ☐

   (c) If Yes : Visit Number : a. Per 5 Years ☐ b. Per Year ☐ c. Per month ☐

10. Type of Migration Permanent ☐ Temporary ☐ Seasonal ☐

11. If Parmanent, Period of Migration :

    a. < 5 Years ☐ I. Self ☐ Years :

    b. 5-10 Years ☐ II. Father ☐ Years :

    c. > 10 Years ☐ III. Grand Father ☐ Years :

12. Type of Migration :

    Forced ☐ Semi-Voluntary ☐ Voluntary ☐

13. Housing : Ownership ☐ Rented ☐

14. Type of Houses :

    More Then One Storied ☐ Single Storied ☐ Flat ☐

    Bunglow ☐ Area ______________________________.

15. If any Open Space in the House ______________________________.

16. If Yes. Veranda ☐ Garden ☐ Frontal Open Space ☐

17. Source of Drinking Water :

    Tap Water ☐ Tube Well ☐ Well ☐ Other ☐

18. Tap Water Supplied By Municipality ☐ Other ______________.

19. Water Quality : With Iron ☐ Chlorinated ☐ Normal ☐

20. Water Used as : Filtered ☐ Filtered ☐

21. Water Storage Facility : Yes ☐ No ☐

22. Water Tax : Yes ☐ No ☐

23. Drainage System Underground Sewerage ☐ Open Drain ☐

24. Mode of Garbage Disposal :

I. Do you dump Garbage Anywhere : Yes ☐ No ☐

II. It is collected by Municipality/Panchayet Staff Yes ☐ No ☐

III. It is collected– From Individual Household ☐ From Dumping Ground ☐

IV. It is Collected Regularly : Yes ☐ No ☐

V. Do you use Poly Pack Yes ☐ No ☐

25. Type of Diseases faced in last five years :

A. General Disease : ______________________________

B. Water Borne : Stomach Related Problem ☐ Hepatities ☐ Skin Disease ☐

C. Disease due to air Pollution : Asthma ☐ Other Problems ___________

26. A. Nearest Hospital/Health Centre Name : ____________________

Distance : ____________________

B. Nearest Market : Name : ____________ Distance : __________

C. Nearest Educational Institute :

| | Primary School | Secondary School | High Secondary School | College |
|---|---|---|---|---|
| Name | | | | |
| Distance | | | | |

27. Mode of Transport : Bus ☐ Auto ☐ Bicycle ☐ Motor Bike ☐

28. Green Coverage in locality if Any : Yes ☐ No ☐

29. Family Expenditure :

| Item | Weekly | Monthly | Item | Weekly | Monthly |
|---|---|---|---|---|---|
| Food | | | Clothing | | |
| Education | | | Transport | | |
| Festival | | | Recreation | | |
| Social Programmes | | | Medical Expenses | | |

30. Savings : Yes ☐ No ☐

31. Ever taken Loan from Bank Yes ☐ No ☐

(If yes) Amount :

32. Any Mediclaim/LIC : Yes ☐ No ☐

33. Civic Amenities :

| Type | Number | Distance | Type | Number | Distance |
|---|---|---|---|---|---|
| Post Office | | | Grocery Shop | | |
| Bank | | | Police Station | | |
| Pharmacy | | | Bus Stop | | |
| Railway Station | | | School | | |
| Market | | | Hospital | | |

34. Role of Administration:
Excellent ☐ Satisfactory ☐ Needs Improvement ☐ Poor ☐

35. State of Crime : Frequent ☐ Moderate ☐ Rare ☐

36. Cable Connection : Yes ☐ No ☐ If Yes, Amount :

37. Cooking Provision : LPG ☐ Cooking Coal ☐ Fire Wood ☐

38. Problem Water ☐ Open Space ☐ Drainage ☐ Medical ☐ V. Pollution ☐

39. Tele-Communication Land Line ☐ Mobile Phone ☐ Internet ☐

40. Assets : Car ☐ Cycle ☐ Motorcycle ☐ Color TV ☐ Air Cooler ☐ Air Condition ☐ Refrigerators ☐ Computer ☐ Internet ☐ Microwave ☐ Inverter ☐ Other (if any)_____

41. Degree of Satisfaction :

| Concerns | Excellent | Satisfactory | Needs Improvement | Poor |
|---|---|---|---|---|
| Safety & Security | | | | |
| Congestion | | | | |
| Noise Pollution | | | | |
| Open Tracts | | | | |
| Air Quality | | | | |

