

5

Field Surveys



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You have studied aspects of Physical Geography of the world, as well as, of India in Class XI. In the present class, besides the Practical Work in Geography you will study the various aspects of Human Geography. While studying these aspects, you may have observed that issues addressed pertain to global or national level. In other words, the given information helps us to understand the issues at macro level. You may also have observed that the forms, events and processes in your surroundings are similar to what you have studied at macro level. Have you ever thought how would you study some of the aspects at local level? You know that regional level information is used to analyse different physical and human parameters of a large area. Similarly, information has to be gathered at the local level by conducting primary surveys for generating information. The primary surveys are also called **field surveys**. They are an essential component of geographic enquiry. It is a basic procedure to understand the earth as a home of humankind and are carried out through observation, sketching, measurement, interviews, etc. In the present chapter, we will discuss the procedure involved in carrying out the field surveys.

Why is Field Survey Required ?

Like many other sciences, geography is also a field science. Thus, a geographical enquiry is always needed to be supplemented through a well-planned field survey. These surveys enhance our understanding about patterns of spatial distributions, their associations and relationships at the local level. Further, field surveys facilitate the collection of local level information that is not available through secondary sources. Thus, field surveys are carried out to gather required information so as the problem under investigation is studied in depth as per the predefined objectives. Such studies also enable the investigator to comprehend the situation and processes in totality and at the place of their occurrence. This is possible through 'observation', which is a useful method of gathering information and then to derive inferences.

Field Survey Procedure

The field survey is initiated with well-defined procedure. It is performed in the following functionally interrelated stages :

1. Defining the Problem

The problem to be studied should be defined precisely. This can be achieved by way of statements indicating the nature of the problem. This should also be reflected in the title and sub-title of the topic of the survey.

2. Objectives

A further specification of the survey is done by listing the objectives. Objectives provide outline of the survey and in accordance to these, suitable tools of acquisition of data and methods of analysis will be chosen.

3. Scope

Like clearly defined objectives, scope of survey needs to be delimited in terms of geographical area to be covered, timeframe of enquiry and if required themes of studies to be covered. This multi-dimensional delimitation of the study is essential in relation to fulfilment of the predefined objectives and limitations of analysis, inferences and their applicability.

4. Tools and Techniques

Field survey is basically conducted to collect information about the chosen problem for which varied types of tools are required. These include secondary information, including maps and other data, field observation, data generated by interviewing people through questionnaires.

(i) Recorded and Published Data

These data provide base information about the problem. These are collected and published by different government agencies, organisations and other agencies. This information, alongwith cadastral and topographical maps, provides basis to prepare the framework of survey. Listing of households, persons, landholdings in the survey area can be done using the official records or electoral rolls available with the village panchayat or the revenue officials. Similarly, essential physical features, like relief, drainage, vegetation, land use and cultural features, like settlements, transport and communication lines, irrigation infrastructure, etc. can be traced out from the topographical maps. The field boundaries of land parcels can be marked out from cadastral maps available with land revenue officials. The field survey is conducted either for the entire 'population' or for the 'samples'. These basic information and maps are required to select the units of observation. The large-scale maps of the survey area also help the investigator to orient and locate him/her on the ground. This initial orientation helps the investigator to insert additional features in the map appropriately.

(ii) Field Observation

The effectiveness of field survey is associated with the investigators' capability to collect information about the landscape through observation. The very purpose of a field survey is to observe the characteristics and associations of geographic phenomena.

To supplement the observation, certain techniques of acquisition of information are useful like that of sketching and photography. As you find sketches and photographs provided in your textbooks enhance your comprehension of facts, situations and processes being explained. It is, therefore, essential to learn and apply sketching techniques to capture the prominent features of the landscape to strengthen the explanations. Similarly, landscape scenario can also be captured by photography of the landscape, objects and activities.

At times, when suitable large-scale map is not available, a sketch or a notional map of the survey area can be prepared based on reconnaissance survey. This kind of exercise also helps in getting oneself introduced with the area as each feature needs to be observed carefully for locating them in the sketch.

All the observations in the field are to be noted down for keeping a systematic record. You cannot memorise every thing you see, feel or understand. Thus, using appropriate scheme of categorising of facts one should record relevant characteristic of objects. While taking notes, a brief interaction with the people or with the members of the field party or referring to recorded information is always required for clarifications and unambiguous recording of observations.

