



Third Edition

Environmental Studies

(FOR UNDERGRADUATE CLASSES)



Dr. J.P. Sharma

ENVIRONMENTAL STUDIES

FOR UNDERGRADUATE CLASSES

*(Science, Commerce, Humanities, Engineering,
Medicine, Pharmacy, Management and Law)*

ENVIRONMENTAL STUDIES

[For Undergraduate Classes in Science, Commerce, Humanities,
Engineering, Medicine, Pharmacy, Management and Law]

Strictly as per model curriculum prescribed by UGC

By

Dr. J.P. Sharma

M.Sc., Ph.D., FISST

Head, Deptt. of Botany

Hindu College, Sonapat

M.D. University, Haryana

UNIVERSITY SCIENCE PRESS

(An Imprint of Laxmi Publications (P) Ltd.)

BANGALORE ● CHENNAI ● COCHIN ● GUWAHATI ● HYDERABAD
JALANDHAR ● KOLKATA ● LUCKNOW ● MUMBAI ● PATNA
RANCHI ● NEW DELHI

Published by :
UNIVERSITY SCIENCE PRESS
(An Imprint of Laxmi Publications (P) Ltd.)
113, Golden House, Daryaganj,
New Delhi-110002
Phone : 011-43 53 25 00
Fax : 011-43 53 25 28
www.laxmipublications.com
info@laxmipublications.com

Copyright © 2009 by Laxmi Publications Pvt. Ltd. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the publisher.

Price : ₹ 125.00 Only.

Edited by : Pragma Dixit

Third Edition : 2009

OFFICES

© Bangalore	080-26 75 69 30	© Chennai	044-24 34 47 26
© Cochin	0484-237 70 04, 405 13 03	© Guwahati	0361-251 36 69, 251 38 81
© Hyderabad	040-24 65 23 33	© Jalandhar	0181-222 12 72
© Kolkata	033-22 27 43 84	© Lucknow	0522-220 99 16
© Mumbai	022-24 91 54 15, 24 92 78 69	© Patna	0612-230 00 97
© Ranchi	0651-221 47 64, 220 44 64		

UES-9319-125-ENVIRONMENTAL STUDIES

Typeset at : Goswami Associates, Delhi.

C—16577/08/10

Printed at : Pack Printers, Delhi

PREFACE TO THE THIRD EDITION

The third edition of the book **Environmental Studies** is before you. It has been thoroughly revised and updated as per the latest courses of studies prescribed for the undergraduate classes of different streams. This edition has been supported with several new well labelled, accurate and self explanatory diagrams and a number of 'Case Studies'. A consistent effort has been made to incorporate all the latest information in such a way that the learners may fully be aware of even the minutest details of the environment. The book aims to create a consciousness towards environment which is the most vital concern for us. We can't do without it.

It is confidently hoped that the present edition of this book will prove to be more useful than its previous editions.

We invite suggestions from the esteemed teachers and sincere students so that we can assess our book properly. We shall thankfully incorporate all the justified suggestions in our next edition.

— Author

PREFACE TO THE FIRST EDITION

'Environmental Studies' is a growing discipline which stresses on the study of environment in its totality with special emphasis on man and his comfort.

In February 1971, the UGC in collaboration with other organisations launched a symposium on the development of environmental studies in the Indian Universities. The consensus was that ecology and environmental issues should be a part of the courses of study in the Indian Universities at all levels. The Honourable Supreme Court of India in view of Writ Petition No. 860 of 1991, directed UGC to prescribe a course on 'Man and Environment'. Consequently the UGC notified to all universities of the country to introduce a course on 'Environmental Studies'.

The present book entitled '**Comprehensive Environmental Studies**' has been written in accordance to the syllabus prescribed by UGC for environmental studies for all undergraduate courses. The present text is an attempt to make the readers acquainted thoroughly with the basic principles of the environmental science.