42. Recommendations if Any :

Place

Signature of the Surveyor
with Date

### 2.4.4 Demographic, Socio-economic Questionnaire Survey

**NETAJI SUBHAS OPEN UNIVERSITY**
**DEPARTMENT OF GEOGRAPHY**

**HOUSEHOLD SURVEY SCHEDULE FOR FIELD WORK**
**(STUDY AREA : Example : GANGTOK, SIKKIM)**
**DATE**
**Special Paper/Subject Name**

**A. IDENTIFICATION :**

1. Name of the Head of Household : ______________________ Sex ______
   S/D/W of ______________________ Religion _________ Caste/tribe ______
2. District ___________ Village _____________ Sub division ___________.
3. Language Known _____________ Voter I.D. and Ration Card __________
   Place of Birth ___________________.

**B. DEMOGRAPHIC STRUCTURE :**

| Sl. No. | Name | Relation with | Sex/ Age | Mar ital | Edn. | Occupation | | Periodicity | | Work Place | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | M | S | M | S | | |
| | | | | | | | | | | | |

**NB. : M–Main, S–Subsidiary, Periodicty–Periodicty of work**
**Specify No of days in the cropping season ________________**

**C. ECONOMIC STATUS :**

1. How much land do you own? Cultivated __________ House area _______
2. Specify the type and nature of land ________________________________________________
3. How many crops do you cultivate? _______________________ (Name crops) ________________________________________________________
4. Which crop do you cultivate most? (Please specify cropped area) _____________________________________
5. Do you have surplus production? (Specify the quantity) _______________
6. Do you have any savings? _______________________________________
7. What is you total earnings? ______________________________________
8. Do you have Bank/Post Office Account? Yes/No ____________

**D. SOCIAL STATUS :**

1. Can you read or write your name? _________________________________
2. Have you gone to school or you learn at home? _______________________
3. Was your father literate? If yes specify the level of education ___________ ______________________________________________________________
4. Was your mother literate? Yes / No
5. Are you sending your children to school willingly or under compulsion? ______________________________________________________________
6. Do you differentiate between male and female child as far as education is concerned? Yes / No __________________________________________
7. What is the age or marriage for boy and girl? ______________________________________________________________
8. What is the age difference between male and female at the time of marriage? ______________________________________________________________
9. Is there any occupation difference between male and female? ______________________________________________________________

10. Who take decisions in family affairs? (mother/father, father, husband alone, husband wife together or collectively) ____________________
11. Ancestral/Father's property (landed) is distributed equally among sons/sons and daughter together? ____________________
12. Is there practice of widow marriage? Yes / No ____________________
13. Is there any legal provision in your society for divorce/separation and re- marriage after divorce and separation? ____________________
14. Do you have any preference for male child or not? ____________________
15. Do you have dowry system in you society?

____________________

**E. HEALTH AND HYGENE :**

1. Where do you dispose of your garbage? Nearby house/any where in a particular distant

   place ____________________
2. What is the source of drinking water? ____________________
3. Do you follow some specific rules while constructing houses? (Such as door side, open space, south, north, east, west) ____________________
4. What is the common disease in your locality? ____________________
5. What is the common disease in your locality which is fatal in nature?

   ____________________
6. Whether Government provide vaccine and other medicine to you free of cost or not? ____________________
7. Normally whether you use traditional medicine or other medicine? ________
8. At the event of serious illness where do you go for treatment? ________

   ____________________
9. Dispensary in you locality is sufficient for your treatment or not?

   ____________________
10. What is the common disease of infants in your village? ____________________
11. Do you take special care of women during pregnancy? ____________________

12. Do you like large size family or small size family? ____________________

13. Who takes care of women during delivery time? Hospital staff/trained personnel/ village dhai/others ________________________________________

14. Size of house and number of rooms? ________________________________

**F. AGRICULTURE :**

1. How much lands do you posses? (Please give breakup) Cultivated _______ Residential _________________ Commercial _____________ Fallow land _________________.

