INDIAN INSTITUTE OF SCIENCE
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MONITORING THE STATUS OF ENVIRONMENT

(Manual for School and College Teachers)

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Contents:

9) Human population dynamics.

10) Food consumption.

11) Human health.

12) Medicinal plants.

13) Soil organic matter status.

14) Study of bird diversity.

15) Study of plant diversity.

16) Biomass use as fuel for cooking.

17) Source of fuel and fuel gathering practices.

18) Crop production; Inputs and outputs.

19) Enduse of crop byproducts.

20) Efficiency test for cook stoves.

21) Electrification and electricity consumption.

22) Wages and prices.

23) Diary of activities (of human and animal labour use)

MONITORING THE STATUS OF ENVIRONMENT

AIMS OF THE PROGRAMME:

1. To educate the students regarding the status of their environment, the degradtion of their environment, depletion of the resource level and their impact on the quality of life.

2. To teach the students the scientific methods or techniques of monitoring the status of their environment by actually carrying out field studies in their environment and analysing the results.

3. To generate data base for the selected ecosystems for long term monitoring of the status of environment.

4. To expose them to some solutions to overcome the problems of their environment based on the results of monitoring.

NEED FOR MONITORING THE ENVIRONMENT AND THE ROLE OF STUDENTS:

There is no need to stress the urgency of creating awarness in students regarding the degradation of their environment and its impact on quality of life. The final goal of any environment education programme is that it should lead to action. To initiate action or to participate in any environmental conservation or reconstruction programme, data or information is required to plan and execute the programmes at microlevel. Right now there is no proper agency or programme at micro level to generate data or to monitor the status of environment. The high school students and teachers could play a vital role here. Majority of the students in rural high schools stay back in their villages. Thus if they are made aware of the status or dynamics of their environment, one could expect them to play a positive role in protecting their environment. The proposed programme in addition to educating the students on the status of their environment, it also aims at generating data base at micro level for planning and execution of solutions to the environmental problems. This programme also teaches students the methods for studying their environment which may help them in future.

In each taluk or block a few high schools could be involved in monitoring the status of the local environment and generate information on the dynamics of the resource use and status of the components of the environment over a period of time.

APPROACH TO THE PROGRAMME:

It us proposed that the programme would be restricted initally for standard 8 and 9 of the high schools.

1. The main approach to monitor the status of the environment is by actually carrying out field studies. The methods to be employed are obeservations, measurements, experiments and surveys. The students will carry out the field studies under the guidance of trained teachers.

2. Each of the selected school would identify and demarcate the geographical unit for monitoring the environment. The unit could be a village, a cluster of villages or a watershed.

3. The high schools are expected to dedicate one afternoon (about 2 hours) per week for discussing the parameters to be monitored, the methods of monitoring, analysis of data and discussion of results.

4. The main activity like observation or survey or measurement should be carried out after the school hours, on holidays and during vacation periods.

5. Monitoring of most of the parameters should be completed during the period starting from June to end of December. However, a few parameters may have to be monitored even after December in such a way that it doesn't affect the students or teachers preparation for their examinations.

   The main aim is not disturb the normal school schedule or to tax the teachers' time.

6. There is a need to continue the monitoring programme over a period of years or continuously in all the selected schools. This would help to understand the dynamics of the status of the components of the environment. Status reports could be prepared periodically say, once in two years.

7. All the material or inputs required for conducting the programme has to be provided for the school. For example, spring balance, thermometer, rain guage and progorma for recording the data.

ABOUT THE MANUAL

The manual is meant to be used by the teachers. For each parameter the following aspects are presented;

1. The aim of monitoring the parameter.
2. Material required.
3. Sampling technique.
4. Description of the method.
5. Analysis of data.
6. Sample proforma.

The teachers are welcome to modify the proforma or method of analysis to suit to the local condition.

SCHEDULING OF MONITORING OF DIFFERENT PARAMETERS

JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
Land use	Land use		Trees on farms	Crop output	Crop output		Grazing practices
	Vegetation mapping	land use mapping	Water consumption			Cattle population	Food consumption
Cattle population		Grazing practices	Fuel wood use -cooking	Medicinal plants	Electrification	Cattle:Input output	Fuel gathering practices
Cattle input/output	Crop: Input data	Fuel gathering practices				Bird diversity	
Crop : Input data	Wages & Prices	Animal or plant diversity	Cook stove test	Wages-prices	Wages-prices	End use of byproducts	Fuel use for cooking
	Food consumption	Soil organic matter					

CONTINUOUS MONITORING - DAILY RECORDING

1. Climatic parameters
2. Diary of activity
3. Human population dynamics
4. Human health

PERIODIC MONITORING- (FORTNIGHTLY/MONTHLY)

1. Ground water status
2. Bird diversity

DEFINING THE ENVIRONMENT/ECOSYSTEM FOR MONITORING

ENVIRONMENT is the physical, chemical and biological surroundings of an organism at any given time.

ECOSYSTEM is a functional unit of biotic and abiotic components. In otherwords, ecosystem is a community of organisms and their physical environment interacting as an ecological unit.

For monitoring the status of the environment or for planning developmental programme there is a need to define the spatial unit. One of the aims of the programme is to generate data for planning and preparing environment status report for the selected areas.

The geographical unit could be termed as an ecosystem. Indian rural ecosystems are generally termed as agricultural ecosystems; characterised by interactions or interlinkages among the components through the flow of energy and materials. The major components of any typical agricultural ecosystem are as follows;

1. Crop land
2. Grazing land
3. Livestock
4. Human population
5. Trees
6. Soil
7. Water; wells, tanks
8. Birds
9. Insects
10. Wild animals

Defining the boundary of an ecosystem is a difficult task. Given that an ecosystem is characterised by interactions among the components, a village could be defined as an ecosystem. The village ecosystem could consist of a settlement (human plus livestock), the land cultivated by the humans and the common land on which the cattle and humans depend for fodder and fuel respectively. Defining a village as an ecosystem may sometimes pose difficulty as it may consist of hamlets or as in forest and Malnad districts, the houses, farms and common lands are geographically dispersed. Another approach is to consider a watershed as an ecosystem defined by the topography of the land and flow of rain water.

A watershed could consist of several villages and several thousand hectares of land. Thus a watershed may be too large for the students to comprehend or to monitor or to make any watershed level calculations.

Thus it may be suggested that if there is a clear demarcation of a village (settlelment, crop land and common land), then it could be selected as an ecosystem for monitoring.

For the proposed programme the village from where majority of the students come to the high school could be selected as the ecosystem for the study. It is better to avoid very large villages or small towns.

Among the list of parameters considered in this programme monitoring of some of the parameters should be restricted to the main ecosystem. This would enable students to make ecosystem level calculations. The students from this village ecosystem could be mainly involved in monitoring these parameters;

1. Climatic parameters.
2. Study of land forms and land use.
3. Trees on farms.
4. Sources of water and consumption levels of water.
5. Ground water status.
6. Livestock population dynamics.
7. Grazing practices and labour use.
8. Human population dynamics.
9. Human health.
10. Medicinal plants.
11. Study of bird diversity.
12. Study of plant diversity.
13. Sources of fuel and fuel gathering practices.
14. Crop production: Inputs and outputs.
15. End use of crop byproducts.
16. Electrification and electricity consumption.

Normally students would be coming to any highschool from several nearby villages. Then they could be involved in monitoring the following parameters;

1. Fodder consumption by cattle.
2. Food consumption.
3. Human health.
4. Soil organic matter status.
5. Biomass use as fuel for cooking.
6. Efficiency test for cook stove.
7. Wages and prices.
8. Diary of activities (of human and animal labour use).

