UNIT 8:
Field Work

8.1 VISIT TO A LOCAL AREA TO DOCUMENT ENVIRONMENTAL ASSETS RIVER/FOREST/GRASSLANDS/ HILL/MOUNTAIN

Background

Documenting the nature of an ecosystem gives us a deeper appreciation of its value to mankind. Each ecosystem has something different to offer us. It may contain natural resources that local people depend on; or provide important ecological functions for us all; or have tourist or recreational potential; or simply have a strong aesthetic appeal that is difficult to quantify in economic terms. In fact it can have multiple benefits for mankind at global, national and local levels. An ecosystem is not only used by different cultures and socio-economic groups in various ways, but has a different significance for different individuals depending on their way of life. A tribal from a wilderness setting, an agriculturalist from farmlands, a pastoralist from grasslands, or a fisherman looks on his or her environment very differently from an urban resident who is mainly focused on the management of the quality of air and water and the disposal of garbage. In many cultures, men and women will have different views and relationships with Nature. In rural India, for example, it is mostly women who collect resources and see the degradation of their ecosystem as a serious threat to the existence of their family and are thus more prone to fight against processes that lead to loss of their resource base.

Tribal people who live by hunting and gathering have a deep understanding of nature and what it provides for them to survive. Farmers know about utilisation of their land and water resources, and also appreciate what droughts and floods can do to their lives. A shepherd or livestock owner knows the grasslands intimately. In contrast, urban dwellers are far removed from the sites from where they get their natural resources. As these have originated from a remote area and have been collected by rural people, they cannot relate so easily to the value of protecting the ecosystems from which the resources have come.

In assessing an ecosystem's values it is not enough to look at its structure and functions, but at who uses it and how the resources reach the users. One also needs to appreciate what it means to oneself. The wilderness provides a sense of wonderment for all of us, if we experience it in person. This helps to bring about a desire to conserve natural resources.

Guidelines for the study of environmental assets:

There are two parts to this study:

1. Documenting what you see.

2. Documenting the findings of what you ask local user groups.

There are several key questions that one should attempt to answer in a study of any ecosystem's natural resources.

1. What are the ecosystem's natural resource assets?
2. Who uses these and how?
3. Is the ecosystem degraded? If so how?
4. How can it be conserved?

One could go into enormous detail in answering these four basic questions. You will need to refer to relevant chapters in this textbook, the guidelines provided in this Unit, as well as field guides to plants, insects, birds, etc.

You should begin your field study by observing the abiotic and biotic aspects of the ecosystem and documenting what you see. Ask questions to local user groups about their environment. Is their utilisation sustainable or unsustainable? Look for and document signs of degradation. Finally, study aspects that can lead to its conservation.

- Describe the ecosystem as you see it. Its structural nature, its quality and the differences one can perceive in its geographical features, and its plant and animal life. This takes time and patience. The more time one spends on a careful scrutiny, the more one begins to appreciate its intricacies.

- How does the ecosystem function? What are the linkages between different species with each other and with their habitat? Observe its food chains. Look at it as if it is an intricate machine at work.

- By interacting with local residents and multiple user groups, decide if this is sustainable or unsustainable utilization. If it is undisturbed, why has it remained so? If it is sustainably used, how is its use controlled? If it is degraded, how did it get to this state and when? If it is seriously degraded what measures would you suggest to restore it and to what extent could it be used so that utilisation would be sustainable?

You may not be able to observe all these questions during a single visit. You will thus have to ask questions of local people who have a stake in the area to answer these questions. You may need the help of an ecologist, botanist, zoologist, geologist, hydrologist or forester to get deeper insights. A historical background frequently helps to clarify many of these questions as landscapes are not static and always change over time.

Proforma for field work on documenting Environmental Assets of each ecosystem

Use the format below as a general guideline for your field analysis. The points provided in the guidelines can be used to fill in the answers to the various issues for each ecosystem.

The field work should be recorded in your Journal as:

Aims and objectives: To identify and document:

- What are the ecosystems goods and services? (checklist of resources)

- Who uses them and how?

- Is the utilisation sustainable or unsustainable? (signs of degradation)

- How can the ecosystem be used sustainably?

Methodology: - Observation of the ecosystem

- Questioning local people on the use of resources and sustainability.

Discussion: Observations on levels of resource use found during the field work.

Findings: Specific concerns relevant to the study site's sustainable utilisation as discussed with local people.

Results and Conclusions

Documenting Environmental Assets of each ecosystem

Documenting general features during the field survey: Describe the site and its features as provided in the proforma for fieldwork under the following headings – Aims and Objectives, Methodology, Observations on the site, Findings of interviews with local people, Results and Conclusions.

Documenting the special resource features of individual ecosystems

Once the general features are documented, observations pertaining to the specific features of the ecosystem must be documented.

The checklist on resource use of each ecosystem can help in creating an environmental profile of an area and will help in your appreciation of the ecosystem's goods and services, which include its important assets. However, this is to be used only as a guideline and a note needs to be prepared on each finding once you have made your observations and asked local people relevant questions about the ecosystem's resources in detail. Unless one does this for several different areas, one cannot really appreciate the assets of an ecosystem in clear terms, as these are often qualitative judgements that one makes by comparing the resources available in the study area with many others.

RIVER ECOSYSTEM

Guidelines on what to look for on river resource use:

- Observe what local people use from the river, wetland or lake:
  They collect drinking water and use it for other domestic needs. They catch fish and crabs, graze their cattle and buffaloes in or near the water. They lift water from the lake by pumps to irrigate their fields.

- Mapping land use in terms of its water resources:
  Document the pattern of landuse around the aquatic ecosystem –river, tank or lake, and assess the importance of the water resources in the ecosystem. Observe that all the animals both wild and domestic must come to the water source, or have its water brought to them.

- Field observations on a river front:
  1. *Observe a clean stretch of river in a wilderness area. The water is clear and full of life. In its many pools fish dart about. Tadpoles swim around and crabs crawl along the bottom of the water.*
  2. *In a rural area observe all the different ways in which people use the water from the river.*
  3. *Observe a river in an urban area, the water cannot be used for drinking as it is dirty. Observe the water in a glass – it is coloured – can we drink it! 'Who has polluted it and how?' This is a sign of unsustainable use of water.*

- Possible Observations:
  1. *Along a river in a forest observe all the different animal tracks at the edge of the water. All wildlife depends on this resource for their day-to-day survival.*
  2. *Identify the different fish that local fishermen have caught. Ask if the fish catch has decreased, remained the same, or has increased during the last decade or two.*
  3. *Resource use: Observe and document the different types of fish and other resources used by local people. Is this for consumptive or productive purposes.*
  4. *Observe how the ecosystem is utilized and document these assets – water distribution, fish, crustacea, reeds, plants used as food, any other resources.*

- In your report, compare and contrast an unpolluted and polluted body of water. Only the more robust species remain in polluted water while the more sensitive disappear.