2. Have you purchased the land or it is your ancestral land? ______________

3. What are the products you cultivate? (give details) ____________________

4. Are you interested in shifting your occupation from present one? It yes which occupation ________________________________________________________

5. How much land for food crop and cash crop? ______________________

6. What are the other agricultural items you produce? ___________________

7. Is there any surplus? (food crop _____________ other crop ____________)

8. Where do you sell your surplus produce? ____________________________

9. Are you self sufficient in agriculture? _______________________________

   If not how do you manage? ________________________________________

10. Do you receive any support from Government / Panchayat for your agricultute? (Loan/subsidy/training/seed/fertilizer/insecticides etc.) ___________________

11. Do you think Panchayat plays a positive role in rural development? _______

12. Are you involved in Panchayat activities? ____________________________

13. During off season of agriculture in what other activities you involve yourself

14. Whether crop rotation and diversification practiced? ___________________

**G. RURAL DEVELOPMENT :**

1. What are the rural development programmes in operation in your village? (Like Jawahar Rojgar Yojana, Indira Awas yojana/IRDP etc.)___________________

2. Do you have food for work scheme in operation?___________________

3. Regarding different rural development schemes who keeps link with Panchayet or BDO office?________________________________________________
4. Are you taking part in different activities organized by Panchayat or BDO?

________________________________________________

5. Do you have any Co-operasive among yourself? ______________________
6. Is there any voluntary organizations (NGO) working for upliftment living standard of people of your locality? ________________________________________
7. Is there any specific scheme for women? ___________________________
8. Do you get seeds and fertilizer etc. at a concessional rate from Government?

________________________________________________

________________________________________________

**H. EDUCATION :**

1. Is there any adult education centre in your locality?______________________

________________________________________________

2. Are you equally motivated for sending both male and female child to school?

________________________________________________

3. Do you think female child also can of help during old age?

________________________________________________

4. Do you think that education can play a positive role in the development of your area? (Please specify the way)_______________________________________
5. Do you have to pay any fees for your children's education? _______________
6. Is there any incentives for sending children to school?____________________
7. If the government provides all facilities are you interested in higher studies for your children?________________________________________________
8. What kind of problem you are facing while sending your children to school?

________________________________________________

**I. OTHERS :**

1. Is there inter-caste/inter-religion marriage in your society?

________________________________________________

2. What is the source of fuel? ____________________

3. Please specify the duration of rituals you perform after birth or death of a person?
____________________

4. Do you know the negative consequence of forest cutting?____________________

5. Do you have your own toilet? (Yes / No). If No please mention the system
____________________

6. Name the festivals of your locality ____________________

7. Have you taken any loan? (Please specify the purpose, sanctioning agency, amount and amount repayment ____________________

8. Please mention your place of birth?____________________

9. Is polygamy is allowed in your society?____________________

10. Do you have electricity If yes, what is the monthly bill you pay?__________
If NO. what is the source of light?____________________

11. Are you satisfied with transportation linkage with GANGTOK? What is the main means of transport? It the frequency of transport is sufficient of not.
____________________

12. How do you keep transport linkage with other place during rainy season? __

13. What is the main food item? How many times yuou have meal? __________

14. At the event of crop damage due to flood, how do you sustain as far as food item is concerned ____________________

15. From where do you purchase your daily need? From shops at
GANGTOK/outside GANGTOK ____________________

16. What are the main commodities usually purchased?____________________

17. What are the handicraft products of your locality? Do you make any handicraft item? ____________________

18. Name the item and do you sell the product?

**J. CROPPING PATTERN, PRODUCTION AND USE :**

| Name of the crop season | Total Area | Area irrigated with source | Production Qty value | Sale Qty value | Bye product Qty value |
|---|---|---|---|---|---|
| | | | | | |

**K. ENVIRONMENTAL PROBLEMS :**

1. Do you have any experience of landslide? If yes give details _______________

   _______________________________________________

2. Where do you dispose your domestic wastes?_______________
3. Do you get safe drinking water? If yes please specify the source? ________

   _______________________________________________

4. Whai kind of problem do you face during rainy season? _______________

   _______________________________________________

5. What kind of problem do you face during winter season? Give details _______

   _______________________________________________

6. During winter and rainy season what kind of physical sickness is generally found in your locality ?_______________________________

**L. TOURIST SURVEY :**

1. Is this your first visit? Yes / no

   If no for how many times have you visited GANGTOK _______________
2. From where did you get the information regarding the place (Relatives / Friends/Newspaper/T.V./Others) _______________
3. Why have you choson GANGTOK as your tourist destination?_______________
4. With whom have you come to GANGTOK (Friends/relatives/parents/others)
5. Normally with whom do you prefer to visit a tourist place?_______________
6. What kind of tourist place do you like the most? (mountain/beach/ forest/ desert/ historical sites/religious sites/otehrs). _______________