However, the teacher is welcome to change the distribution of parameters among the villages depending on the number of students coming to the school from the main village ecosystem and other villages.

SAMPLE AND SAMPLING METHODS

AIM: 1. What is a sample, why sampling is necessary.

2. Describe different methods of sampling.

POPULATION: Population is any collection of people, animals or objects that we are interested in studying. The examples of populations are; A village, cattle in a village, school students, all the village land, total area under rice, a district etc.

SAMPLE: A sample is a portion, or part or a subset of the population of our interest. Example: out of 500 students in the school select 50 to study the height or weight. Out of 500 cattle select 50 cattle for measuring dung yield. This subset of 50 is called a sample. We select a sample to study the behaviour or characteristics of the population or to draw inferences about the population.

NEED FOR SAMPLING: We are interested in studying the characteristics of the population. For example, we may want to know the dung production in the village or fodder consumption in the village or weight of the cattle, etc. Say, if there are 1000 cattle in the village it is difficult, it is expensive and it requires large human effort to study all the cattle. Therefore we resort to selecting only a part of the population to draw conclusions on the population. Experience has shown that a study of a properly selected sample is as good as studying the whole population. Thus one can save money and human effort by studying a sample.

SAMPLE SIZE: The sample size depends on a number of factors

(i) level of confidence desired,
(ii) variability in the population being desired,
(iii) time available,
(iv) man power available and
(v) finance available.

For monitoring several parameters mentioned in this report, the sample size should be determined by the concerned teacher in consultation with the students. The factors that would determine the size in the present case are; (i) the number of students available, (ii) time frame available, (iii) willingness of the subjects (population) and (iv) facilities available (like number of balances or thermometers available).

The approximate size of the sample to be selected is given for each parameter seperately. Where-ever possible teachers are welcome to increase the sample size. " Larger the better" would be the phrase for sampling.

SAMPLING METHODS:

Once the sample size is decided the next question is who in the population or which objects are to be selected. The sample units or subjects should be selected without any bias to get correct information about the entire population. To estimate the dung production of the village cattle, if only huge cattle are included in the sample, the population estimate would be an over estimate.

1. SIMPLE RANDOM SAMPLING:

The widely used method of sampling without bias is the method of "simple random sampling". Here a sample is choosen so that each member of the population has the same chance of being selected. One procedure is to secrue a list of the entire population. Write the name or identifying number of each of its members on a slip of paper. Scramble the slips and select the desired number through lottery method.

2. STRATIFIED RANDOM SAMPLING:

If the population is heterogenous then simple random sampling may not give a correct picture especially if the size of the sample is small. If the population is made up of groups with homogenous characteristics, it is better to divide the population into groups. For example, to estimate the weight of cattle population or dung yields of cattle, it may be better to group them as calves, adult buffaloes and adult cows and then select the sample randomly from each of the groups. This method is called stratified random sampling. Here the population is sub-divided into sub-groups called strata (example; age, sex, land holding size, income). Then the sample is selected randomly from each stratum.

For monitoring most of the parameters given in this report a stratified random sampling method should be adopted.

CLIMATIC PARAMETERS

AIM:

1. To know the variations in maximum and minimum temperatures between-different parts of a day, -different months and seasons.
2. To measure the total rainfall, the distribution of rainfall and the dry periods during crop season.

WHY:

1. To get an idea of the variation in rainfall between different years.
2. It will be useful to correlate the rainfall (total and distribution) with crop yields, water inflow into village irrigation tanks or ponds or streams.

MATERIAL REQUIRED:

1. Maximum-minimum thermometer
2. Rainguage

LOCATION OF THE INSTRUMENTS:

1. The rainguage will have to be kept in fenced up area with no trees or buildings nearby. In the schools the rainguage may be kept on the roof of the building for convinience.
2. Thermometer: It has to be kept inside a wooden box with proper ventillation. Infact the thermal screen (box) has to be prepared according to specific measurements. In the absence of such a facility it may be hung inside the school building where there is adequate ventillation.

PROCEDURE:

1. The measurements have to be taken in the morning at 8 AM.
2. Record the temperature and rainfall if any in to the register.

ANALYSIS:

1. Prepare graphs of mean monthly or fortnightly maximum and minimum temperatures.
2. Prepare graphs of monthly or fortnightly rainfall data.

RAINFALL, MAXIMUM AND MINIMUM TEMPERATURE

	Mean Max. temperature	Mean Min. temperature	^ Total rainfall (in cms or mms)
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

DATA RECORDING SHEETS

Dates	January			February		
	Max. temp.	min. temp.	Rainfall in mms	Max. temp.	min. temp.	Rainfall in mms
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
27						
28						
29						
30						
31						

STUDY OF LAND FORM AND LAND USE

AIM:

1. To descirbe the nature of terrain in the neighbourhood of the school.

2. To relate human use pattern to the terrain and catchments.

2. WHY:

To understand how nature of land and water courses relates to human use of the resources.

3. MATERIALS

Village revenue survey numbers map, REQUIRED magnetic compass, 20 meters tape, nylon rope of 110 meters length with knots tied at interval of 10 meters can of yellow paint, a rope of 2 m length.

4. SAMPLING:

One straight line of 1 km (or more) length to begin at school and proceed in a direction passing through the most important public land used for grazing, fuelwood collection etc. in the village.

5. METHOD:

1. Along this transect of 1 km mark the spot every 10 meters and observe the following:

   a) Whether the slope of land is nearly flat, gentle, moderate, steep

   b) Whether there are any gullies within 2 meters of the spots

   c) Whether it is in a stream/river bed; if so width of stream and river bed at that point and whether the stream/river flows all around the year or if it is dry in some months

   d) Whether that spot is Government revenue or forest land, public land such as temple land, private land

   e) Whether there is any tree, or shrub within 2 m radius of that spot; if so its girth at 132 cm

   f) Whether there is any cultivated crop within 2 m radius of that spot, if so what crop in what season

g) Whether there is any building or well within 2 m radius of that spot, if so what kind of building and who owns that building.

6. ANALYSIS:

a) Proportion of land with different levels of slope

b) Proportion of land affected by gullies

c) Occurence of streams, rivers and their seasonality

d) Proportion of land under different ownership

e) Proportion of land under cultivation, wasteland, habitation

f) Proportion of land with some tree, shrub growth

g) What kind of land in terms of slope is under cultivation, habitation, wasteland etc.

h) What kind of land in terms of ownership is affected by erosion gullies

i) What kind of land in terms of ownership has more or less tree/shrub cover.

7. PROFORMA

PROFORMA FOR RECORDING INFORMATION AT EACH OF THE HUNDRED SPOTS AT TEN METER INTERVAL ALONG THE 1 KM TRANSECT

Sl. No.	Slope	Gullies	Stream/ river	Ownership	Girth at 132cm for trees	For shrubs height	Cultivated	Building

TREES ON FARMS

AIM:

1. Estimate the variety of trees on the farms and their end uses.
2. Monitor the growth rates of different tree species.
3. Record the species and number of seedlings planted or number of trees felled and their end use.

WHY:

1. What type of trees traditionally farmers used plant in the past and compare it with the species planted now.
2. Which trees grow faster and to learn the method of studying the growth rates.
3. What is happening to the tree resource? Which type of trees are being cut and why and what is their destination or end use.