Water – the greatest of all resources:
What do you use water for during the course of one day?
How much do you use?
Can you stop wasting water by using it carefully?
How can you reduce the water you use for bathing and other uses?
Discuss how wastewater can be used in the garden.
How can water be recycled?

Observations on the site that should be recorded:

- Type – Permanent flow/ seasonal flow. Slow moving/ rapid flow; deep/shallow.
- Qualitative aspects – Describe its abiotic and biotic aspects.
  – Is the flow natural or disturbed by a dam upstream?
- Describe its aquatic plant and animal life.
- What are the characteristic features of its components – banks, shallow areas, deep areas, midstream areas, islands. How is the land used?

Findings on the site that should be recorded through interviews:

- What is the water used for and in what proportion? – Domestic use/Agriculture/Industry.
- What other resources are used – fish, crustacea, reeds, sand, etc. What impact does the level of use have on the ecosystem?
- Is the water potable? If not what are the sources of pollution – domestic sewage/ agricultural runoff/industrial effluents. Which of these affect it most seriously?
- Extent of pollution – Severe/high/moderate/low/nil. Explain why.
- Test the water quality. What are the results of your water quality tests?
- What efforts are made to keep the river clean, or to clean it up?
- Is its utilisation sustainable or unsustainable?
- Provide a historical profile of and changes in its environmental status by asking local people.
- Does it flood? If so how frequently? How does this affect people? What preventive steps can be taken to prevent ill effects of floods?
- How can you enhance public awareness on the need for keeping the river clean?
- How are you dependent on the river ecosystem? How is it linked to your own life?
- Results of the water analysis.

FOREST

Guidelines on what to look for on forest resource use:

- Assessing forest use:
  Ask local people, especially the women, what products they collect from the forest. Document what they use for household use, those that are sold in the local market-place and those that are taken out and sold to other areas. Fruits, leaves, roots, nuts, fuelwood, timber, grass, honey, fiber, cane, gum, resins, medicinal products are all forest products of great value.

- Looking for signs of forest use:
  Several signs tell us how the forest is used by people.
  Look for human footprints and hoof marks of domestic animals, which demonstrates the dependence of man and his animals on forest vegetation.
  Observe the number of cattle tracks and cow dung piles, which tell where the local people graze their domestic animals. Specially look for cattle tracks near watering places. The zigzag paths on a hillslope that have very little vegetation cover are a sign of overgrazing.
  People cut the branches of the trees and shrubs for fuel wood. The amount of cut stumps of branches can be used to assess the level of utilisation. If the forest is seriously lopped all around, the forest clearly appears degraded. Most of the energy required to cook meals and heat their homes in winter is forest dependent. Ask local women how far they must travel for fuelwood. Larger stumps of tree trunks show the number of poles used for building houses, or that have been felled and sold as timber. Observe the environment in a neighbouring village. Look for the various products used by the people, or marketed by them, which they get from the forest.
  Where do local people get their water? The presence of water in the streams is dependant on the existence of the forest.

- Document the level of forest loss:
  Observe areas around villages where forest is overused and contrast this to the intact vegetation of Sanctuaries and National Parks. Are there signs of degradation of the canopy, formation of wasteland or signs of soil erosion?

- What are the products that you use in daily life that originate in forests?
  Examples: water, paper, wood, medicines. The oxygen we breathe is produced by vegetation etc. Draw up a list of articles you use that could have originated from a forest ecosystem.

Observations on the site that should be recorded:

- Identify the forest type – evergreen/ semi evergreen/ deciduous/ dry deciduous/ thorn forest.

- Is it a natural forest or a plantation?

- Observe its qualitative aspects – Undisturbed/ partially disturbed/ mildly degraded/ severely degraded.

Findings on the site that should be recorded through interviews:

- List its natural resources – goods and services.
  Goods- food, fuelwood, fodder, non-wood forest products, water, etc.
  Services- water regime, climate control, oxygen, removal of carbon dioxide, nitrogen cycle, etc.

- Who uses the ecosystem's natural resources and to what extent? List the level of use of each of its natural resources (sustainable/ unsustainable). Are these used for personal use, for marketing or for both? What proportion of the income of local people comes from the sale of fruit, fodder, wood, non-wood forest products?

- Make a map of the study area showing the different land uses and where resources are collected from.

- Provide a historical profile of its utilisation and changes in its environmental status by asking local people about their resource dependency.

- Is the ecosystem overused due to the number of people that depend on it, or the greed of a few, or both?

- Is it protected, if so how?

- If it is to be restored, how can one make this possible?

- What forest produce do you use in your day to day life?

GRASSLAND

Guidelines on what to look for on grassland resource use:

- Utilisation pattern of the grassland:
  Discuss with local people how they use the grasslands, grazing cattle, cutting fodder, collecting fuelwood from the shrub cover etc.

- Grassland carrying capacity:
  Observe the enormous quantity of grass needed for the number of domestic herbivores dependent on it. This is an indication of the 'carrying capacity' of the grassland, ie how many animals it can support.

- Mapping landuse in grassland areas:
  Near a village make a landuse map showing where the cattle are sent for grazing and for water, where people collect fuelwood, etc.

- Documenting grassland degradation:
  Document if there has been a change in landuse patterns during the last few decades by asking local people. Observe differences in protected and degraded areas.

- What are the products that you use that come from grasslands?
  Examples: milk, meat, etc.

Observations on the site that should be recorded:

- Identify the type of grassland – Himalayan/ Terai/ semi-arid/ shola/ area developed for grass collection/ common grazing land/ forest clearing.

- Qualitative aspects – Describe its abiotic and biotic features – Document the nature of its soil, plant and animal species (wild and domestic). How do they use their habitat?

- What changes occur seasonally?

Findings on the site that should be recorded through interviews:

- Who uses it and to what extent?

- Estimate the extent of free grazing – cattle, sheep, goats, and their proportion.

- Extent of fodder collection.

- What is the productivity of the grassland? Estimate from local people if the fodder is - Not enough for their own livestock/ just enough for their own livestock/ enough for their own livestock and to sell to other fodder short areas.

- Provide a historical profile of its utilisation and changes in its environmental status by asking local people.

- Is this utilisation level sustainable or unsustainable?

- Is the grassland burned too frequently? Document why local people burn the grass.

- Can they do a rotation grazing of their common grasslands and thus manage it better?