7. At what intervals do you visit a tourist place?________________________

8. For how long do you stay at GANGTOK ____________________________

9. What are the places that you will visit / visited at ____________________

10. Which places attracted you the most? _________________________________

11. What is your budget for this tour? _________________________________

12. Where are you staying? ______________________________________

13. Are you satisfied with the following?

| Items | Excellent | Very good | Good | Satisfactory | Not satisfactory | Worse |
|---|---|---|---|---|---|---|
| Transport | | | | | | |
| Accommodation | | | | | | |
| Food | | | | | | |
| Law and order | | | | | | |
| Behavior of local people | | | | | | |
| Cooperation of officials | | | | | | |
| Others | | | | | | |

14. What kind of problems have you faced at GANGTOK (Give details) _______
_______________________________________________________________

15. Do yon have any suggestion for future development? ____________________

_______________________________________________________________

**M. ACCOMODATION / HOTEL :**

1. Name of hotels _______________________ year of establishment __________
2. No of rooms ____________________________________________________
3. Give details of tarrif ______________________________________________
4. What kind of facility do you provide? Give details of facility and services ____
_______________________________________________________________

5. No of employee ______________________
6. Do you have any other hotels other than this?______________________
7. Hotel building your own or rented or leased? If yes give rent or lease amount ______________________
8. What is your monthly income from hotel?______________________
9. Are you satisfied with present levels of income? ______________________
10. If there any plan for further development? ______________________
11. Are you satisfied with behavior of customer?______________________
12. Give details about occupancy level?______________________
13. Have you started present business on your resource or by taking loan or financial help from some agency?______________________
14. Please specify problems you faced in the present business ______________________

**N. TRANSPORT :**

1. For how long are you associated with the transport sector? ______________________
2. Are you a driver / owner of the car?______________________
3. Which are the route (place) do you drive your car?______________________
4. Frequency of services ______________________
5. Average number of passenger do you carry daily?______________________
6. Give details about passenger ______ Tourist ______ Locals ______

**O. MARKET SURVEY :**

1. Name of the owner of shops ______________________
2. Types of shops ______________________
3. Year of establishment ______________________
4. Type of commodities sold ______________________
5. Initial investment in the business ______________________
6. Most customers are ______________________

Place

Signature of the Surveyor
with Date

## 2.5 A plan for Topographic Survey

Topographic survey involves determining the horizontal and vertical locations of objects on the surface of the earth.

Horizontal location entails locating 'objects' like roads, railways, ponds, houses, boundaries of properties, etc. by measuring horizontal distances; the objects are indicated by symbols.

Vertical location includes the location of hills, valleys, depressions, bench-marks, RLs of points, etc. by measuring vertical distances; the objects in this case are represented in relief.

Thus, a topographic map shows the nature of the earth surface along with the positions of different objects.

From the general map of a country, only the positions of objects can be found out, and the nature of the ground surface (i.e. the location of undulation, hills, valleys, depressions etc.) cannot be identified.

To indicate the nature of the ground the map is represented in relief. The following are the different methods generally employed for representation of relief.

A. In spot level on RL system, the RLs of specific points are found out and noted in the map.

B. In colouring system, a certain colour convention is assumed for a particular range of altitudes and each zone is shown in light colour wash. This system of relief is adopted in geographical maps.

In Triangulation or Traversing method, the area to be surveyed is first enclosed by horizontal control and vertical control points (i.e. main stations). Horizontal control represents the relative horizontal positions of points and vertical control the relative altitudes of these points. Then, triangulation or traversing is done on the basis of the natural features of the area.

In the Triangulation method, the whole area is divided into well-conditioned triangles, the sides of which are measured accurately by invar tape or computed by Tacheometer. The magnetic bearing of the base line of triangulation is accurately measured by Theodolite. The angles between main survey lines adjacent to each other are fixed by chain angles.

In the method of Traversing the whole area is enclosed by ''closed traversing''. The magnetic bearing of the base line (the line should be long enough and pass through fairly level ground) is accurately measured by Theodolite, as are the interior angles of the traverse.