MATERIAL REQUIRED:

1. Proforma
2. Measuring tape to measure girth at breast height (GBH).

SAMPLING:

1. If possible select all the 8th standard studensts so that they can monitor the trees for 3 years (8th to 10th Standard).
2. A sample of 10-15 farms is adeqate. Select as many as possible from 8th standard and the remaining could be selected from 9th standard. Try to include small and large farmers in the sample.

METHOD

1. On the selected farms let them
   - list all the trees including seedlings planted.
   - Make a paint or colour mark on tree trunk at 132 cms from ground.
   - Measure the girth of the tree at 132 cms above the ground for all the trees on the farm.

- Record the species of seedlings and number planted during the year.

- Record the trees felled during the year, its destination and end use.

2. Let them repeat all the measurements during the second and third year.

3. Girth of all the trees should be measured again after one year on the same mark (at 132 cms) to estimate the increment in girth in one year.

ANALYSIS

1. Estimate the tree population and diversity of trees on the farms.

2. Growth rate of different tree species.

3. Rate of tree depletion and regeneration.

1. Tree population and diversity on farms

Farm No.	No. of trees	No. of species	Type of trees (main use)					
			Fruit	Timber	Leaf manure	Fodder	Fuel	Others
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								
Total								

2. Grow rates of plants

	Initial girth cms	Final girth cms
Species A: 1. 2. 3.		
Species B: 1. 2. 3.		

3. Rate of tree felling or planting during the year

Farm No.	No. of seedlings planted	Which type			No. of trees felled	Destination			End use of felled tre		
		Fodder	Timber	Fruit		Family	Locally	Exported	Fuel	Timber	others
Farm 1. 2. 3.											
Total											

4. Number of tree seedlings planted or trees felled according to species

Species	No. Planted	No. felled	Total No present *
1. 2. 3. 4.			

* Here data from all the farms should be considered together.

PROFORMA

TREES ON FARMS

Name of farmer	Species	No. of trees present	Main end use	Secondary end use	No. of seedlings planted during the the year	No. of trees felled during the year	Destination (family, locally, export)	Enduse of of felled trees
1.	1. 2. 3.							
2.								

PROFORMA

GROWTH RATES OF TREES

Species	Girth at period 1	Girth at period 2	Girth at period 3
Species A 1. 2. 3. 4.			
Species B 1. 2. 3. 4.			

SOURCES OF WATER AND CONSUMPTION

LEVEL OF WATER

AIM:

1. To know the sources of water for drinking in the village.
2. To estimate the quantity of water consumed per capita per day.
3. Study if any differences in water use levels among different castes.

WHY:

1. Quantity of water consumed is one of the indicators of health. The consumption levels give an idea of the state of health.
2. The source of water is also an important factor. For example the borewell water is safer to drink than say tank water. The quantity of water consumed also depends on the location of the sources. What is the status in the selected village?

MATERIAL REQUIRED:

- Proforma
- Volume of pots

SAMPLE:

1. Select the households of the students for recording the quantity of water consumed. A sample of about 15-20 households is adequate. If possible select different caste households in adequate numbers.

METHOD:

1. In the selected houses, let them record the number of trips made and number of pots fetched, source of water and size of the family.
2. The data collection should be repeated for 3-4 days.

ANALYSIS:

1. Water consumption per capita per day.
2. Dependance of households on different sources.

1. Water Consumption

Household name	Size of the family	No.of days monitored	Total quantity of water	(Size of family)* (No.of days)
1	2	3	4	5
Caste A 1. 2. 3.				
Caste B 1. 2. 3.				

- Water consumption per capita per day

$$= \frac{\text{sum of total quantity of water}}{\text{sum of [(size of family) x (No.of days monitored)]}} = \frac{\text{sum of 4}}{\text{sum of 5}}$$

- Differences among castes could be studied by considring data for different castes using the above procedure.

2. Dependance of households on different sources

Sources	No. of house holds depending	%
Total		

PROFORMA

WATER CONSUMPTION

Name of the household	Size of the family	Days or dates	Quantity of water con-consumed (pots, buckets, litres)	Source	No. of trips made/ day	No. of pots/ trip	Caste
1. 2.		1. 2. 3. 4					

GROUND WATER STATUS

AIM:

1. To record the ground water level fluctuations in different months.

WHY:

1. It helps to understand the fluctuations in ground water status or level - among different seasons and from year to year.
2. When recorded over a number of years, it gives an idea of the levels of depletion or recharge.
3. It is possible to correlate ground water level with rainfall.

MATERIAL REQUIRED:

1. Measuring tape and string.

SAMPLE:

1. Select all the drinking water wells in and around the ecosystem.
2. Also select a few (say about 5) irrigation wells, as far as possible unused or less used ones.

METHOD:

1. Let them fix a point at the top of the well and mark it with a peg or stone or paint.
2. The string (with graduations) with a weight should be inserted from the reference mark, till it touches the water. Then lift the string and measure it with a tape.
3. Ground water measurements should be recorded once in a fortnight.
4. In the case of irrigation wells, record the water level after a couple of days after the previous irrigation.

ANALYSIS:

1. Prepare graphs of the ground water level in the wells.

PROFORMA

GROUND WATER STATUS

(in meters)

Fortnight	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6

LIVESTOCK POPULATION DYNAMICS

AIMS:

1. To estimate the livestock population.
2. To understand the composition of livestock; cows, sheep etc.
3. To understnad the purpose for which each type of livestock is domesticated.

WHY:

1. It helps to estimate: the fodder consumed in the village, the total quantity of dung available, biogas potential etc.
2. It is possible to estimate the changes in animal population from season to season and year to year
3. It is possible to study the purpose of maintaining the livestock

MATERIAL REQUIRED : Proforma

METHOD:

-Ask all the students from that ecosystem to list the livestock of their families in the proforma.

-For recording the animal population in other houses select 5 students and let them record the population data in the proforma.

-If possible let them collect the data at 2 periods; summer/beginning of the crop season and in winter/end of the crop season.

ANALYSIS:

1. Estimate the total livestock population.
2. List the population of animals according to purpose of maintenance.

1. Livestock population:

	Total population -Period I	Total population -Period II
Bullocks		
Cows		
Buffaloes		
Calves		
Sheep		
Goats		
Others		

2. Purpose of maintaing the animals

	Ploughing	Milk	Dung	Meat	Others
Bullocks					
Cows					
Buffaloes					
Calves					
Sheep					
Goats					

PROFORMA

LIVESTOCK POPULATION:

House No.	Bullocks		Cows		Buffaloes		Calves		Sheep		Goats		Pigs	
	No.	Purpose	No.	Purpose	No.	Purpose	No.	Purpose	No.	Purpose	No.	Purpose	No.	Purpose

GRAZING PRACTICES AND LABOUR USE

AIM:

1. Locations of grazing lands.
2. Extent of grazing on farms, village common lands and forests.
3. Man, woman and child labour use for grazing livestock.

WHY:

1. To know the extent of dependence on common lands for grazing and highlight the role of grazing lands.
2. What is the extent of human effort involved for taking the livestock for grazing
   - This reflects on the scarcity of fodder or grazing land.
3. Helps to plan strategies to meet the fodder needs and to protect grazing lands.

SAMPLE:

1. Select about 15 students who own livestock. Let the sample comprise as far as possible about 5 landless, 5 small farmers & 5 large farmers. At least make sure the sample consists of different categories of households. Let the sample cover households owning cattle and sheept+goats.

METHOD:

1. List all the locations where livestock of the ecosystem graze, and approximate area in acres, if possible.
2. Records for the selected families man, woman and child labour use for taking livestock for grazing in the proforma.
3. Record the livestock grazing practices;
   - whether cattle and goats are taken to separate grazing locations or same location.
   - whether households take cattle for grazing separately or send all the village cattle together.
4. If possible let the students record the locations of grazing land and human labour use for grazing at two periods; during rainy or crop season and after crop harvest.