- What products do you use from grassland ecosystems in your daily life?

HILLSLOPE

Guidelines on what to look for on hill resource use:

Hills are fragile ecosystems that are easily degraded. They are however utilised by a variety of user groups. Understanding the level of pressure can be observed and its utilisation patters elicited from local people.

Observations on the site that should be recorded:

- Identify the type of hill – steep/ gradual slope. Top – peak/ plateau top.
- Qualitative aspects – Describe its abiotic (soil characteristics) and biotic (vegetation) characteristics.
- Describe its contour and make a map marking its features such as nala courses, rocky outcrops, precipices, springs.
- Describe if its soil cover is intact/ degraded/ partially or severely eroded.
- Is it covered with cattle tracks? Do hoof marks of domestic animals and their dung piles indicate excessive grazing?
- Describe its vegetation profile and map different vegetation patterns (tree cover, scrub, grass cover, bare rock).
- Identify the plants that grow on it (trees, shrubs, herbs, grasses) and wild and domestic animals present.

Findings on the site that should be recorded through interviews:

- What is it used for – Urban housing/ slum development/ tourism/ fuelwood collection/ grazing livestock/ collecting water from its watercourses/ greening. Observe the proportion or extent used for each purpose. Is it sustainable?
- Provide a historical profile of its utilisation and changes in its environmental status by asking local people.
- If it is eroded, what measures can be suggested to reverse the trend?
- How is this linked to your own life?

MOUNTAIN

Guidelines on what to look for on mountain resource use:

Mountains have very specialized ecosystems with clearly defined altitudinal variations. They are used by several different stake holders. Effects of human interference on mountains affect people in the valleys below.

Observations on the site that should be recorded:

- Identify the type – Himalayan range/ foothills.
- Qualitative aspects – Describe its abiotic and biotic features.
- Describe its topography and soil characteristics. Make a map marking its features. Snowcapped/ rocky precipice/ grassy slopes/ tree line. Discuss proportion of each type.
- Describe its plant and animal species. How do they use their habitat?
- Identify the forest type with its dominant (common) tree species.
- Describe its soil cover/ degree of erosion.

Findings on the site that should be recorded through interviews:

- Describe the utilisation pattern of any forest cover and its grassy slopes.
- Who uses it?
- Do local people get as much natural resources from it today as they did in the past?
  - If yes, how is this managed?
  - If no, why not, and what measures can be taken to remedy these trends?
- Provide a historical profile of its utilisation and changes in its environmental status by asking local people. Have there been landslides or floods in the valley below?
- How is our own life linked to this ecosystem?

8.2 VISIT TO A LOCAL POLLUTED SITE

Pollution occurs from a variety of sources and affects different aspects of our environment and thus our lives and our health.

Polluted sites include urban, rural, agricultural and industrial areas.

Identify the site type and describe the sources of pollution.

Pollution can affect:

- Air (smoke, gases),
- Water (urban sewage, industrial chemical effluents, agricultural pesticides and fertilisers),
- Soil (chemicals, soild waste from industry and urban areas),
- Biodiversity: effects on plant and animal life.

(Observations on pollution must include all the above aspects.)

General observations:

The following aspects need to be observed and documented:

- The type of land or water use in the polluted area, it's geographical characteristics, who uses the area, who owns it.

- Map the area to be studied.

- Identifying what is being polluted – air, water, soil; the cause(s) of pollution and the polluting agent(s).

- Assess the extent of pollution – severe/moderate/slight/nil, to:
  air, water, soil, biodiversity.

- Assess from literature, the health aspects associated with the pollutant.

- Ask local residents about its effect on their lives.

- Make a report of the above findings.

Proforma for fieldwork

Aims and objectives: To study the cause and effects of pollution at the site.

Methodology: Certain key questions related to the polluted site are given below. Explore the site to answer the questions about the area you have visited.

- What is the site?
  Rural - agricultural area, polluted waterbody, polluted industrial area
  Urban - Solid waste management site, Polluted industrial area

- What do you observe at the polluted site?
  A solid waste- garbage dump, polluted water at a river or lake, gaseous effluents or smoke coming out of an industry area, etc.

- Explore the reasons for pollution. Observe and document the components in the garbage/ the polluted waterbody/ industrial chimneys.

- Observe the area and list the waste that is seen in the garbage dumping site. Categorise the waste into the three types:
  - Degradable wastes, are those which are easily decomposed by micro organisms. These include food wastes, plant material, animal carcases, etc.
  - Non-degradable wastes are those which are not easily decomposed. Eg. plastic, glass.
  - Toxic wastes are those that are poisonous and cause long term effects. Eg. Several chemicals, paints, sprays, etc.

Findings:

- What are the effects of the pollutant?

- What actions can you take to get the pollution reduced?

1. SOLID WASTE study site

Guidelines for the study of solid waste polluted sites:

Pollution caused due to solid waste can be seen at various places:

A. Garbage dumps: One of the urban or rural environmental problem sites that can be studied is a garbage-dumping area. This problem is basically due to increase in population, an over utilization of non-biodegradable disposable consumer goods and lack of awareness of the management of waste at the household level. How much garbage is produced everyday is not given much thought. No one really thinks about where the garbage goes or what happens to all the things we throw away.

Garbage is a source of various diseases. Improper handling of organic waste leads to a large population of flies, cockroaches and rats that are responsible for the spread of diseases. Products like plastics are not degraded in nature and hence remain for a long time in the environment, thus adding to the need for more dumps. For many years waste has also been dumped into oceans, rivers or on land. These methods off disposing off waste contribute to contamination of soil, groundwater under the dumping site, foul up the air and aid the spread of diseases.

Interview of a ragpicker at a roadside disposal area or at a dump and understand their problems.

Prepare a survey sheet and ask them:

- What is the area covered in a day?
- How many hours are spent in collecting the waste?
- What are the types of waste collected?
- What are the problems faced while collecting waste?
- What do they prefer to collect and why?
- What is done with the waste collected?
- If it is sold, where?
- Would it be better to collect waste from homes rather than from roadside bins?
- Do they feel that segregation of waste would help them?

It is essential to understand that ragpickers do an environmentally important activity for all of us. While we throw away our own waste insensitively, it is they who separate out various types of waste for recycling and reuse. They are thus performing a great pro-environmental function for most of us.

Study of a dump site

The location of the site and where the garbage comes from.

How it is collected, by whom and with what frequency.

Understand how the waste is managed.

What are the different types of garbage?

What proportion is non-degradable and degradable?

What can we do to reduce the quantity of garbage?