If the area is extensive, it is divided into a number of sectors. Each sector is enclosed by a closed traverse having proper connection with the other sectors.

During the process of locating objects, the contours are located on the map. This may be done directly by plane table. However, this method is very laborious.

The contours may also be located indirectly by dividing the area into squares or by taking cross-sections. Spot levels are taken on the relevant points by means of a levelling instrument. Then the RLs of the corners of the squares of specific points on the cross-sections are noted on the map, and the contour lines are drawn by interpolation.

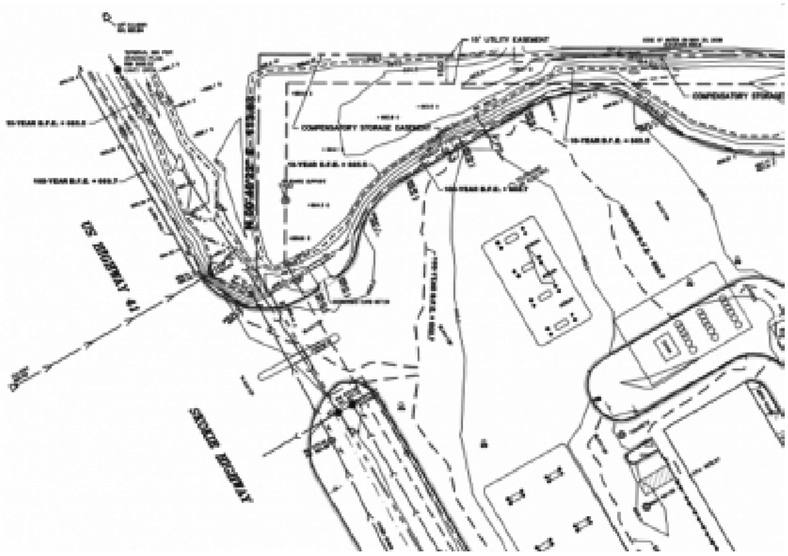

Fig. 2.1 Topographic Survey Plan

# Unit - 3 ❑ Writing of Field Study Report

**Structure**

**3.1 Some Considerations for Field Report preparation**

**3.2 Field Report outline details**

**3.3 Participant's observation**

**3.4 Survey Analysis**

**3.5 Statistical guideline in geographical data analysis**

(The report should be hand written in English on A4 size paper in candidate's own words within 5000 to 8000 words excluding figures, tables, photographs, maps, references and appendices)

## 3.1 Some considerations for Field Report preparation

Some points to be kept in mind in writing the field survey report are :

(a) Justification of the each chapter, section, paragraph etc in field report.

(b) Give appropriate headings, captions, sectional sub headings in written text, photographs, diagrams of the field report.

(c) Language should be simple, readable and geographically justified to address purpose of the field study.

(d) Be careful about all secondary data. Data sources, time and specification should arrange properly.

(e) ***Your understanding is the most important part of your field work. You are a student, not an expert researcher. So do not struggle for many expert's views or ideas or opinions.***

(f) Ensure your involment in correctness of facts, objectives, planning of maps and diagrams and references.

(g) Do not copy the appendix tables, charts, calculation on the main text.

## 3.2 Field Report outline details

Firstly any outline related with Field Report should not be considered as a rigid programme to be strictly followed. Secondly it is not only a tentative one but also is likely to undergo charges considering the ground reality of the study and the concerned purposes.

Generally there are two types of outlining—in the topic outline the topic heading and the sub sections headings are noted and the points to the discussed under each sub sections may be denoted by major keywords only. The sentence outline requires more thought and decisions on what to include and the way of expression also. In this outline the essential ideas to be discussed under each sub-sections or topic are stated systematically.

After the detailed outline is developed, the entire report should be verified and studied carefully to see all aspects have been fully covered with logical and scientific sequences.

| **Topic outline** | **Sentence outline** |
|---|---|
| 1. Extent of member's participation<br>—Measurement<br>—Categorisation | 1. Extent of member's participation<br>—Measured by a scale<br>—On the basis of the score respondents categorised into activity non-activity and medium participants<br>—Reasons for low participation |
| 2. Factors influencing Democratic control characteristics and democratic participation<br>— Age<br>— Formal Education | 2. Factors influencing Democratic control<br>A person's social participation influenced by his personal characteristics like age, education etc.<br>— Age and democratic participation<br>— Testing this relationship<br>— Presentation of the table<br>— Interpretation of the table |

## 3.3 Participant Observation

It is the base of the result of any fundamental Field Work. Originating in anthropological research on so-called traditional societies, participant observation is one of the principal qualitative methods. Based on prolonged and intensive first-hand FIELD WORK, participant observation involves a conscious any systematic attempt to understand the way of life of a group of people or a locality that is often significantly different from the researcher's own. Participant observation frequently entails a year or more in the field and may require learning another language.