(iii) Measurement

Some field surveys demand on site measurement of objects and events. This is all the more necessary when one wants to present the analysis with precision. It involves the use of appropriate equipment, which enables the investigator to measure the characteristics precisely. Thus, the field party should carry with them relevant equipment required to measure the selected features, such as measuring tape, weighing machine to weigh soil, pH meter or paper strip to measure the acidity or alkalinity and thermometer.

(iv) Interviewing

In all field surveys dealing with social issues, information is gathered through personal interviews. Experiences and knowledge of each individual about his/her environs as well as about his/her own livings are nothing but information. These experiences, if retrieved efficiently are important sources of information. However, extraction of information through personal interviews is greatly influenced by an interviewer's abilities in terms of understanding of the subject and the people to be interviewed, communicative skills and rapport with the people.

- (a) **Tools** : Interviewing of people can be done either through pre-structured questionnaires and schedules or through participatory appraisal methods, like social and resource mapping and discussions.
- (b) **Basic Information** : While conducting interviews as means of data collection, certain information like that of location, socio-economic background of the respondent are to be noted. On the basis of these parameters, an investigator categorises and compiles the information for further computations and analysis.
- (c) **Coverage** : During field studies, an investigator has to decide whether the survey will be conducted in the form of census for the entire population or will be based on selected sample. If the study area is not very large but composed of diverse elements then the entire population should be surveyed. In case of large size area, one can limit the study to selected samples representing all segments of the population.

- (d) *Units of Study* : Elements of study need to be defined precisely alongwith the decision about census or sample survey. These elements consist of primary unit of observation, like households, parcels of land, business units, etc.
- (e) *Sample Design* : A framework of sample survey, including its size and method of selecting samples is to be decided in relation to objectives of survey, variations in population and cost and time constraints.
- (f) *Cautions* : Field interviews or participatory appraisal methods are highly sensitive activities and should be conducted with utmost sincerity and caution as one is dealing with human groups, which always do not share the cultural ethos and practices that of the investigators. As a student of social science, you should be careful of the larger purpose of the study and should not stretch the argument beyond the scope of the study. To get the correct picture, your conversation and behaviour should reflect that you are one of them. While conducting the interview, ensure that no other person is intervening in your conversation either by his/her presence or by replying in between.

5. Compilation and Computation

You need to organise the information of varied types collected during the fieldwork for their meaningful interpretation and analysis to achieve the set objectives. Notes, field sketches, photographs, case studies, etc., are first organised according to sub-themes of the study. Similarly, questionnaire and schedule-based information should be tabulated either on a master sheet or on the spreadsheet. You have already learnt the features and use of spreadsheet. You can even construct indicators and compute descriptive statistics.

6. Cartographic Applications

You have learnt different methods of mapping and drawing of diagrams and graphs and also use of computer in drawing them neatly and accurately. For getting visual impressions of variations in the phenomena, diagrams and graphs are very effective tools. Thus, the description and analysis should be duly supported by these presentations.

7. Presentations

The field study report in concise form should contain all the details of the procedures followed, methods, tools and techniques employed. The major part of the report will be devoted to the interpretation and analysis of information gathered and computed alongwith supportive facts in the form of tables, charts, statistical inferences, maps and references. At the end of the report, you should also provide the summary of the investigation.

On the basis of above outlines, you will select a problem or topic and carry out the fieldwork as a team of investigators in the supervision of your teacher.

Field Survey : Case Studies

You know that field survey plays a significant role in understanding the forms, processes and events at a local level. A field survey may be conducted to study any issue of general concern. However, the selection of a topic for the case study depends upon the nature and character of the area where the survey is to be

carried out. For example, in low rainfall and agriculturally less productive regions, droughts form a major topic of study. On the other hand, in States, like Assam, Bihar and West Bengal, which experience high rainfall conditions and occurrences of frequent floods during the rainy season necessitates a survey for the assessment of the damages caused by the floods. Similarly, a case study on air pollution emerges as a major topic near a smog-emitting industrial plant or a survey of the changing patterns of agricultural land use in Punjab and western Uttar Pradesh, which has drawn the benefits of the Green Revolution for several years becomes important. In the present chapter, we will discuss how specific case studies on droughts and poverty are conducted. These have been selected from case studies given in your syllabus. These are :

1. Groundwater Change
2. Environmental Pollution
3. Soil Degradation
4. Poverty
5. Droughts and Floods
6. Energy Issues
7. Land Use Survey and Change Detection.