B. Households: The garbage generated in our homes is termed domestic waste, while a community's waste is referred to as municipal waste. This is classified as kitchen waste, which is degradable, wet waste and non-biodegradable recyclable home waste which consists of plastic, glass and metal. Observe and document what happens in homes of different economic groups. What happens to your own household waste? Could it be managed better?

C. Agriculture: Agricultural waste consists of biomass including farm residues such as rice husk, straw, bagasse, etc. This biomass could be effectively used for generating power or producing paper. Waste material from fields includes fertilizers and pesticides that are a serious health hazard.

D. Industries: Industrial solid waste includes material from various industries or mines. Industries produce solid wastes during manufacturing processes. Some of these are chemicals that have serious environmental ill effects, as they are toxic. Visit an industry and ask what are the waste products and how they are disposed off.

The waste generated during mining is non-biodegradable, it remains in the environment nearly indefinitely. Solid waste is also generated as a result of excavation and construction works.

E. Hospitals: The waste generated from hospitals contains cotton dressing and bandages with blood or other tissue fluids and pus, all of which can contain pathogens. It can spread bacteria, fungi and viruses. Used needles, syringes, bottles, plastic bags, operation theatre waste, such as tissues, blood, plastic disposable equipment all need very careful disposal. The hospital should have a waste separation system at source into biomedical waste, glass, plastics, etc. The biomedical waste can be autoclaved or incinerated so that microorganisms are killed.

2. WATER POLLUTION site

Guidelines for study of polluted water sites:

Observe if the river/ lake/ tank can be considered unpolluted/ slightly polluted/ moderately polluted or severely polluted by looking at the water and by simple tests using a water monitoring kit.

- Document the name of the river and the nearby urban or industrial site from where the pollution is generated.
- Is there urban garbage dumped on the bank?
- Are there industrial units near the site?
- Do the industries discharge their wastewater into the site? Is this treated or untreated?
- What is its colour and odour?
- Are there any sources of water contamination from the surface runoff from adjacent agricultural land on which fertilizers and pesticides are used?
- Ask fishermen if this has affected their income.
- Identify plants, birds and insects found on the banks.

3. AIR POLLUTION site

Guidelines for the study of polluted air sites:

Air pollution sites include cities due to traffic congestion in urban centers and industrial areas due to gaseous products released during manufacturing processes.

- Ask people from the area the effects on their lives.
- How can this be reduced?
- How can you make more people aware of this issue and the effects on their health?

8.3 STUDY OF COMMON PLANTS, INSECTS, BIRDS

Guidelines for the study:

These taxa have been selected as they occur nearly everywhere. Whereas one may have to visit a National Park or Sanctuary to see mammals or reptiles, several plants, insects and birds can be seen around an urban or rural setting where there is some vegetation.
If you have an opportunity to visit a National Park or Sanctuary, you can add other animals.

One needs a little equipment – a journal to take notes, preferably a pair of binoculars, field guides to identify plants, insects, birds, reptiles and mammals. These are available from Bombay Natural History Society (BNHS).

Field reference books:

1. The book of Indian Animals – S.H. Prater, BNHS
2. The book of Indian Birds – Salim Ali, BNHS
3. The book of Indian Reptiles – J.C. Daniel, BNHS
4. Field Guide to the Common Trees of India – P.V. Bole and Y Vaghani, BNHS
5. CD ROM on The Biodiversity of India – EK Bharucha, Mapin Publishing

Plants:

1. Identify and list common plant species at the study site (at least 20; 10 trees, 5 shrubs, 5 herbs).

2. Identify if there are rare species by using a field guide or asking a botanist.

3. Identify and list the types of plants – trees/shrubs/climbers/ground cover – herbs, grasses. Observe their abundance levels.

4. Describe five plant species. Document the characteristic features that help in identification of the selected species:

   Specific characteristics of leaves/ flowers/ fruit/ seeds.

   Describe the plant's role in the ecosystem.

   How is it used and by whom?

   Is it being collected sustainably or over harvested?

   Is it common or rare? If rare, why?

   Is it a keystone species? If so why.

Animals:

- Identify and list all the species you see in the study site.

- What are the major field identification features of the common animals and birds that you observe?

- Look for and document for each group; insects, birds (mammals if possible) at least 10 species.
- Document the characteristic features for each of the ten species and record the following:

    a) The role of the species in the ecosystem: What role does the species play in nature – producer, herbivore, carnivore, decomposer, pollinator, seed dispersal agent, pest, etc.

    b) The level of abundance at the site – Classify as abundant/ common/ rare/ very rare.

- Watch and document the area unobtrusively to observe all the linkages between the different species and between a species and its habitat. What role does each species play in the food chain and energy pyramid?

- Observe the habits of each of the selected species such as feeding behaviour, nesting (for birds), breeding, territorial behaviour, etc.

- Refer to a relevant field guide and document the following:
    - The distribution of each of the selected common species in the country.
    - The current status from a field guide – abundant, common, uncommon, rare, endangered. If rare, is it on the endangered list?

- Is it used by people? For what purpose?

- How can it be protected?

8.4 STUDY OF SIMPLE ECOSYSTEMS

Field studies to be documented:

Describe any two ecosystems in the same way - specific forest type, marine, coastal, mangrove delta, lake, cave, etc. that you have visited for documentation of an ecosystem.

Discuss its abiotic and biotic aspects.

Describe its common species and their habitats.

Describe its food chains, food web, food pyramid.

Discuss its biogeochemical cycles.

Describe all its habitat characteristics.

Describe its utilisation.

Discuss its conservation potential.

Remember to take the time also to just enjoy the feeling of being with Nature. Learn to appreciate the beauty of natural vegetation. It can become a thrill to watch wild species of animals and birds without disturbing them in their habitat.

General guidelines on aspects that can be observed and documented during ecosystem field studies:

1. The *major questions* that must be addressed during a field visit to any ecosystem such as a forest, grassland, semi-arid, desert, hills, mountain ranges, lake, river or seacoast include:
   - What is the ecosystem called on the basis of its typical features? What are its abiotic and biotic characteristics?
   - Are its goods and services being misused or overused? What are the signs that can be observed of degradation of the ecosystem that have occurred in the area? Deforestation, pollution of a waterbody, soil erosion, are signs of degraded ecosystems.
   - How can this degradation process be prevented by sustainable use of the ecosystem's goods and services by changing ones own habits, such as by saving water, electricity, paper etc?
   - How can we all care for our 'mother earth' in our own way? Many small actions together reduce the adverse impacts of human activities on the ecosystems.

2. Observing the Water Cycle:

   During a monsoon field trip observe the effect of the rain.