5. It is ideal to monitor for one week, if not monitor at least for 3 days.

ANALYSIS:

1. Listing of locations of grazing during different seasons.

2. Grazing practices of cattle, sheep and goats.

3. Human labour use for grazing livestock.

1. Locations of grazing in the village ecosystem

	Cattle grazing locations	Sheep + Goats grazing locations	Approximate area
Crop season	1. 2. 3.	1. 2. 3.	
Summer	1. 2. 3.	1. 2. 3.	

2. Livestock grazing

	No. of house-holds
Cattle are grazed separately	
Sheep + Goats are grazed separately	
Cattle, Sheep and Goats are grazed together	

FODDER CONSUMPTION BY CATTLE

AIM:

1. What is the level of consumption of fodder by different animals; cows, bullcks, buffaloes.
2. Total quantity of fodder consumed in the ecosystem or village.
3. Type of fodder used for stall feeding.
4. What is the extent of import or export of fodder taking place in the ecosystem.

WHY:

1. It would be possible to estimate the shortage of fodder, extent of dependance on imports, differences among different animals in fodder consumption etc.
2. Data is necessary for planning fodder production strategies.

MATERIALS REQUIRED

1. Spring balance
2. Proforma

SAMPLE:

-select atleast

10-15 cows,
10-15 bullocks
10-15 buffaloes
10-15 claves
40-60 cattle

-First select the houses of the students and next select other househols.

-Select houses as far as possible with one type of animal say only cows or only bullocks

METHOD:

1. Weigh a bundle of straw and let the households use it for stall feeding.

2. Go after 24 hours and weigh the remaining fodder. The difference will give the fodder stall fed per day for the given number of animals.

3. Also record the type or species of fodder and number of animals.

4. If more than one type of animal is in the stall, try to keep a seperate account. If 2 or more of the same type of animal are in the stall, then data for all the animals could be collected together.

5. Repeat the observations for atleast 3 days in each of the selected house.

6. If possible monitor the feeding levels at two periods namely during rainy months and summer.

7. If any concentrates or grains are fed to cattle, let them record the quantity fed per day.

FODDER IMPORT OR EXPORT:

1. Select about 5 students for monitoring the import or export of fodder in large quantities through trucks or carts.

2. Record exports during harvest time, imports at the beginning of the crop season or in summer.

3. Record only the number of bundles or carts or trucks involved in the import/export of straw

4. By counting the number of bundles and recording weight of a sample of bundles, total weight could be calculated.

ANALYSIS

1. Estimate the fodder consumed/day for cows, bullocks, buffaloes, calves.

2. Estimate the total quantity of fodder consumed in the ecosystem.

3. Types of fodder used.

4. Quantity of fodder imported and exported

2. TYPE OF FODDER FED TO CATTLE

Type of fodder	No. of Houses

type: species, part of the plant

3. IMPORT AND EXPORT OF FODDER DURING THE YEAR:

	Tonnes
Total quantity of fodder imported	
Total quantity of fodder exported	

PROFORMA

FODDER CONSUMPTION BY CATTLE

Name of the Household	Animal type	Number of cattle	Initial wt. of fodder	Final wt. of fodder	Type of Fodder used

QUANTITY OF FODDER IMPORTED AND EXPORTED:

Date	No. of cart or truck-loads or bundles-imported	No. of cart or truck-load or bundles- exported

MONITORING DUNG YIELDS

AIM:

1. To estimate the dung availability at family level and at village level.
2. To estimate the dung yeilds of cows, buffaloes bullocks and calves.

WHY:

1. To study the biogas potential and nutrient nitrogen potential.
2. Estimate the possibility of meeting the cooking energy needs.

MATERIALS REQUIRED: Spring balance, proforma

SAMPLING:

-Select about 10 cows, buffaloes, bullocks and calves each.
-It is bettter to first select the houses of students who have only one type of animal say, cows.
-If it is not possible to select such houses, ask students to monitor the dung seperately in the cattle sheds.
-If 10 of each type of animal is selected, total sample size= 40 animals.

METHOD:

1. Dung yield has to be measured seperately for stall collection during night and day and if possible on a few occasions during grazing or working periods.
2. Use spring balance for measuring dung yields.
3. The spring balances could be given to different students on rotation
4. Dung yield should be monitored for each animal preferably for 2-3 days.
5. Enter the data in the proforma.

ANALYSIS:

1. Per animal per day dung yield
2. Total dung availability per day for the whole village
3. Biogas potential of selected households
4. Biogas potential at community level

ESTIMATION OF DUNG YIELD

House No.	Cows			(No. of days)* (No. of cows)
	No. of cows	No. of days	Total dung	

- Dung yield/cow/day=

$$\frac{\text{(Sum of total dung)}}{\text{Sum of (No. of days * No. of cows)}} = \frac{\text{Sum of 4}}{\text{Sum of 5}}$$

-Total dung yeild of all cows in the ecosystems

=(No. of cows*Dung yeild/cow/day *365 days)

-Similarly dung yields could be estimated for buffaloes, bullocks and calves

-Cattle population data could be obtained from the earlier studies

BIOGAS POTENTIAL AND REQUIREMENT FOR COOKING

Biogas requirement/head/day	300 litres
Biogas production/Kg of fresh dung	40 litres
Biogas requirement for a family	(300lit/head)*(Size of family)
Dung requirement	$\frac{(300\text{lit/head})*(\text{Size of family})}{40 \text{ litres/Kg of dung}}$

-Biogas requirement and biogas potential available could be estimated at village level for a community biogas plant.

-It is also possible to estimate the conservation of fuelwood if biogas is used for cooking.

-Ask students to estimate biogas potential for each family.

PROFORMA FOR RECORDING THE DUNG YIELD

1. Name of the head of the family: ----------

2. Students Name: ----------

Date/ day	Number of animals	Dung yield		
		Stall Collection	Working/ grazing	Total yeild

HUMAN POPULATION DYNAMICS

AIM:

1. To estimate the total population of the ecosystem and the composition of the population.
2. To record births and deaths.

WHY:

1. To get an idea of the growth rate of the population and the distribution of population according to age.
2. How may are born each year and how many die.
3. Population data is necessary for making calculations on resource use or resource requirement.

MATEIRAL REQUIRED:

Proforma

METHOD:

-Select about 2-3 students.

-Let them record the population of the ecosystem in the proforma once during the year according to age group.

-Let them also record the deaths and births during the year.

-In villages births and deaths are generally known to all.

ANALYSIS:

1. Calculate the total population and composition of the population-men, women, children.
2. Estimate the total births and deaths during the year.

Population of the Village:

	Total at the beginning	Total No. of births	Total No. of deaths	Population at the end of Year
Adult men Adult women Children (5-15 yrs) Children (0-5 years)				

PROFORMA

HUMAN POPULATION

Sl. No.	Name of the household	Adult men	Adult women	Children		Total family size
				0-5 yr	6-15 yr	

PROFORMA

FOR RECORDING- DEATHS & BIRTHS

Sl. No.	Name of the household	Births		Death	Appox. age at death
		Boy	Girl	Boy, Girl, Man, Woman	

FOOD CONSUMPTION

AIM :

1. Composition of foods - cereals, pulses, oil, milk, meat etc.
2. Food consumption levels.
3. Variations in food intake between different categories.

WHY :

1. To know quality of food intake.
2. What is the extent of malnutrition.
3. It helps to plan strategies to correct the deficiency.