A summary of the procedure that could be followed in carrying out the field survey on any of these topics is provided in *Annexure II*.

Instructions for the Students

The students should prepare a blueprint of the field survey in consultation with the class teacher to include details of the area to be visited, alongwith a map of the area, if available, clear understanding of the objectives of the survey and the well-structured questionnaire. The teacher should also give a few necessary instructions to the students. These include :

1. Be courteous to the people of the area you are visiting for the field survey.
2. Develop friendly attitude with the people you meet and establish rapport.
3. Ask questions in comprehensible language.
4. Avoid asking the questions that may either hurt the feelings of the people you are interviewing or those that may irritate them.
5. Do not make any promises with the inhabitants of the area and do not tell lies about your purpose.
6. Record each and every detail as given by the respondent of your queries and show them the recorded version, if asked for.

Field Study of Poverty: Extent, Determinants and Consequences

The Problem

Poverty denotes a state of people in terms of income, assets, consumption or nutrition at a given point of time. It is often understood and conveyed in the context of **poverty line**, which is a critical threshold level of income, consumption, access to productive resources and services below which people are classed as poor.

The issue of poverty is closely linked with inequality, which is the cause of poverty. Poverty is, thus, not only an absolute but also a relative state. It varies

from region to region. However, there is something absolute about it and despite the variations in regions and diversified society, people require adequate levels of food, clothing and shelter. Poverty can be either a chronic or temporary phenomena. The chronic poverty, which is also known as structural poverty, is more crucial to be understood. Another significant aspect of poverty is that in spite of high rate of economic growth more and more people are identified below the poverty line. It is rampant in both rural and urban areas alike. Thus, the dimensions of poverty and its measures could be studied through a field survey. Fig. 5.1 and 5.2 provide a glimpse of poverty-ridden families and the villages.

The first step to conduct such a survey is listing of its objectives.

Objectives

The study of extent, determinants and consequences of poverty can be carried out with the following objectives in mind:

1. To identify appropriate criteria to measure poverty line.
2. To assess the levels of well-being of people in terms of income, assets, expenditure, nutrition, access to resources and services.
3. To explain the state of poverty in relation to historical and structural conditions of the village and its people.
4. To examine the implications of poverty.

Coverage

The spatial, temporal and thematic aspects of survey be understood clearly.

Spatial

In order to achieve the aforesaid objectives a field study may be conducted in a selected part of the rural or urban settlements. Spatially, it may cover an area of 200 hectares or more and inhabited by about 400 persons or 100 households.

Temporal

If the problem pertains to chronic poverty, the study should be based on average conditions or reflecting responses with references to normal rainfall year for the



Fig. 5.1 : A Poverty-ridden family



Fig. 5.2 : A Poverty-ridden Village

village as well as for the surrounding area. In case of temporary poverty, current year situations are to be investigated.

Thematic

Thematically, the study should cover household and individual level aspects like socio-demographic characteristics, permanent and consumer assets, income and expenditure, access to health, educational, transport and power services and infrastructure facilities to capture the targeted issues of status, determinants and implications of poverty.

Tools and Techniques

Secondary Information

Before you proceed for field study, you should go through the literature on poverty and the region, in general, and the selected village, in particular. The conceptual aspects of poverty, like its meaning, measurement, criteria, causes, etc., can be understood through published work related to economic development, social changes and economic surveys. Basic population statistics can be obtained from district census handbooks or the village level primary census abstract, agricultural and livestock statistics can be acquired from village revenue official or the *Patwari Lekhpal, Karamchari, Karnain*, etc. Household lists and other village level information can be collected from *Gram Panchayat* office. Similarly, other relevant data are available with respective departments located at tehsil or block headquarters. All these information are essential to build the framework of the village resources and economy as well as to develop research design including sample design if survey is not to be based on the entire population.