   - *The type of vegetation is an indicator of the amount of rainfall. Classify the ecosystem: forest / grassland/ semiarid/ desert type on the basis of rainfall.*
   - *Observe how rain percolates into the subsoil. This recharges ground water, which charges wells, streams and rivers.*
   - *Document if the rain is eroding the soil. This can be judged by observing if the water is brown in colour. The colour is an indicator of the extent of soil erosion and is darker wherever plant cover has been destroyed. It takes thousands of years for new soil to form. Excessive silt eventually changes the course of the river and leads to flooding of surrounding land.*

3. Observing the Carbon Cycle:

   Since plants take up carbon dioxide, which we exhale, and split it into carbon and oxygen, which we breathe, we are dependent on the plant life on earth. Eventually large-scale deforestation could make life on earth impossible. Document this as an ecosystem service.

   Carbon is a component of the food we eat in the form of carbohydrates, which come from plant material. Thus we need plants to give us oxygen and food, without which we cannot survive.

4. Observing the Oxygen cycle:

   While on the field trip focus attention on the amount of green material that plants contain. Without this there would not be enough oxygen for animals to breathe.

   Sunlight is essential for plant photosynthesis, which produces new leaves, branches and the growth of the trunks of trees. It leads to growth of grass and herbs every year. Sunlight is essential for plant growth in the water, including microscopic algae and underwater vegetation which is the food producer for all aquatic forms of animal life.

5. Observing the Nitrogen Cycle:

   Observe the quantity of dried leaves on the ground in a forest, or the dried leaves of plants planted in the area that have collected as detritus. This material can be seen to be decaying. Ants, beetles and worms that feed on this dead material are breaking it up into small fragments. Microscopic bacteria and fungi are acting on this material to convert it into nutrients for plants to grow.

6. Observing the Energy Cycle:

   Look for the different types of insects and birds in the trees. Frugivorous birds feed on fruit, insectivorous birds and spiders feed on insects. These form food chains. There are thousands of such food chains in an ecosystem. These inter-linked chains can be depicted in the form of a 'web of life'. Observe that in our surroundings there is a great amount of plant material. There is much less animal life in which there are a relatively larger number of herbivores than carnivores, which live on herbivorous animals. Estimate and document the differences in the number of plants, herbivores and carnivores in an area. This can be depicted as a food pyramid.

Specific ecosystem studies:

Objectives of a Field Visit to an Ecosystem:

Identify the local landscape pattern in the forest, grassland, desert, river, hills, etc. These are unmodified 'natural' ecosystems.

Identify the modified ecosystems such as farmland, grazing land, industrial land and urban land. Compare and contrast natural and intensively used areas.

The study site may have a mosaic of landscapes and aquatic ecosystems. Use the observations to create a map of the area and its ecosystems.

Document the following:

A. Common plants you see (trees, shrubs, grasses, etc.).

B. Animals observed (mammals, birds, fish, insects, etc.).

The natural landscape is beautiful. Describe how you feel about it. The plants and animals have several exciting features that can be 'discovered'. Observe and document their abundance or rarity, their habitat, their behaviour and their links to other species.

A. FOREST

Field Visit to a Forest – Depicting the nature of the ecosystem:

Visit the nearest or most convenient Reserved Forest, National Park or Wildlife Sanctuary. Meet the Forest Official to explain your study. Check if there is an Interpretation Centre where there may be local information. Ask for brochures or other material. Officials may agree to address a group of students. Observe the forest type. Make notes on the ecosystem..

- Classify the forest type:

  During the field visit to the forest identify which type of forest is found in the area. Is there only one type or are there several types? If so why?
  Coniferous, deciduous, evergreen, thorn forest and mangrove are some examples.

- Interpreting the connection between abiotic and biotic aspects of the ecosystem:
  Observe differences in vegetation types during the field visit and relate this to abiotic features such as temperature, rainfall, soil and topographic patterns wherever possible.

- Understanding food chains and food pyramids:
  - Observe the abundance of different species in the ecosystem.
    Observe which plants are found commonly in the forest. Only a few species are very abundant but there are a large number of less common species of trees, shrubs and climbers and small ground plants that add to the diversity of plant life in any forest.
  - *Observe and document the names of animals seen. Classify them as mammals, birds, reptiles, amphibian or insects. Classify these into herbivores and carnivores. If these are counted, you will appreciate that there is a relative abundance of herbivores over carnivores.*

- Identify the structural levels in a forest:

  Identify the layers of the forest. Draw profiles of the structure and label the levels.

  Ground – trunk – branches – canopy.

- Document the micro-habitat for species in different levels of the forest:

  Observe which animal uses different parts of a forest habitat. Some live on the ground among the fallen leaves (worms and insects such as ants, termites and beetles), others live in the middle layer on branches and tree trunks (lizards and woodpeckers), many others live in the canopy of the tree tops, (such as fruit and nectar dependant birds such as sunbirds, parakeets and mynas. There are insectivorous birds, (flycatchers, drongos and bee eaters) in the canopy. Several insects live under the ground. If one turns over dead leaves on the forest floor there are a large number of animals (millipedes, ants, beetles etc.).

Document what you have seen and estimate their abundance at different levels.

- Observe food chains and interpret the food web.

  Field Observation – examples of food chains that are easily seen:

  Flower → butterflies → spiders

  Flower → sunbirds → birds of prey

  Fruit → parakeet → birds of prey

  Seeds → rodents → birds of prey

  Flowers → bees → bee eaters

  Seeds → munias → small carnivorous mammals and birds of prey

  Leaves → monkey → leopard

  Grass → chital → tiger

  Observe what all the animals are feeding on and reconstruct as many food chains as possible.

  Observe that a single species can play a role in several food chains. Thus the chains form a food web.

  Write about what you have seen about the food chains and food web in the area.

- Interpreting the food pyramid and biomass distribution:

  Observe that in the forest the number of trees, shrubs and ground cover of plants constitutes an enormous amount of living material (biomass). Compared to this plant life, the number and biomass of herbivores is less while the number and biomass of carnivores is smaller still.

  Write an explanation for this phenomenon using the examples you have observed in the study site.

  Though ants are very small, together the thousands of ants form a large amount of living material. Thus they have a great influence on the ecosystems functions.

  Observe and document how an ant colony works together.

- Explaining the detritus cycle:

  Observe the large number of ants and beetles in the dead leaves fallen on the forest floor. Together they constitute a very large mass of living animals. They thus break-down an enormous amount of dead plant and animal waste material. Without this process the forest ecosystem would loose its integrity.