In the present text efforts have been made to make the subject matter comprehensive up-to-date and concise. Every care has been taken to make the language simple and the presentation systematic. Well informative diagrams have been included to supplement the text. While great emphasis has been laid on basic fundamentals, no effort has been spared to incorporate recent information in sufficient details, so that the students may have a solid background for competitive examinations and higher studies.

It is confidently hoped that the present text will prove useful to the undergraduate students in science, commerce, humanities, engineering, medicine, pharmacy, management and law. Constructive criticism and valuable suggestions from the readers for further improvement of the book shall be gratefully acknowledged.

— Author

SYLLABUS

FOR UNDERGRADUATE COURSES OF ALL BRANCHES OF HIGHER EDUCATION

Unit 1 : The Multi-disciplinary Nature of Environmental Studies (2 Lectures)

Definition, scope and importance, need for public awareness.

Unit : 2 : Natural Resources (8 Lectures)

Renewable and non-renewable resources : Natural Resources and associated problems.

- (i) **Forest resources** : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- (ii) **Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (iii) **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- (iv) **Food resources** : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizers — pesticide problems, water logging, salinity, case studies.
- (v) **Energy resources** : Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- (vi) **Land resources** : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, equitable use of resources for sustainable life styles.

Unit 3 : Ecosystem (6 Lectures)

Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession. Food chain, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems : Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4 : Bio-diversity and its Conservation (8 Lectures)

Introduction ; definition, genetic, species and ecosystem diversity ; Biogeographical classification of India, value of biodiversity ; consumptive use, productive use, social, ethical, aesthetic and option values ; Biodiversity at global, national and local levels ; India as a megadiversity nation ; Hot spots of biodiversity ; Threats to biodiversity ; habitat loss, poaching of wildlife, man-wildlife conflicts ; Endangered and endemic species of India ; conservation of biodiversity ; In-situ and Ex-situ conservation of biodiversity.

Unit 5 : Environmental Pollution (8 Lectures)

Definition, causes, effects and control measures of : (i) Air pollution, (ii) Water pollution, (iii) Soil pollution, (iv) Marine pollution, (v) Noise pollution, (vi) Thermal pollution, (vii) Nuclear pollution.

Solid waste management : Causes, effects and control measures of urban and industrial wastes ; Role of individual in prevention of pollution ; Pollution case studies ; Disaster management : floods, earthquake, cyclone and land slides.

Unit 6 : Social Issues and the Environment (7 Lectures)

From unsustainable to sustainable development ; urban problems related to energy ; water conservation, rain water harvesting, watershed management ; Resettlement and rehabilitation of people, its problems and concerns, case studies ; Environmental ethics : Issues and possible solutions ; climate changes, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation, consumerism and waste products. Environment protection acts ; Air (prevention and control of pollution) act, Water (Prevention and control of pollution) act, Wildlife protection act, forest conservation act ; Issues involved in enforcement of environmental legislation ; Public awareness.

Unit 7 : Human Population and Environment (6 Lectures)

Population growth, variation among nations ; Population explosion, Family welfare programme ; Environment and human health ; Human rights ; Value education ; HIV/AIDS, Women and child welfare ; Role of Information technology in environment and human health ; case studies.

Unit 8 : Field Work (5 Lectures)

Visit to a local area to document environmental assets : river/forest/grassland/hill mountain.

Visit to a local polluted site : urban/rural/industrial/agriculture.

Study of common plants, insects and birds.

Study of simple ecosystem : pond, river, hill slope etc.