Maps

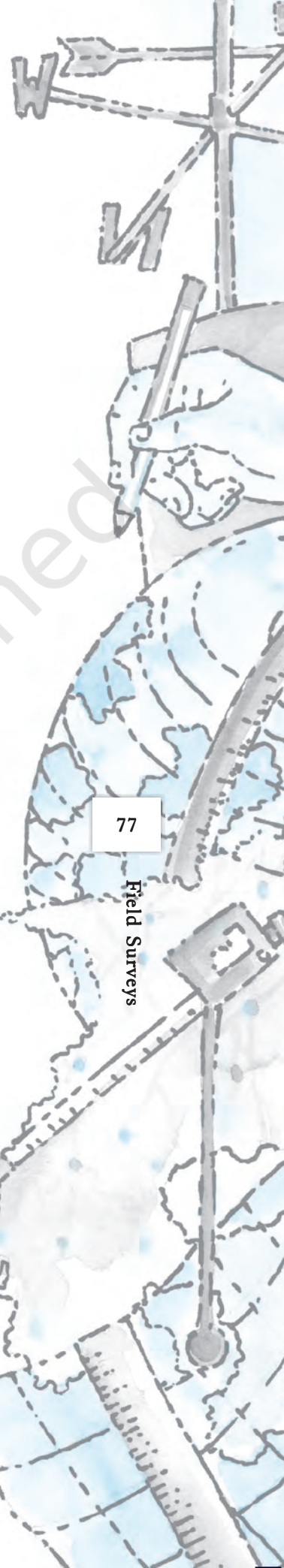
Topographic details, including relief, drainage, water bodies, settlements, means of communications and other topographical features of a village and its surrounding region are to be traced and studied from 1:50,000 or 1:25,000 scale topographical maps. Similarly, the 1:4,000 scale cadastral maps and revenue records of the villages may be obtained from the revenue officials. These maps provide spatial dimension of inequality in land distribution if plotted by ownership of households.

Observations

As a fundamental tool of field survey, much of the details of poverty scenario can be visualised through keen observation. Observation of the routine activities of poverty-ridden people; quality and quantity of the food items; sources of fuel wood and drinking water; state of clothing and shelter, human sufferings associated with malnutrition, hunger, sickness, etc.; locational, social and political deprivations due to poverty and other pertinent attributes can be understood. These observations with aids, like photography, sketching, audio-visual recordings, etc., or just in the form of notes are valuable sources of non-quantifiable information to validate different point of views and to draw conclusions.

Measurement

In some situation, the actual measurement needs to be taken up. This is required in case of non-availability of data pertaining to quantity of food items consumed



daily or the state of health in terms of height and weight, quality of drinking water or the nutritional value of different food items, availability of living space, etc. Simpler means of measurement are fruitful in quantifying certain items precisely.

Personal Interview

Most of poverty measures are based on aggregate household conditions. Thus, field data collection through interviewing will be at household level. However, information about the household will have to be extracted either from the head of the household or the more responsive and knowledgeable member of the household. Apart from canvassing questionnaires, household data will also be collected by interviewing village leaders, service providers, institutional heads, etc., to compute relevant indices.

Survey Design

Survey can be conducted, as census covering all the households of the village if the number of household are manageable with the number of students in the class otherwise a stratified sampling will be appropriate to extract information. Stratification of households can be done on the basis of land holdings classes, social classes, division of settlement into grids or concentric circles. For stratification listing of households alongwith these criteria/attributes and notional map showing the plan of settlement are to be completed as follows :

Table 5.1 : List of Households with Basic Attributes of Stratification of Sampling

S. No.	Head of Household with Father's Name	Social Class/ Category	Land Holding (ha)	Location of House (Grid/ Circle Reference)	Remarks
1.	Mohanlal S/o Sohanlal	Dhaker : OBC	7.2	A2	
2.	Homaji S/o Kaluji	Bheel : ST	0.2	D4	
3.					

Grids or circles in the notional map/plan may be drawn for spatial stratification as shown in *Fig. 5.3*.

Schedule/Questionnaire

Interview, observation, and at times, measurement-based household information is to be enquired and recorded systematically in the pre-designed questionnaire (Please see Annexure 1 A to H).

Compilation and Computation

Data Entry and Tabulation

After completing the survey in the field, the collected information need to be compiled for further computation and analysis. Now, this task can be accomplished more conveniently in spreadsheet formats, which you have already practised as part of your computer-related practical work. For efficient management of these data follow the following sequence :