SAMPLE :

- Select mainly the families of the students
- Select about 15 families such that it will include as far as possible about 5 poorer (landless), 5 small farmers and 5 affluent (large farmers, teachers etc.) households.
- Preference could be given to girl students for monitoring.

METHOD :

- In the selected families let the students record the quantity of each food item in the proforma in their own local units.
- It will be ideal to record for one week during summer and one week after the harvest to account for day to day and seasonal variations. However, if it is not possible to monitor for one week let them record for at least 2 to 3 days in each family in both the seasons.
- Let them record in any units like : cups or bottles or local units. If in monetory units, convert it to physical units by considering market price.

ANALYSIS :

1. Food consumption/capita/day
2. Variation in food consumption among different categories
3.

1. Food consumption per capita per day

	units	Consumption per captia/day
Cereals 1. 2.		
Pules 1. 2.		
Oil		
Vegetable		
Milk		
Meat or Fish		

2. Variation in food consumption among different categories of households.

	units	Category 1 (landless)	Category 2 (large farmer)	Category 3 (small farmer)
Cereals 1. 2.				
Pules 1. 2.				
Oil				
Vegetable				
Milk				
Meat or Fish				

PROFORMA

Food consumption data

(in local units)*

House number/ name	Size of family	Day or date	Cereals		Pulses		Oil	Milk	Meat or fish
			1	2	1	2			
1		1 2 3 4 5 6 7							
2		1 2 3 4 5 6 7							
3		1 2 3 4 5 6 7							

* use units like kgs, grams, cups, bottles, local measuring jars and in monetary units in some cases.

HUMAN HEALTH

AIM : 1. To list the occurance of different diseases.

2. To study the sex, age and seasonal specificity of different diseases.

3. Which are the fatal diseases - deaths due to diseases.

WHY : - It gives an understanding of the occurance of diseases plus its sex, age and seasonal specificity.

- This knowledge helps to plan strategy for controlling the diseases as some are water borne and many are contagious.

- It gives an idea of the health status of the village.

- It is possible to calculate infant mortality rate etc.

MATERIAL REQUIRED : Proforma.

SAMPLE : 1. Select all the students and their families.

2. In addition let each student select 3 to 5 families with which they are very familiar for monitoring.

3. The sample should include families belonging to different categories; landless, small and large farmers.

METHODS : 1. Let the students record the occurance of all the diseases in their family and the selected families. The details to be recorded are given in the proforma.

2. Students who are in 8th standard could continue to record for two more years.

3. Deaths due to diseases should be recorded for the whole village or ecosystem.

ANALYSIS : 1. Seasonality of the diseases.

2. Age and sex specificity of the diseases.

3. Deaths due to diseases.

1. Seasonality of the diseases

	No. of cases reported					
	Disease 1	Disease 2	Disease 3	Disease 4	Disease 5	Disease 6
June						
July						
August						
September						
October						
November						
December						
January						
February						
March						
April						
May						

2. Age and sex specificity of the diseases

Age (years)	No. of cases reported					
	Disease 1	Disease 2	Disease 3	Disease 4	Disease 5	Disease 6
Male						
< 1						
Female						
Male						
1-5 years						
Female						
Male						
6-15 years						
Female						
Male						
15-60 years						
Female						
Male						
> 60 years						
Female						

3. Deaths due to disease

Diseases	< 1 year		1-5 years		6-15 years		15-60 years		> 60 years	
	M	F	M	F	M	F	M	F	M	F
Disease 1										
Disease 2										
Disease 3										
Disease 4										

PROFORMA

Monitoring human health

Family name	Disease	Approximate age of person	Sex	Month	Record if any death

MEDICINAL PLANTS

AIM : 1. To list the names of the medicinal plants used in the region.

2. To which ailment these herbs are used.

3. Location of different herbal plants.

4. If any medicinal plants are extinct from their environment.

WHY : - The practice of using herbal medicines is on the decline. Thus it is necessary to list them and to learn about them.

- This shows the need to conserve and protect such plants for future use.

- It gives an idea of the role played by plants and the self reliance of the medical system depending on herbs.

METHOD : 1. Ask all the students to enquire from their family members and others the plants used as medicine and for which ailment.

2. Ask students to record if any herbal plants are used in their family during the year.

3. Let them record the location of plants.

ANALYSIS : 1. Plants, diseases for which used and location of plants.

2. Extent of use of medicinal plants during the year.

1. Herbal plants, diseases for which used and location of these plants

Plants	Disease for which used	Location of the plants	Part of the plant used

2. Extent of use of medicinal plants during the year

Students name	Plant used	Disease for which used	From where obtained

PROFORMA

MEDICINAL PLANTS

Plant	Which part used	For which disease	location of plant in or out-side village	If used during the year in family	From where obtained	Does it exist in your village

ESTIMATION OF ORGANIC MATTER CONTENT IN SOIL

AIM: To estimate the organic matter status of soil.

WHY: IMPORTANCE OF ORGANIC MATTER FOR PLANT GROWTH:- Organic matter influences physical, chemical and biological properties of soils. It serves as an abode for organisms, provides nutrient and energy material, and abets the effects of mineral colloids. It exerts a strong influence upon the formation of structural aggregates, retention of moisture, and absorption of nutrient ions. In many soils, organic matter is synonymous with soil fertility.

THE WET DIGESTION METHOD:- This is also known as "Walkley and Black's Rapid titration method". By using this method, a large number of samples can be analysed in a day.

PRINCIPLE:- A known weight of the soil is treated with an excess volume of potassium dichromate ($K_2Cr_2O_7$) solution in the presence of concentrated H_2SO_4. The soil is digested by the heat of dilution of H_2SO_4 and organic carbon in the soil is thus oxidized to CO_2. The excess of $K_2Cr_2O_7$, unused in oxidation is titrated back against a standard solution of ferrous ammonium sulphate in the presence of NaF or H_3PO_4 and diphenylamine solution as indicator. At the end point, the colour of the suspension changes from violet, through blue to bright green.

REAGENTS REQUIRED :

1. 1N $K_2Cr_2O_7$ solution:- Dissolve 49.04 g of $K_2Cr_2O_7$ in distilled water and make upto 1 litre.

2. 0.5 N Ferrous ammonium sulphate (Mohr's salt): Dissolve 392 g of Ferrous ammonium sulphate ($FeSO_4(NH_4)_2SO_4$. 6 H_2O) in distilled water, and add 15ml of Conc. H_2SO_4 and make up the volume to 2 litres with distilled water (or dissolve 196 g in water and make up the volume to 1 litre).

3. Diphenyl amine indicator: Dissolve 0.5g of diphenylamine in a mixture of 100ml of conc. H_2SO_4 and 20ml of distilled water.

4. Conc. H_2SO_4 (36 N)

5. Sodium flouride (NaF) powder or orthophosphoric acid (H_3PO_4) (85%)

APPARATUS REQUIRED : -500ml conical flask - 10 ml pipette - Burette - measuring cylinder - Analytical balance - spatula - 1 litre volumetric flasks.

METHOD :

1. Weigh 0.2 g of soil (which has passed through 0.2 mm sieve or remove gravel and powder the soil) into a 500 ml conical flask.
2. Add 10 ml of 1 N $K_2Cr_2O_7$ solution and shake to mix. (use pipette- 10ml)
3. Add 20 ml of Conc. H_2SO_4 from the sides of the flask. (use measuring cylinder)
4. Keep the contents of the flask undisturbed for 30 minutes to complete the reaction.
5. Add 3 g. of NaF or 10 ml of H_3PO_4 and 100 ml of distilled water and shake vigorously.
6. Add 10 drops of diphenylamine indicator which give violet colour to the suspension.
7. Titrate against 0.5 N ferrous ammonium sulphate solution till the colour changes from violet to bright green and note down the volume of solution used.
8. Carryout blank titration in a similar manner.