  See what earthworms, millipedes, ants and beetles do without disturbing them. Insects and earthworms moving on the forest floor are breaking down the detritus so that microscopic fungi and bacteria can recycle this material into nutrients for the forest plants to grow. Look for the larger fungi such as mushrooms and bracket fungi that also do this work. This shows how the cycle works.

- Interpret the temperature and moisture control functions of the forest:

  Observe temperature differences under a closed forest canopy and outside in the open. Feel the moisture in the detritus and superficial layers of soil, which can be compared with the dry soil elsewhere.

- Appreciate species diversity:

  Make a rough estimate of the number of species of the trees, shrubs and the different plants that form the ground cover. One need not name them all. Appreciate the wide variety of plants in a forest as compared to a mono culture plantation.

- Appreciate abundance of different plant species:

  Look around at the trees in the forest. Only a few are very abundant, while a much larger number of species are uncommon. Identify the most commonly observed trees.

  Appreciate that there are some rare species of plants. These can become extinct if the forest is cut down.

- Appreciate abundance of different animal species:

  On the forest floor the most commonly observed animals are ants. There are more ants than any other animal species on earth. Look for beetles. There are more species of beetles in the world than any other group of species. Observe how many different types of beetles there are, even though one cannot name them.

  The integrity of the ecosystem is based on these small but very important species that are a major part of the web of life of the forest. They are the prey of insectivorous birds, amphibians and rodents.

  Insects break down the detritus of the forest, which is the nutrient material on which the forest plants grow.

  Mankind thus cannot survive without these ants as they produce the nutrient material on which plants depend. Man is dependent on plant life, and is thus indirectly dependent on the insects in the forest detritus.

- *How do forests influence the water cycle?*

  The forest acts as a sponge: Feel the moisture and coolness of the forest air and compare this with the drier and warmer temperature outside the forest cover. The difference is obvious as shade of the trees reduces the local temperature. Feel the level of moisture on the forest floor and compare this to the dryness of the ground outside the forest. A considerable amount of moisture is retained in the dead leaves (humus) of the forest floor. Dig a small hole in the ground. It is moist and cool under the forest floor. This demonstrates how the forest acts as a sponge and releases water gradually into streams after the monsoon is over. This can continue for the rest of the year and provide water for people outside the forest.

- Understanding Prey and Predator relationships – Food chains:

  There are spiders on the ground, which form tunnel webs to catch the crawling insects. In the trees wood spiders make giant webs three feet in diameter to catch flying insects. Look for the insect life in the canopy of the trees, on trunks, on the ground and especially under dead fallen leaves.

  Identify which species are predators and what is their prey.

- Searching for examples of food chains, food webs and food pyramids:

  Different species of lizards are found on the tree trunks and on the forest floor. There are chameleons in the trees and skinks on the ground. They are feeding on insect life, which in turn feed on the plants. This is a simple food chain that can be easily observed.

  A spider catching an insect in its web is another demonstration of a simple food chain. The same insects are used by spiders and lizards as prey. Thus multiple food chains are linked to each other. This forms a small part of the food web of the forest.

  There are several insectivorous birds such as bee eaters, fly catches of many species, babblers, etc. that form many different food chains.

  There has to be a very large amount of plant life to provide enough food for the herbivores, which are prey species for the very few carnivores in the forest. This demonstrates how a food pyramid works and how energy moves from one level to the other. The energy is used for day to day functions of animals such as hunting for food, respiration, metabolising food and breeding. Observe that there is a very large amount of plant life, a smaller number of herbivores and very few carnivores. This observation explains the concept of the food pyramid.

- Document the linkages between food chains and processes such as pollination of plants in the forest:

  Animals such as monkeys, squirrels and birds feed on leaves, fruits and seeds. Insects such as ants, butterflies and birds such as sunbirds and mynas use flower nectar for food. These flowers have bright colours to attract them. During this process the insects and birds pollinate the plants.

  At night when most animals sleep, the bats and moths pollinate flowers. These flowers are usually white in colour so that they can be seen at night.

  Thus many plants depend on animals to pollinate them so that seeds can develop. The regeneration of forests thus depends on these animals. These linkages are important aspects that maintain the forest's web of life.

  Look for the pollinators – butterflies, moths, beetles, ants and nectar feeding birds are easy to observe.

  Look for birds that eat berries and fruit and disperse seeds. These include bulbuls, parakeets.

  Look for birds of prey that complete the food chain.

- Seed Dispersal:

  Observe that monkeys, squirrels and birds such as parakeets, mynas and hornbills are agents of seed dispersal as they feed on fruit and spread the seeds far and wide. Birds such as bulbuls eat small berries along with their seeds. After passing through the birds' intestines they are defecated and can germinate. They germinate more effectively as their covering is removed in the bird's intestine. The birds thus help in the dispersal and regeneration of plants. Though a plant is rooted to the same spot, evolution has linked plants with animals that help the plant species to spread by dispersing its seeds.

  Other seeds are light and have wings or hair. These are dispersed by the wind. Observe how these float thought the air for long distances.

- Regeneration:

  Look for seeds and seedlings growing on the forest floor. Observe that while there are plenty of small seedlings there are fewer saplings as a majority of seedlings die. Only a few of the surviving young saplings will finally grow into large trees. Plants thus need to generate a very large number of seeds. Only those seeds that find a spot that has all the conditions needed for their germination and growth can end up as large trees. Many seedlings die due to forest fires, grazing or trampling by domestic animals.

- Forest Animal Communities and interrelationships:

  Forest birds form feeding parties of many different species. Together they feed on different parts of plants such as flower nectar, fruit, or on insects. Observe that when fruit eating birds search for their food in the foliage they disturb the hiding insects, which are then caught by the insect-dependent birds. Others, while looking for berries in the bush layer, disturb insects that are caught by other insectivorous birds. Thus birds of different species help each other in finding their food and stay together in large mixed feeding parties that move from one tree to another. Identify what each bird species feeds on.

  When the langurs feed on fruit, a part of the fruit is dropped uneaten on the forest floor. Chital and sambar deer following the langurs are able to eat this fallen fruit. From the top of the tree the monkeys can easily spot an approaching tiger or leopard more easily than the deer. The monkey gives an alarm call at the approach of a predator alerting the deer to its approach.

- Major prey- predator behaviour:

  Carnivorous animals are very shy of human beings, as man has killed them for thousands of years. These animals are very stealthy so that they can catch their wary prey. They become invisible as their colour and pattern camouflage them in the undergrowth to be able to approach the prey unnoticed. The predators have to make several unsuccessful attempts before they catch their prey, as the prey is extremely sensitive to any movement or sound. For these unsuccessful attempts they have to spend a large amount of energy to catch the watchful deer. The deer have sharp eyesight and a good sense of smell to avoid being caught. Predators like tigers or leopards counter this by moving very cautiously in the forest. Other predators such as wild dogs hunt in

packs. Omnivorous birds such as hawks and eagles swoop down from the sky on their quarry at great speed. Even though they are superb hunters, their prey is frequently able to escape.