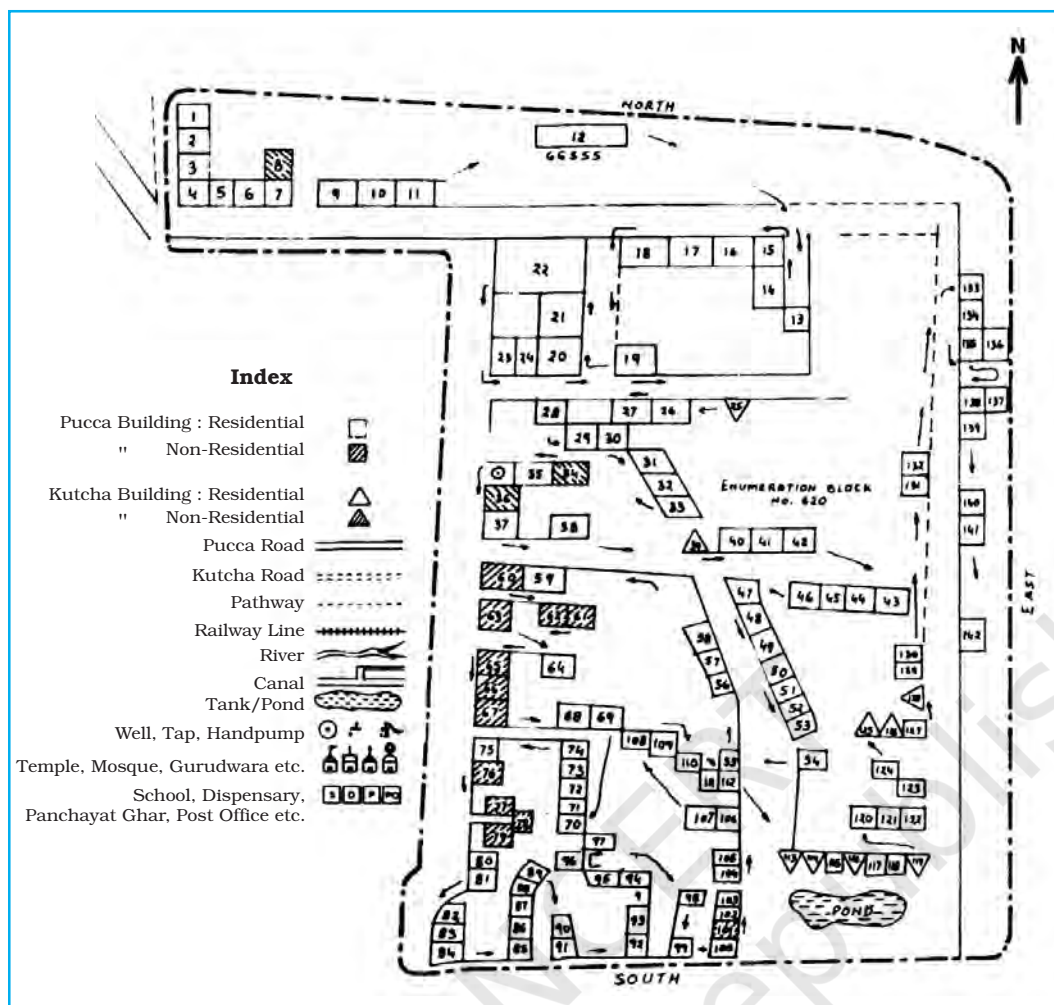


Fig. 5.3 : Notional Map of the Settlement with Grids for Sampling

1. Assign unique identity code to each surveyed household.
2. Similarly, each person in the demographic table will also be assigned unique identity code for compilation in separate spreadsheet.
3. It will be more convenient if each type of household level information is compiled on separate sheet.
4. Unique name to be assigned for each attribute in each column.
5. Information on each sheet will be filled according to household code for further processing.

Verification and Consistency Checks

After data entry, random verification of entries is necessary to ascertain the correctness of data. This is further checked by cross total and with the help of maximum and minimum values as well as in the light of related variables.

Computation of Indices

Computation of indices using available value parameters and calculating the ratios is a significant task before analysing the situation of poverty. In this regard,

following set of indices may be computed at household level for further analysis :

1. Indices indicating the state of well-being measured on the basis of total assets, total income, total expenditure, food consumption, nutrition level, etc.
2. Indices explaining the reasons of chronic poverty like social class membership and perpetuating legacies, size of household, type of family, type of occupations, educational levels, size of land holdings and state of irrigation, type of crops cultivated, subsidiary sources of employment, ownership of productive assets, state of gender equality, etc.
3. Indices related to consequences of poverty can be computed on the basis of state of gender discrimination, literacy and educational level among the youths and young ones, employment diversification, productive and consumer assets, crop yields, pattern of expenditure and nutritional intakes.