As the method has increasingly been applied in contemporary urban settings, studies using participant observation have become more common in sociology and geography. Participant observation endeavours to interpret other culture from a participant's perspective. This normally involves living with the people being studied and engaging as thoroughly as possible in their lives. Those employing the method usually keep a field diary, recording observations in a systematic fashion, constantly mediating between their insider and outsider roles. You have to realise that participant observations are very much on outcome of researchers' personality and attitudes towards the issue.

## 3.4 Survey Analysis

The various procedures involed in the collection and analysis of data from individuals, almost invariably using questionnaires.

A survey involves several stages. The first is definition of the research problem, including the formulation of HYPOTHESIS and identification of the needed information. The second includes determing the population to be studied, which includes deciding whether sampling will be necessary and, if so, how the sample will be taken. The next stage involves deciding how the hypotheses will be tested (including the analytical techniques to be employed), and is followed by development of a questionnaire (which should include pre-test stages and pilot investigations).

It is the most important the techniques of statistical and cartographic analysis for representation of data must be chosen based on the type of data. Any geographer must not forget to explain 'the pattern' in terms of 'processes' in operation as observed in the field. An organised and deciplined mental set up associated with well documented data lead towards a success story in survey results.

## 3.5 Statistical guideline in geographical data analysis

Statistics is the scientific approach to drawing conclusions from numerical information, i.e. the methods used to collect, process and interpret quantitative data. Such methods are highly dependent on the mathematical theory of probability. Two branches are normally recognized :

(i) Descriptive statistics, which summarize data and

(ii) Inferential statistics, which seek to identify relationships between acts of observations.

An alternative breakdown used in social science, is between exploratory statistics which seek hypothesis and confirmatory statistics, which test hypothesis.

Geographers have been using quantitative methods for identification, explanation and decision-making. Their endeavors in this direction generally take the following forms :

(i) to tabulate data methodically and systematically,

(ii) to extract sample from a large and unmanageable universe in such a manner that the analysis with the sample become valid for the universe;

(iii) to identify, classify and extract the inherent characteristics of phenomena;

(iv) to study distributions; frequency, variance and measures of inequality inherent therein—growth and development along the temporal scale; variation, concentration, clustering and dispersion along the spatial scale;

(v) to analyse the matrix of flows across space and the characteristics of networks;

(vi) to identify association and correlation between and combination of phenomena across space and/or through time;

(vii) to composite and synthesis relevant variables in hierarchical regional systems;

(viii) to explain : to relate causes with their effects and/or effects with their causes in a system of unidirectional, bi-directional or multi-directional relationships;

(ix) to project processes in time and to predict;

(x) to simulate and build spatial models.

The more geography moves from the descriptive to the analytical from the ideographic to the nomothetic, the more would be the need for the use of quantitative tools.

Let us take the example of health, which is an integrated quality, cannot be broken up into homogeneous parts, and therefore, cannot be measured directly.

To start with, the geographer has to diagnose—to identify the nature of the health of region, which is quality and cannot be measured directly. Depending on his/her analytical system, he/she may select the following quantitative indicators that can be measured; for example :

(i) land capability index,

(ii) aridity index,

(iii) per capita income,

(iv) percentage share of the secondary sector in the working force,

(v) index of urbanization,

(vi) literacy rate,

(vii) index of income inequality,

(viii) share of the deprived communities in the total population and

(ix) share of working women in the total female population.

The values of these indicators either singly or after composition help him/her to arrive at a qualitative assessment about the ''health'' of the region.

# Unit - 4 ❑ Concluding Remarks of the Field Study Report

**Structure**

**4.1 Concluding Remarks**

**4.2 Specific Task Instructions**

**4.3 Essential Related Issues**

(A copy of the bound report, duly signed by the concerned teacher, should be submitted)

## 4.1 Concluding Remarks of the Field Report

**(a) Overview of the Field Report :** This reads toward the final stage of the field report. The most valuable part of the field report is findings and fundamental observation by concerned student or researchers. This chapter should be well-documented, mutually justified and logically arranged. Remember, the findings section should be an organised presentation of the observation, realisation and results of investigation. It is never a compilation of statistical records, data, charts, sattelite maps or graphical documentation.