ANALYSIS : OBSERVATIONS AND CALCULATIONS:

-Weight of the sample = 'S' g

-Volume of 0.5 N ferrous ammonium sulphate solution used for blank titration. = x ml

-Volume of 0.5 N ferrous ammonium sulphate solution used for titration of the excess nascent oxygen. = y ml

Volume of 1 N $K_2Cr_2O_7$ used for the oxidation of carbon = $\frac{(x - y)}{2}$ ml

-1 ml of 1 N $K_2Cr_2O_7$ = 0.003 g of organic carbon

% of organic carbon in the soil

$$= \frac{x-y}{2} \times 0.003 \times \frac{100}{S} = A$$

% of organic matter = A x 1.724

INTERPRETATION:

% Organic carbon		Rating
< 0.40	-	low
0.4 - 0.75	-	medium
> 0.75	-	high

STUDY OF BIRD DIVERSITY

1. **AIM:** To describe the variety of birds in the village ecosystem.

2. **WHY:** The health of the ecosystem is reflected in the number of bird species it supports.

3. **MATERIALS REQUIRED** One wristwatch with seconds hand, and the availability of the permanently marked transect.

4. **METHODS:** Once a month between June to December in the morning between 7 a.m. to 9.30 a.m. a group of 5-10 students should move along the transect, stopping for one and a half minutes at each marked spot and noting how many different kinds of birds can be seen at each spot. The local Kannada or English names of the birds, if any are known should be recorded.

5. **ANALYSIS:**
   1. Number of bird species in different kinds of lands,, with different types of crops, tree cover etc.
   2. Compare the results with those from other parts of the State.

6. **PROFORMA FOR RECORDING INFORMATION AT EACH SAMPLED SPOT**

DATE OF OBSERVATION:

Sl.No. of spot	Local or other known name of the bird, or unknown 1, unknown 2, etc.	

STUDY OF PLANT DIVERSITY

AIM: To describe the variety of plant species in the village ecosystem.

WHY: Soil and climate and land use all determine the number of plant species in a given area.

MATERIALS REQUIRED: Transect with 100 spots already marked 5 meter tape, 2 meter rope.

METHODS: Once each month from June to December, observe an area of every tenth spot beginning with 6 for June, 7 for July, 8 for August, 9 for September, 10 for October, 1 for November and 2 for December for all seasonal plants observe all 100 spots just once a year for shrubs, perennial climbers and trees. Ignore if the spot falls on a water body or a building. Identify how many different kinds of plants there are at each spot, note their local names if known.

ANALYSIS:

1. Number of species of plants classified as seasonal herb, perennial herb, seasonal climber, perennial woody climber, shrub (with woody stem), tree in different kinds of lands both in terms of whether it is cultivated land, wasteland etc. and in terms of slope.

2. It would be of great interest to compare such information from different parts of state by pooling it together from different schools.

PROFORMA FOR RECORDING INFORMATION AT EACH SPOT SAMPLED FOR HERBS OR SEASONAL CLIMBER (Only one record for each species)

DATE OF OBSERVATION:

Sl. No.	Seasonal herbs	Perennial herbs	Seasonal climbers

Record local names or as unknown 1, unknown 2 etc.

PROFORMA FOR RECORDING INFORMATION AT EACH SPOT SAMPLED FOR SHRUB AND TREES: Record separately for each individual shrub or tree.

Sl. No.	Shrubs		Trees		Woody climbers
	Name	Height	Name	Girth at 132 cms	Name

Record the local names, if not known record as unknown 1, unknown 2, etc.

BIOMASS USE AS FUEL FOR COOKING

AIM:

1. Which are the types of biomass used as fuel for cooking.
2. To estimate the quantity of biomass used as fuel for cooking, per capita and at village level.

WHY:

1. To get an idea of the extent of requirement or scarcity of fuel.
2. To generate data for planning biomass production strategies.

MATERIALS REQUIRED:

1. Spring Balance
2. Proforma for recording the data

SAMPLING:

1. Proper sampling is required as per capita fuel use may vary for different communities.
2. Grouping or stratification of households: Households are generally grouped based on the economic status in other words Land holding size or income.
3. Sample size: About 40 to 60 households have to be selected

Landless	: 10 -15
Small farmers	: 10 -15
Large farmers	: 10 -15
Other groups	: 10 -15
	40 -60

METHOD:

1. Select the households in consultation with the students. Students households could be selected first.
2. In the selected houses, let the students weigh a bundle of fuel and record it as the initial weight of fuel. Also record the species and type of fuel used and the size of the family.
3. Let them go after 24 hours and record the weight of the remaining fuel.
4. The difference in weight will give the fuel consumption for that family for one day.

5. Ask them to repeat the measurement for a period of atleast 3 days to account for day to day variations. If possible, one week is the ideal period.

6. Let them go for measurements on normal days and avoid festival or fasting days.

ANALYSIS:

1. Estimate fuelwood used/capita/day
2. Estimate fuelwood used/year in the ecosystem
3. Analyse the type of fuel used

1. FUEL USE PER CAPITA/DAY

House No.	Size of Family	No. of Days	Total Fuel used	(Size of Family) * (No. of days)
1	2	3	4	5

- Fuel use per capita/day

$$= \frac{\text{Sum of total fuel used}}{\text{Sum of(size of family * No. of days)}} = \frac{\text{Sum of (4)}}{\text{Sum of (5)}}$$

- Fuel use estimate for the community/year

= (Fuel use/capita/day) * (population) * 365 days per year

- Fuel use could also be estimated for each category or group and summed up to get the community level data.

- 2. SPECIES USED AS FUEL:

Species of tree/crop	No. of houses using
Trees: 1 2 3 4	
Shrubs: 1 2 3	
Crops: 1 2 3	

-3. TYPE OF FUEL USED MAINLY:

Type of Fuel	No. of houses using
Twigs	
Leaves	
Cut wood	
Dung	
Crop residue	

* type: twigs, leaves, cutwood, dung, crop residue.

PROFORMA FOR ESTIMATING FUEL USE:

1. Name of the head of the family: _____

2. Group/strata: _____ 3. Size of the family: _____

4. Fuel use

Date/ day	Type of fuel *	Initial weight	Final weight	Difference	Species

* Record: Twigs or cut wood or leaves or thorns or crop residue. Write down the species of the fuel.

SOURCES OF FUEL AND FUEL GATHERING PRACTICES

AIM : 1. Which are the sources or locations for obtaining fuel for cooking.

2. Man (M), Woman (W) and Child (C) labour use for gathering cooking fuel.

WHY : 1. Gives an idea dependance of the ecosystem on different locations. What is the role of commonlands in supplying cooking fuel needs of the village.

2. What is the human effort involved in gathering cooking fuel.

3. Distance of the location and extent of human labour involvement are the indicators of the scarcity of cooking fuel.

MATERIAL REQUIRED : Spring balance and proforma.

SAMPLE : The households of students could be selected for monitoring the sources of fuel, location of fuel source and human labour use. About 15 families representing the landless small and large farming families could be selected.

METHOD : 1. Let the students list all the locations from where cooking fuel for the village settlement is obtained.

2. Let the students record the source of fuel, location of the fuel source and M, W and C labour use for gathering cooking fuel for a period of about one week.