It is significant to note that many of the causative factors are also resultant facts due to their circular relationship with poverty.

Visual Presentation

Summarised tables, diagrams and graphs as you learnt as part of cartographic work can be employed to represent the salient characteristics of poverty in the village. For this purpose, tables may be prepared according to land holding categories or the social categories of households, including the caste-based classifications. Similarly, composite indices of productive assets or total expenditure can be used to segregate households for showing their state of well-being. Variations in well-being can also be shown in the form of drawing a poverty line and class-wise distribution of households above and below that line to visualise the poverty-affected sections of the society and their social background. A significant graphical tool to indicate the inequality is Lorenz curve and it can be drawn to show unequal distribution of assets, income and expenditure among the households of the village.

Thematic Mapping

Spatial distribution of agricultural as well as non-agricultural land within the revenue limits of the village and in the settlement can be shown by chorochromatic maps to assess the extent of control on natural resources of certain social groups as a source of inequality, and one of the important causes of poverty. Poor accessibility in relation to site of houses and location of services can also be visualised with the help of maps.

Statistical Analysis

Simple descriptive statistical methods, as well as, measures of associations, explanatory relationships and composite indices based on household level indicators can be employed meaningfully to draw inferences. In this regard, simple arithmetic mean can indicate the average situation, whereas, the coefficient of variation will indicate the extent of relative inconsistency in socio-economic well-being among different groups of households. Similarly, you can measure the intensity of relationship between two indices using the coefficient of correlation and explain the probable causes of perpetuation of poverty or its impact on other socio-economic aspects.

Report Writing

Finally, using all the analysed material, you will present your report in group or individually as instructed by your teacher in the systematic way as you followed in the investigation of the problem. All the details, we discussed till now will be part of your presentation in the same sequence, alongwith major conclusions and inferences you have drawn. You will also enrich your presentation with appropriate illustrations, including maps, diagrams, graphs, photographs, sketches, etc. The statement in the text will be duly supported by the facts shown in tabular forms as well as references of earlier works.

Field Study of Droughts : A Study of Belgaum District, Karnataka

Some of the regions in India have plenty of water, and shortages are rare. But in many parts of the country, water is scarce and people can never be sure when it will rain next. Droughts happen when for months or even years, the earth's surface loses more water than it collects. In some places of deserts, it almost never rains at all. Droughts can affect many peoples' lives.

Droughts and floods are two adverse factors, which Indian farmers have to face. A specific definition of any one of them is quite difficult. However, qualitatively, agricultural drought can be defined as a prolonged and acute moisture deficiency.

Drought, as commonly understood, is a condition of climatic dryness that is severe enough to reduce soil moisture and water below the minimum limit necessary for sustaining plant, animal and human life (Fig 5.4 and 5.5). It is usually accompanied by hot dry winds and may be followed by damaging floods.



Fig. 5.4 : Drought-affected Area



Fig. 5.5 : Soil Moisture Loss

Drought has been recognised as one of the main causes of human misery. While generally associated with semi-arid or desert conditions, drought can occur in areas that normally enjoy adequate rainfall and moisture levels. In the broadest sense, any lack of water for the normal needs of agriculture, livestock, industry, or human population may be termed a drought. The cause may be lack of supply, pollution of the water, inadequate storage, conveyance facilities, or abnormal demand.

The effects of drought depend on its severity and duration and the size of the affected area. The impact depends on the level of socio-economic development. Societies that are more developed and economically diversified can better adjust to a drought and can recover more quickly. The poor regions, especially those reliant on any crop or pastoral economies, are more severely affected.

The worst effects of drought are the dramatic reduction of surface water and loss of food. Crop failures cause a chain reaction of human suffering (hunger and malnutrition) and economic difficulties. In developing countries, these conditions can culminate in a large number of starvation deaths and farmers' suicides.

Objectives

A field survey for the assessment and magnitude of the droughts can be carried out with the following objectives in mind :

- (a) To identify and record areas experiencing recurring drought conditions.
- (b) To get the first-hand experience of droughts as a natural disaster.
- (c) To suggest drought preparedness measures for the people of the area.

Coverage

The aspects related to the spatial, temporal and thematic coverage be understood.

Spatial

In order to achieve the aforesaid objectives, a field study may be conducted of a drought-prone area, if it has experienced drought in or around your district.

Temporal

If the problem pertains to recurring droughts, the study should be based on average conditions reflecting responses with references to normal rainfall year for affected area and its surroundings. Besides, the data on agricultural productions for the drought years may be compared with the non-drought year production figures.