**(b) Recommendations and Conclusions :** We already discussed that findings are statements of factual information based upon geographical understanding and associated data analysis whereas conclusion are futuristic orientation or logistic inferences drawn from the findings and related hypothesis. The formulation and presentation of conclusions are the two important aspects of field report. These are the answers to the research questions or the approach of acceptance or rejection of hypothesis associated with specific problem of the study area. Originality is very much expected in this part of the report.

A student or a group of student researchers sometimes may be overwhelmed to generalize the entire observation or partial observation on the basis of his or her limited data or inaccurate data or prior convictions, not tested by the statistical and cartographic analysis. However, it is very essential to address the situations of falsehood or qualities of skepticism.

The lesson will be of immense use in future planning and conducting follow up field studies in the same area in future.

(c) **The final words :** Recommendations made by any other concern research team, study group, expert committee, however important they may be, should not mention directly without declaring sources and your own opinion related to the concerned findings.

Your recommendations should address not only policy makers or administrative authorities but also all stakeholders like local people, visitors and related non governmental contributory groups.

Remember this section is more extensive than the scope of study given in the beginning of the field report.

(d) **Some essential elements for a successful field work :** When properly constructed, a field research work plan can be the most beneficial resource available to research teams. By having an easy-to-consult work plan document, students group or individual researchers can perform their needed tasks virtually autonomously. No constant overview/monitoring is needed, and any potential challenges will ideally have solutions built within the work plan.

## 4.2 Specific Task Instructions—Who? What? When?

The most critical component of a field research work plan is the scheduled work breakdown for each individual task. This information is often the central focus of a group's work plan, yet they can often forget the needed level of specificity to prevent confusion or oversights—

- **Who?**—Naming specific individuals or students groups as responsible for the task is best practice.
- **What?**—A field study proposal should have already outlined the data collection methodology, including expected practices and specific tasks needed to handle that data upon input. A work plan can reference the proposal instructions, or it must provide its own specific task descriptions that explicitly state the needed steps to fulfill the task.
- **When?**—Work plans can delineate specific times (Date, time, day) to accomplish tasks or start and end dates, but the more discrete and specific the desired task duration, the better oversight on task completion progress.

## 4.3 Essential Related Issues

- **Accountability :** Assigning roles to the appropriate team is another critical research component that work plans help fulfill. For every discrete task or task group, an overarching team member should be designated responsible to ensure that the task is completed as needed. From there, categories of tasks like field interviews, data entry, etc. should be designated towards other responsible administrative parties so that everyone knows who is accountable for what.
- **Assessment, Review and Compilation Dates :** Ongoing tasks can be audited while data is simultaneously processed for later accessibility using periodic assessment and reporting tasks. The goal or these tasks is to ensure that "completed" tasks were actually conducted as needed, and auditors can also help summarize the data assembled so far in an easy-to-reference report.
- **Contingency Plans** : Anything can go wrong during a study, particularly one as complex and granular as field work. Therefore, make sure your work plan includes flexible contingency periods for "catch-up" research or alternative strategy planning.

## Model Questions of Module 2

1. What is your study area for field work ? Give details administrative location (eg. Mouza, Panchayat, Police Station, Block, Municipality, District etc.)
2. How do you select your area and the specific problem ?
3. Relate the specific problem of your study area with geographical perspective.
4. What is unique in the physical component of your study area ?
5. How do you relate physical environmental issues with the cultural environment of the study area ?
6. Ho do you justify popular demand on this issue of the study area ?
7. What are the administrative orientation about the specific problem ?
8. What is your first hand experience on the people's perception on the event or incident or problem in that area ?
9. What is your learning experience from door to door survey covering different social and economic groups of the study area ?

10. What are the surveying tools in your physical environmental study ?
11. What is the most fundamental observation in this study ?
12. What are the three major problems or compulsions in this study ?
13. How do you analyse the future of this problem ?
14. What is your self-assessment about the comparison of primary and secondary data associated with the problem ?
15. How do you justify your main recommendation to address the concerned problem ?

## References of Module 2


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