- Searching for camouflaged species:

  The beautiful stripes of the tiger and the rings of the leopard match the light and shade in the forest and thus camouflage these animals so that they cannot be easily seen. They can sometimes be only a few paces away in the undergrowth and yet remain completely invisible. Predators such as tigers and leopards frequently see us before we see them and disappear stealthily into the deeper forest. However we can observe their pug marks on the forest floor. It is exciting to see a fresh pugmark in the forest. It tells a tale. The track if fresh can end up at a sleeping tiger or a leopard!

  The colour of moths is similar to that of the brown tree bark on which they rest during the day.

  Chameleons change their colour to suit their surroundings.

  The green colour of grasshoppers matches the foliage they live in.

  Stick insects look like twigs.

  Look for other signs of camouflaged species in the forest. Each has a reason and is linked with evolutionary processes.

- Study of wildlife signs:

  The wildlife of the forest leaves behind several signs even if we cannot see the animals themselves. Each animal has its own footprint, which can be identified. Animals also leave their characteristic droppings that can be easily identified. Thus these signs in the forest can tell us which species live there and indicate their day to day activities.

  Listen to the birdcalls. There are many different kinds of beautiful calls. This indicates that there are many more birds than we can see in the forest.

- Observe feeding patterns of animals:

  Observe the feeding patterns of forest animals unobtrusively. Learn about those that we cannot observe easily. Some of these are given below:

  - *Tigers feed on sambhar, chital deer and monkeys.*
  - *Leopards feed on barking deer, hare, and occasionally village cattle.*
  - *Jackals feed on hare, mice, and birds.*
  - *The Jungle cat feeds on hare and mice.*
  - *Pangolins feed on ants.*
  - *Mongoose feeds on snakes and mice.*
  - *Cheetal feed on grass.*
  - *Sambar feed on grass, young leaves and fruit of shrubs and trees.*
  - *Barking deer feed on fruit and leaf buds.*

- *Elephants feed on grass in the monsoon and tree leaves in the winter and summer.*
- *Squirrels feed on nuts and fruit.*
- *Porcupines feed on fleshy roots of plants and bark of trees.*
- *Birds of prey feed on rodents, reptiles, frogs and small birds.*
- *Birds like flycatchers feed on insects and worms.*
- *Bulbuls feed on fruit. When they have young one's in the nest the parents feed the chicks with worms and caterpillars.*
- *Sunbirds feed on flower nectar.*
- *Spiders catch insects.*
- *Insects like beetles and bugs feed on plant material.*
- *Insects like the praying mantis and dragonfly feed on other smaller insects.*
- *Ants and termites feed on plant material that is dead.*
- *Beetles and bugs feed on leaves and sap of plants.*
- *Butterflies feed on flower nectar in the day.*
- *Moths feed on flower nectar at night.*
- *Worms feed on forest detritus.*

- *Habitat use by different species:*

  Observe how different species of animals use various layers starting from the forest floor, upwards along the trunk and branches, to the canopy of the trees. These species show that the forest habitat consists of various layers each forming a microhabitat within the forest.

  Among the commoner insects, the termites build their homes out of mud present on the forest floor. The large red fire ants build homes out of leaves in the tree canopy.

  Monkeys such as langurs and macaques use the tree canopy for leaves and fruit as well as the forest floor, where they look for fallen flowers, buds and fruit.

  The leopard hunts on the forest floor for prey such as the barking deer, cheetal, and hare.

  Eagles hunt for their small prey in trees and on the ground. Their prey consists of small birds, rodents, snakes and frogs.

  The Giant squirrel is rarely ever seen on the ground. It looks for fruit and nuts by crossing from one tree branch to another. It requires forests with an unbroken canopy.

  The rat snake is usually on the ground while the vine snake twines onto branches of shrubs and trees. Both are non-poisonous.

  Birds like bee eaters and drongos catch insects while they fly through the canopy by swooping through the branches. Babblers most often look for insects and worms by disturbing the dead leaves on the forest floor.

The hornbill looks for fruit in trees and makes a nest in a large hole after carefully selecting a very tall old tree.

The crow pheasant hunts for grasshoppers and worms on the forest floor and in trees.

The shrews look for insect life underground.

Millipedes, centipedes and scorpions move around on the forest floor. Many of these animals live in holes under the ground, under rocks or among the dry leaves.

B. GRASSLAND

- A Field Visit To A Grassland:

  Observe the variety of plant and animal life in the grassland. Document the food used by each animal that is identified.

- Describe the seasonal changes in the grassland:

  Describe how the grassland would look in different seasons.

  Describe the anticipated changes in colour and the condition of grasses: growing phase, flowering phase, dyeing phase, dry phase.

- Abundance of grassland species:

  Try to count the number of grasshoppers that jump out of a disturbed 1sq.m quadrant on the ground. Count at least 20 such quadrants. You may find this hard! Repeat the count for ants, beetles etc. This will be nearly impossible, as there are just too many of these insects. This will demonstrate the great abundance of insects in the grassland. Compare this to the much smaller number of first order consumers - birds and mammals that can be counted in the grassland. The predators, mammals and birds of prey – raptors, are least abundant.

- Birdwatching in grasslands:

  Make a checklist of common grassland birds by identifying them from the Book of Indian Birds, by Salim Ali. Read what each species feeds on.

- Observing the insect world:

  Observe how the ants live and collect food. Observe how beetles behave in the grassland. Observe the abundance of grasshoppers, beetles and ants. Compare this with the number of their predators.

- Observe a spider catch its prey:

  See the different types of webs. Tunnel web spiders make a tunnel and sit inside waiting for prey, which are pulled in and eaten. Other spiders in the grassland make small orbwebs that have radial and spiral threads. Some spiders build a colony which is like a mass of web material.

- Document animal behaviour:

  Make a general list of behavioural patterns of all the animals, birds and insects you see. What are they doing? How and where did you find them in the grass? What is their relationship to the grassland as a habitat?

- Understanding grassland food chains:

  Identify as many plant and animal species. Use the list to form as many food chains as possible.

C. DESERT AND SEMI ARID-AREAS

- Observe desert and semi-arid landscapes:

  Observe the sparse but specialised nature of vegetation in a desert or semi-arid landscape. Document the number of animal species that are seen in the vicinity. There are very few compared with other types of ecosystems.