Thematic

Thematically, the assessments for the agricultural production and crop land use, rainfall variability and vegetation status should be made to understand the magnitude, determinants and implications of the droughts.

Tools and Techniques

Secondary Information

The maps and the data pertaining to the rainfall, crop production and population should be collected for drought-affected areas for the drought years from the following government/ quasi-government offices :

- (i) *Indian Daily Weather Reports*, Indian Meteorological Department (IMD), Division of Agricultural Meteorology, Pune
- (ii) *Crop Weather Calendar*, IMD, Agrimet Division, Pune
- (iii) Government of Karnataka, *Belgaum District Gazetteers*, Bengaluru, 1987

- (iv) *Census Handbooks*, Census of India, New Delhi
- (v) *District Handbook/Village Directories*, Government of Karnataka
- (vi) *Statistical Abstracts*, Bureau of Economics and Statistics, Government of Karnataka, Bengaluru.

Maps

1 : 50,000 and large-scale topographical maps of the drought-affected areas enable the identification and mapping of the perennial and non-perennial water bodies, settlements, land use and other physical and cultural features. Besides, the cadastral maps help in collecting the data about land use.

Observation

Observation means looking around and talking to people and noting down the observed information about the shortage of water, crop failures, lack of fodder, starvation deaths, farmer's suicides, if any.

- (a) *Targeted Objects and Processes* : A detailed study of the changes in the crop land use pattern of the selected village, as well as, major rivers, streams, nullah, tanks and wells and irrigation facilities, if any, should be made in the light of the drought situation.
- (b) *Photographs and Sketches* : Photographs and sketches of parched lands, people and livestock can give a qualitative touch to the study if carried out during the field survey.

Measurement

Objects (to be measured)

The village, as a unit, is selected for this type of survey. A cadastral map is obtained from the village *patwari*. This map shows the *Khasra* numbers and boundaries of the fields. Some copies of the outline map are prepared and information filled in. These include the wells, tanks and streams in terms of depth of water, limits of perennial water in larger streams; sowing in the total number of fields, loss of seeds, harvesting; availability of drinking water facilities; official relief measures, etc.

Interviewing

The questionnaire method involves asking previously framed questions to the person to be interviewed. The surveyor has to ask the questions and take down the answers if it is a structured questionnaire. The questions should be related to drought and economic conditions of the farmers, in terms of the amount of rainfall received, rainy days, sowing, watering, nature of crops, livestock and fodder, domestic water supply, healthcare, rural credit and employment and anti-poverty programmes of the government. The degree of feeling of the respondent can be noted on a five-point scale (very good, good, satisfactory, bad and very bad).

Tabulation

The data collected from the primary and secondary sources has to be organised in a systematic manner for easy processing and interpretation. Different methods are used to quantify the data into groups or heading such as the tally mark method.

Presentation of Report

The information gathered during field survey is finally recorded in the form of a detailed report about the cause and magnitude of the drought and its impact on the economy and life of the people.

Exercises

1. Choose the right answer from the four alternatives given below :
 - (i) Which one of the following helps most in planning for a field survey ?
 - (a) Personal Interviews
 - (b) Secondary Information
 - (c) Measurements
 - (d) Experimentation
 - (ii) Which one of the following is taken up at the conclusion of a field survey ?
 - (a) Data entry and Tabulation
 - (b) Report Writing
 - (c) Computation of Indices
 - (d) None of the above
 - (iii) What is most important at the initial stages of field survey ?
 - (a) Outlining the Objectives
 - (b) Collection of Secondary Information
 - (c) Defining the spatial and thematic coverages
 - (d) Sample Design
 - (iv) What level of information is acquired during a field survey ?
 - (a) Macro level information
 - (b) Maso level information
 - (c) Micro level information
 - (d) All of the above levels of information
2. Answer the following questions in about 30 words :
 - (i) Why is a field survey required ?
 - (ii) List the tools and techniques used during a field survey.
 - (iii) What type of coverages need to defined before undertaking a field survey?
 - (iv) Describe survey design in brief.
 - (v) Why is the well-structured questionnaire important for a field survey ?
3. Design a field survey on any one of the following problems :
 - (a) Environmental Pollution
 - (b) Soil Degradation
 - (c) Floods
 - (d) Energy Issues
 - (e) Land Use Change Detection