CONTENTS

<i>Chapters</i>		<i>Pages</i>
<i>Syllabus</i>	...	(vii)
1. Environmental Studies—Scope and Importance	...	1
2. Natural Resources	...	13
3. Ecosystem	...	49
4. Biodiversity and Its Conservation	...	81
5. Environmental Pollution	...	113
6. Social Issues and the Environment	...	160
7. Human Population and the Environment	...	193
8. Field Work	...	215

IMPORTANT ABBREVIATIONS

AEC	—	Atomic Energy Commission
BSI	—	Botanical Survey of India
CAZRI	—	Central Arid Zone Research Institute
CEC	—	Council of Environment Quality
CFC	—	Chlorofluorocarbons
CIDA	—	Canadian International Development Agency
CITES	—	Convention on International Trade in Endangered Species.
CPCB	—	Central Pollution Control Board
DNES	—	Department of Non-conventional Energy Sources
DST	—	Department of Science and Technology
EE	—	Environment Education
EIA	—	Environmental Impact Assessment
ENVIS	—	Environment Information System
EPA	—	Environmental Protection Agency
EPC	—	Environmental Protection Council
FAO	—	Food and Agriculture Organisation
GEF	—	Global Environment Facility (Fund)
GEMS	—	Global Environmental Monitoring System
HEAL	—	Human Exposure Assessment Location
IAEA	—	International Atomic Energy Agency
IBP	—	International Biological Programme
ICRAF	—	International Council for Research in Agro-Forestry
ICSU	—	International Council of Scientific Unions
IUBS	—	International Union of Biological Sciences
IUCN	—	International Union for Conservation of Nature and Natural Resources
MAB	—	Man and the Biosphere Programme
NCEP	—	National Committee on Environmental Planning
NEPA	—	National Environmental Policy Act (1969)
NWDB	—	National Wastelands Development Board
SPCB	—	State Pollution Control Board
UNCED	—	United Nations Conference on Environment and Development also called “Earth Summit 1992”
UNEP	—	United Nations Environment Programme
UNESCO	—	United Nations Educational Scientific and Cultural Organisation
WCS	—	World Conservation Strategy
WHO	—	World Health Organisation
WWF	—	Worldwide Fund for Nature (also known as World Wildlife Fund)

**IMPORTANT GOVERNMENT AND NON-GOVERNMENT
ORGANISATIONS/AGENCIES INVOLVED
IN ENVIRONMENTAL ISSUES**

1. Advisory Board on Energy (ABE)
2. Bombay Natural History Society (BNHS)
3. Central Forestry Commission (CFC)
4. Department of Non-conventional Energy Sources (DNES)
5. Industrial Toxicology Research Centre (ITRC)
6. National Environmental Engineering Research Institute (NEERI)
7. National Dairy Development Board
8. National Natural Resources Management System
9. National Wetland Management Committee
10. State Pollution Control Board
11. Tata Energy Research Institute (TERI)
12. Central Soil Salinity Research Institute

IMPORTANT DAYS OF ENVIRONMENTAL SIGNIFICANCE

- | | |
|---|---------------------|
| 1. World Environment Day | 5th June |
| 2. World Nature Day | 3rd October |
| 3. World Population Day | 11th July |
| 4. World Forest Day | 21st March |
| 5. World Health Day | 7th April |
| 6. National Science Day | 28th February |
| 7. Earth Day | 22nd April |
| 8. Anti Tobacco Day | 31st May |
| 9. World Food Day | 16th October |
| 10. Wild Life Week | 1-7th October |
| 11. National Environmental
Awareness Month | 19th Nov.-18th Dec. |
| 12. United National Day | 24th October |
| 13. Ozone Day | 16th September |

1

Environmental Studies—Scope and Importance

- Introduction
- Environment
 - Spatial and Time Scale of Environment
- Weather and Climate
- Habitat
- Components of Environment
 - Abiotic (non-living) Components
 - Biotic (living) Components
- Types of Environment
- Human Interference with the Environment
- Need for Public Awareness
- Environmental Ethics
- Environmental Education
 - Objectives of Environmental Education
 - Principles of Environmental Education
 - Stages of Environmental Education
 - Importance of Environmental Education
 - Scope of Environmental Education
- Important Terms

INTRODUCTION

Nature consists of two very much complex, interdependent mutually reactive and interrelated entities—the **organisms** and the **environment**. The organisms can survive only in appropriate environments, interact with each other, and are influenced by the whole complex of environmental factors. The various principles that govern the relationships between the organisms and environment is called **ecology**. The term 'ecology' (Gk. *Oikos*—house or place to live, *logos*—study or discourse) was first introduced by a German biologist **Ernst Haeckel** (1869), and defined it as '*the study of reciprocal relationships between organisms and their environment*'. Ecology is the branch of biology that deals with the study of interactions between organisms and environment. An understanding of ecological principles is essential for the sustainable use of resources and to evolve strategies for the mitigation of environmental problems at local, regional and global levels.