3. If possible record the above information at 2 periods; during cropping season and post-harvest season.

4. Data on quantity of fuel gathered could be recorded as headloads or as cartloads. A sample of headloads could be weighed to estimate the weight of a bundle. If possible attempt to weigh a cartload of wood.

ANALYSIS : 1. Location of gathering cooking fuel.

2. Quantity and type of fuel gathered.

3. Labour use for gathering fuel.

1. Location of gathering cooking fuel

Family	Location of fuel source	
	1	2
1 2 3		

2. Quantity and type of fuel gathered/week

Family	No. of head-loads gathered	Weight of fuel gathered	Type of fuel gathered; mainly				Source; mainly	
			Twigs	Leaves	cut wood	others	Trees	Shrubs

3. Labour use for gathering fuel/week

Family No.	No. of trips/week	Who gathered:No. of days			Total hours spent for gathering			If cartloads No. of loads
		M	W	C	M	W	C	
Total								
Mean								

PROFORMA

FUEL GATHERING PRACTICES

Family	Days	No. of trips made	Location	Distance	Time taken to reach	Who went for gathering			Time-hours		Type of fuel gathered	How many	
						M	W	C	From	To		Headloads	cartloads
1	1												
	2												
	3												
	4												
	5												
	6												
	7												
2	1												
	2												
	3												
	4												
	5												
	6												
	7												

CROP PRODUCTION; INPUTS AND OUTPUTS

AIM:

1. Levels of use of inputs to different crops and different varieties.
2. Yield per ha of different varieties of each crop.

WHY:

1. Provides data on consumption levels of inputs and crop productivity.
2. It is possible to correlate inputs and crop yields.
3. It is possible to correlate rainfall with crop yields.
4. Variation in inputs and yields from year to year could be studied.

SAMPLE:

1. Select the students from farming families.
2. A size of sample of about 15 would be adequate. It may not be difficult to get 15 students from farming families.
3. Make sure to include small and large farmers in the sample.

METHOD:

1. Ask the students to record data on area, variety, inputs/acre/ha, yield/acre/ha in the proforma.
2. If crops are grown for more than one season let them record for all the seasons.
3. Data on inputs added could be collected during June, July & August and yield data during November and December.
4. Let them record the values in their local units and finally convert them to kgs/ha.
5. Fodder or straw yield could be obtained in terms of bundles, cart loads etc. Later a few sample bundles or cart loads have to be weighed using a spring balance.

ANALYSIS:

1. Area under different varieties, inputs/ha and yield/ha

1. Area under different varieties, inputs/ha and yield/ha

Season	Crop	HYV area	Local area	Fertilizer (Kg)			Manure -cart load -head load -trailor load	Grain yield Total	Grain yield/ ha	Straw or fodder yield/ ha
				Urea	Super Phos-phate	Others				

A

PROFORMA

CROP PRODUCTION: INPUTS AND OUTPUTS

Farmers name	Season	Crop	HYV area	Local variety area	Fertilizer (types) kgs			Manure* type, carts, baskets and trailor loads		Total grain yield	Fodder or straw yield*
					1	2	3	Type	Loads		
1.		1. 2. 3.									
2.		1. 2.									
3.											

* Fodder/straw/manure values could be recorded as bundles, bales, cart loads, tractor loads, baskets, or in money value. Conver them into kgs by measuring a sample.

ENDUSE OF CROP BYPRODUCTS

AIM:

1. To record the purposes for which the byproducts of each crop are used.
2. To monitor the quantity of byproducts used for different purposes.

WHY:

1. Helps to study the role played by the byproducts of crops in meeting the non-food biomass needs of the community.
2. To estimate the total magnitudes of different crop byproducts used for different purposes.
3. Is there any wastage of crop biomass?

SAMPLE:

1. Select the same houses selected for monitoring crop inputs and outputs.
2. Thus the sample size would be around 15.

METHOD:

1. Let the students record (i) the byproducts of each crop (ii) the end uses of these byproducts (iii) if possible the quantities involved in terms of bundles, cartloads, tractor loads etc. (iv) weights of a sample of bundles.
2. Field crops as well as plantation crops should be covered.

ANALYSIS:

1. Cropwise end uses of byproducts.
2. Quantity of byproducts and their end uses.

1. Cropwise end uses of byproducts

Crops	No. of farmers growing	Number of farmers using it as				
		Fuel	Fodder	Thatch	Manure	Unused

2. Quantity of byproducts and their end uses

Crops	Quantity of byproduct produced	End uses; % or quantity				
		Fuel	Fodder	Thatch	Manure	Unused

PROFORMA

ENDUSE OF BYPRODUCTS

Farmer	Crops	Variety	Area	Quantity of by-products - as headloads, cart or tractor loads bundles or kgs		Enduse observed; proportion or quantity*				
				Quantity	Units	Fuel	Fodder	Thatch	Manure	Unused
Farmer 1	Crop 1									
	2									
	3									
	4									
Farmer 2	Crop 1									
	2									
	3									
	4									

* Record the proportion as 1/4 or 1/2 or full. For recording quantities use local measures like bundles or cart/tractor loads or head loads etc. Finally convert all to kgs by measuring a sample of local units of measurement.

EFFICIENCY TEST FOR COOKSTOVES

AIM: To estimate the fuel use efficiency or thermal efficiency of traditional cook stoves and if any ASTRA stove or any other improved stove in that area.

WHY:

1. To teach the method of measuring efficiency of an energy device.
2. To expose them to the fact that some of traditional energy use systems have low energy efficiency.
3. What is the potential available for conserving biomass energy; an example of cooking fuel.

MATERIAL REQUIRED :

1. Thermometer,
2. 2 pan balance (if not available spring balance),
3. Vessels with lids,
4. Firewood,
5. Traditional stove + if any improved stoves like ASTRA stove.

SAMPLE:

- The minimum sample size; 2 traditional and 2 improved stoves.
- To get a reliable estimate at least 5 tests should be carried out on 5 different stoves. A mean value of the 5 stoves could be taken as the efficiency value of the stoves.
- If improved stoves are not there in that area, do not bother.
- Which type of stoves to be selected would depend on the dominant type of stove of that region. Say if the majority of the stoves are 2 pan or hole type, then select only 2 pan stoves. If 3 pan stoves are dominant then select only 3 pan stoves.

METHOD: 1. Stoves in the houses of students could be selected randomly.

2. Stove test should be conducted uniformly when the stove has cooled sufficiently after the previous cooking session.

3. As for as possible same vesssels should be used. Number of vessels to be selected would depend on the number holes in the stove; generally 2 or 3.

PERCENT HEAT UTILIZATION TEST

Thermal efficiency is the percentage of heat that is utilized by the water in the vessels in relation to the amount of heat produced by burning firewood in a stove.

$$PHU = \frac{\text{Heat gained by water in the pans}}{\text{Heat supplied by combustion of firewood}} * 100$$

STEPS:

1. Select 3 (or 2) pans or vessels. Give numbers to the pans and record weight of pans.

2. Add water to all the pans till about 3/4 is full and record the weight of pans + water.

3. Weigh about 1.5 to 2 Kgs of wood.

4. Keep the pans on the stove, record the initial temperature of water in the pans and close with lids.

5. Take a part of weighed wood and ignite the stove and record the time.

6. Record the temperature of water every 10 minutes.

7. Maintain the fire uniformly by pushing wood and adding wood.

8. When water begins to boil the lids are removed from the pans.

9. The run should be continued for 60 minutes.

10. At the end of one hour extinguish the fire and record the weight of - the remaining wood(final),
- charcoal,
- pans with water.