- Observe the fauna of semi arid country:

  Identify the birds and insects which are most easily seen. Document how each species is using its habitat. What do these species feed on in this harsh environment?

- Observe typical species such as dung beetles that roll dung into a ball in which they lay their eggs so that their young get food.

- Observe birds of prey that use this ecosystem.

- There are rare birds in a few areas such as the Great Indian Bustard.

- There are rare mammals such as the wolf.

D. AQUATIC ECOSYSTEMS

- Document the nature of aquatic ecosystems:

  Visit an aquatic ecosystem such as a pond, lake, river or seacoast.

  Observe if the water is clean or polluted. A simple kit can be used to study water quality.

1. Studies on the ecology of a pond:

Make observations on a seasonally active pond if possible on several occasions before, during and after the monsoon. Document the seasonal changes in the plant and animal life.

Example: Guidelines for a writeup on a POND ecosystem

A pond is a highly dynamic mini ecosystem. It changes rapidly during the year. To study a pond one should, as far as possible, cover all its phases. A monsoon phase, when the pond changes from a dry to a wet (aquatic) state. It's growing phase, when it is colonised by microflora and fauna and then other forms of macroscopic life. At the height of the monsoon, it is in a mature aquatic phase, which is full of life. Once the rain stops, the pond begins to shrink. Its periphery becomes dry and is colonised by terrestrial plants like grasses and herbs. As it shrinks, its aquatic flora and fauna dies, giving place to land flora and fauna. Eventually it may only remain in the form of a ditch or depression containing terrestrial forms and dormant aquatic invertebrates such as insects that must await the next monsoon. This process, when repeated year after year, leads to a silting up of the pond which eventually gets shallower and shallower and in the course of time, gives place to a grassland, scrubland and after many decades to a forest. This is the process of *succession*.

- Observe the pond. What seasonal stage is it in?
- What do you expect to occur over the next 3 months, 6 months, 9 months, 12 months?
- What are the vegetation zones in the pond?
- What species use the pond as a habitat?
- Take some water from the pond and examine it under a microscope. What do you see?
- Describe the pond's periphery – its soil, vegetation, fauna.
- Describe the pond's floor – its soil, vegetation, fauna.
- Write a note on the food chains you observe.

- Observe the vegetation zones at the waters edge:

  Observe the different zones of vegetation - grasses on the periphery, emergent reeds, floating vegetation and underwater plants in the pond.

- Seasonal field observations on a pond:

  Early stage - soon after the pond fills with water in the monsoon: Observe algae and microscopic animals. These can be observed under the microscope.

  Fully active phase: Submerged and emergent vegetation – fish, frogs, snails, worms and aquatic insects.

  Shrinking phase: Drying aquatic plant life with dead and dying plant material and terrestrial plants growing on the exposed mud of the pond.

  Dry phase: Overgrown with grasses and shrubs with hidden dormant animals in the mud, which cannot be seen.

- Laboratory exploration:

  Observe water from the pond in a glass. Document its colour and what it contains.

  Observe water from a pond under the microscope. There are a large number of algae and zooplankton that form the basic food chains of the aquatic ecosystem.

2. Observations on a Lake ecosystem:

Document the way in which different water birds use the various habitats both on the shore and in the water. Each of the different species of aquatic birds shares its habitat with only a few other species. Each species specialises in certain types of food and feeds at different depths. The length of the legs of different wading birds is an indicator of the depth at which they feed. The length of their beaks indicates the depth of mud or sand into which they can probe.

- Diversity and abundance of life:

  Make a checklist of all the visible aquatic flora and fauna. Identify those that are most abundant. Observe and document the food chains. Estimate or count the population (abundance) of different species observed in the aquatic ecosystem.

3. Observations at a wetland:

Visit a Wetland. Observe the varied vegetation zones within the ecosystem. Document and map its vegetation patterns – Underwater/ emergent/ floating/ none. Describe if the water is clean or turbid. Describe the level of algal growth and weeds. What is the nature of its bed – rocky/ sand/ silt/ mud/ mixed (in what proportion?). Develop a map of the aquatic ecosystem vegetation and its relationship to species of aquatic birds. Ask local fishermen to show you their fish catch. Observe the ducks, waders and other birds. These are most abundant in the winter as most of them are migrants from across the Himalayas.

4. Observation on a field visit to a beach:

Beaches can be sandy, rocky, shell-covered or muddy. On each of these different types, there are several specific species, which have evolved to occupy a separate niche. Observe all the different crustacea such as crabs that make holes in the sand.

Observe how the various shore birds feed on their prey by probing into the sand.

5. Observations at a river:

Depending on the location of the river, the study can demonstrate its ecological status. The river is a dynamic system with seasonal fluctuations in flow rates that affect its plant and animal aquatic life as well as along its banks. Observe and document how life is dependent on the river's integrity.

Example: Guidelines for a write up on a RIVER ecosystem

A river is an aquatic ecosystem that is influenced by the monsoon. It may be a perennial river, or one that runs dry after the rains. The river ecosystem has abiotic and biotic components. While many of its species are aquatic, there are terrestrial species that use its banks. Both these need water. Aquatic species live in the water, while the terrestrial species live on the banks but are highly dependent on the proximity of water. Many species such as amphibia and aquatic insects use both aquatic and terrestrial habitats.

- Describe the aquatic ecosystem in the river water and the terrestrial ecosystem on the riverbank.
- Describe the characteristics of the bed of the river, the depth of the water and the flow rate in different sectors. Rapid, slow, stagnant.
- Describe the various habitats of different species of flora and fauna in and around the river.
- Document what you see in the water under a microscope.
- Document how different species use the water and the banks of the river.
- Describe how each of the habitat parameters is linked with the species that live there.
- Observe the food chains. Document aquatic food chains, terrestrial food chains on the bank, and those in which both aquatic and terrestrial species occur.

E. HILL/MOUNTAINS

The ecosystem of the hill you are observing is linked to its altitude, slope, soil characteristics, vegetation and animal life. It has different vegetation patterns that create specific microhabitats for a variety of fauna. The habitat changes seasonally. What do you expect will occur in three months, six months and nine months from the present scenario?

Example: Guidelines for a write up on a HILL/ MOUNTAIN ecosystem

- Describe the hill – slope, soil, watercourses, etc.
- Describe its various plants and animals.
- Observe and document its food chains.
- Describe the water cycle, the nitrogen cycle, energy cycle, detritus cycle with specific reference to the hill/ mountain ecosystem.
- What would happen if all the domestic animals were to be prevented from grazing?
- What would happen if ants were to be completely eliminated from this ecosystem?
- What would happen if all the vegetation is removed from the slopes?