11. Calculate (i) the fuel wood used
=(Initial weight of wood - Final weight of wood)

(ii) water evoperated
=(Initial wt. of pan+water)-(Final wt. of pan+water)

Values given:

1. Calorific value of air dry wood: 3800 Kcals/Kg of wood
2. Calorific value of Charcoal : 6000 Kcals/Kg.
3. Latent heat of water : 536 Kcals/Kg.
4. Specific heat of water : 1 calorie/gm of water by $1^{o}C$

Calculate Heat gained by water:

1. Sensible heat gained =

(Initial wt. of water * total gain in temperature * Specific heat of water)

2. Latent Heat =

(Weight of water evoperated) * (Latent heat of vaporization of water)

3. Heat gained by water in the pans =

(Sensible heat gained + latent heat)

Calculate Heat supplied by wood:

= (wt. of firewood consumed * calorific value) - (wt. of residual charcoal * calorific value of charcoal)

$$PHU = \frac{\text{Heat gained by water in the pans}}{\text{Heat supplied by firewood}} * 100$$

Obtain the mean PHU and compare values for traditional and improved stove

PROFORMA

For recording experimental observations:

	Initial	Final
Wt. of pan 1		x
Wt. of pan 2		
Wt. of pan 1 + water		x
Wt. of pan 2 + water		
Wt. of wood		
Temperature		
Wt. of charcoal	x	

Definition of terms:

1. CALORIE: Is a unit of quantity of heat. The amount of heat required to raise the temperature of water through $1^{o}C$.

2. SPECIFIC HEAT: Is the heat required to raise the temperature of unit mass of a substance by $1^{o}C$.

3. LATENT HEAT OF VAPORISATION: The heat required to convert a unit mass of liquid to vapour at the same temperature.

4. LATENT HEAT: The quantity of heat absorbed or released when a substance changes its physical phase at constant temperature.

ELECTRIFICATION AND ELECTRICITY CONSUMPTION

AIM : 1. To record the levels and rate of electrification of houses, pumpsets and industries.

2. To estimate the electricity consumption.

WHY : 1. To get an idea of the consumption levels of electricity. The purpose for which it is used, and the rate of growth.

2. The extent of dependance of village on grid electricity.

MATERIAL REQUIRED : Proforma.

SAMPLE : - For recording the electricity consumption, the houses and pumpsets of the students could be selected first. A minimum of 10 houses (large and small) about 5 pumpsets, and all the industries in the ecosystem (like flour mill) could be selected.

METHOD : 1. Ask 2 or 3 students to list all the households, pumpsets and industries electrified in the village.

2. For the selected household pumpsets and industries let the students monitor the electricity use by recording the meter reading or the electricity use values from the bills. Let them record for one year.

3. Let the students record all the houses, pumpsets and industries newly elecrified during the study year.

ANALYSIS : 1. The total number of installations and new installations connected during the year.

2. Electricity consumption.

Number of electrical installations

Installation	Total number at the beginning	New installations serviced during the year
Houses		
Pumpsets		
Others (specify)		

Electricity consumption

Installations	Number of units measured	Electricity use/month (KWh)	Electricity use/year (KWh)	Total number of units in ecosystem	Total electricity use/year (KWh)
Houses					
Pumpsets					
Flour mill					
Others					
Total					

WAGES AND PRICES

AIM : 1. To record the variation in prices of commodities and wages; seasonal and yearly.

2. To record the variation in the price when farmers sell after harvest and the price at which it is sold in retail shops.

3. Wages of man, woman and bullock labour for different operations.

WHY : 1. Gives an idea of the fluctuations in prices and wages from season to season and year to year.

2. It is possible to study the difference in the changes of prices of inputs and outputs.

3. Seasonal variation in the wages of man, woman and bullock labour could be studied.

METHOD : 1. Select about 5 students from the farming families.

2. Let them record the prices of inputs and outputs in crop production and wages in the proforma.

3. Select 2 more students and let them record information on prices of non-agricultural commodities and wages.

4. Data should be collected at least for 2 periods; at the beginning of crop season and after the harvest of the main crop.

5. Let them record the values in local units. The money value of perquisites or foods given to workers should be included in determining the final wage rate.

6. Teachers are welcome add more articles for monitoring.

ANALYSIS : 1. Variations in prices of inputs and outputs in crop production; seasonal and annual.

2. Variation in wages.

1. Variations in prices and wages

	Units	Prices of output (selling)		Retail price/purchase price	
		Period 1	Period 2	Period 1	Period 2
FOOD GRAIN - Rice - Ragi - Jowar - Cow pea - Togare - Sheep mutton - Fish - Milk					

2. Prices of inputs

	Units	Price
- Fertilizers - urea - super phosphate - Manure/cartload - Others		

3. WAGES

	Units	Period 1	Period 2
- Man - Woman - Child - Bullock pair (ploughing) - Bullock cart - Mason			

PROFORMA

WAGES and PRICES

	Units	Farmer 1		Farmer 2		Farmer 3	
		Period 1	Period 2	P-1	P-2	P-1	P-2
FOOD GRAIN*							
- Rice							
- Ragi							
- Jowar							
- Cow pea							
- Togare							
- Sheep mutton							
- Fish							
- Milk							
OTHERS							
- Fertilizers							
- urea							
- others							
- Manure cartload							
WAGES							
- Man							
- Woman							
- Child							
- Bullock pair (ploughing)							
- Bullock cart							
- Mason							

*. For food grains; the price at harvest time and the retail price in the village should be recorded.

DIARY OF ACTIVITIES

(OF HUMAN AND ANIMAL LABOUR USE)

AIM : 1. To record the Man (M), Woman (W), Child (C) and Draught animals (A) labour use for different activity in typical a day.

2. Type of activity carried out by M, W, C and A in different seasons.

3. To maintain a diary for the selected families.

WHY : 1. To know the extent of employment or unemployment of M, W, C and A labour in different seasons.

2. Share of burden of farm and domestic work among M, W and C in a family.

3. Seasonal characteristics of employment of M, W, C and A labour

4. Differences in employment characteristics (type of activities) of M, W, C and A in different categories of households.

SAMPLE : - Select about 2 landless labour, 2 small farming, 2 large farming and 2 other (fishing/trade/service) families.

- Select the families of the students. Let them monitor their own families.

- If all categories of households cannot be selected from among the students it is okay.

- Select such students who like this type of detailed recording.

- If possible increase the size of sample from 2 to 4 for each category.

- The students should have a wrist watch or a clock in their family.

METHOD : - Let the student record the deployment of M, W, C and A labour belonging to their family for different activities in the proforma given in a note book on the selected days.

- Let the students record the data on holidays, saturdays and sundays. Give them freedom to do it on the days they are free. As they have to be at home or on the farm.

- In addition to sundays insist on including the holidays in different seasons for monitoring. During October holidays they could record at a stretch for a few days or a week.

- Let them select normal days and avoid festival days.

- Make sure the number of days monitored includes all the seasons :

10 days	-	at the beginning of crop season
	-	June, July and August
10 days	-	at the end of crop season
	-	October, November and December
10 days	-	during summer month
	-	may be after their examinations.

PROFORMA

Diary of Activities for household

Date	No. of men	ADULT MEN Time (Hours) From	To	Activity	Date	No. of Women	ADULT WOMEN Time (Hours) From	To	Activity

PROFORMA

CHILDREN					DRAUGHT ANIMALS				
Date	No. of men	Time (Hours) From	Time (Hours) To	Activity	Date	No. of Women	Time (Hours) From	Time (Hours) To	Activity