ENVIRONMENT

The term 'environment' means surroundings, in which the organisms live. It is the sum total of all biotic (living) and abiotic (non-living) factors that surround and potentially influence an organism. Some components of the environment serve as resource (*e.g.* soil, water etc.) while others act as regulatory factor (*e.g.* temperature, light etc.). Different components of the environment are interlinked and interdependent. Environment creates favourable conditions

for the existence and development of living organisms. In context of human beings, environment can be defined in number of ways:

(i) *“Environment is the sum of all social, economical, biological, physical or chemical factors which constitute the surroundings of man, who is both creator and moulder of his environment.”*

(ii) *“Environment refers to the sum total of conditions which surround man at a given point in space and time.”*

(iii) *“Environment is the representative of physical components of the earth wherein man is the important factor influencing his environment.”*

Spatial and Time Scale of Environment

The environment can be understood at both large and small scales. This is reflected in regional and global climatic patterns, as well as the local climatic conditions called the **microclimate**. The term ‘spatial’ refers to the physical space occupied by an organism. Most organisms interact with their environment at several spatial and time scales. For example, a single bacterium in soil, interacts with air and water within a fraction of a cubic centimetre space, while a tree interacts with a large volume of air, water and soil at a large spatial scale. The environment varies from place to place due to variation in climate, and topography. The activities of organisms influence the hydrosphere, the lower atmosphere and the near surface part of the lithosphere through exchanges of matter and energy. Organisms have to cope with the external environment over a range of time scales, varying from few minutes to days, seasons or over a much longer period of geological time scale. For example, the population of phytoplankton (*i.e.* microscopic photosynthetic organisms that float on water surface) may undergo change within a few days with the change in light conditions in aquatic systems. On the contrary, the variations in lithosphere occur very slowly and take a long period of time.

WEATHER AND CLIMATE

The term ‘**weather**’ refers to the short term properties of the atmosphere (such as temperature, pressure, humidity, rainfall, sunshine, cloud cover and wind, etc.) at a given place and time. The average weather of an area including general patterns of atmospheric conditions, seasonal variations and weather extremes averaged over a long period of time is called **climate**. Thus, weather refers to the hourly, daily or weekly changes in the above properties, climate reflects longer periods, such as season or years. The climate is largely determined by the temperature and rainfall of an area. Differential input of solar radiation in different regions and redistribution of heat energy by winds and ocean currents results in global variations in temperature and rainfall. The variations in temperature, rainfall and humidity in different regions of globe determine global climate patterns which govern all life on earth.

Climatic Zones. The entire earth can be divided into four main climatic regions on the basis of mean temperature along latitude. These regions are:

1. Tropical region (0°–20° latitude),
2. Subtropical region (20°–40° latitude),
3. Temperate region (40°–60° latitude), and
4. Arctic and Antarctic regions (60°–80° latitude).

Temperature varies with change in latitude and altitude. The mean temperature decreases as we move from tropical to arctic region. A similar climatic zonation occurs with increasing altitude in the mountains. The mountains which are located in tropical region will successively have tropical, subtropical, temperate and alpine zones with increasing altitude. Likewise, the high altitudes in temperate zone, will have alpine climatic conditions. Within each temperature based climatic zone, the annual precipitation (*i.e.* rainfall and/or snowfall) varies considerably. The two factors, temperature and precipitation, together determine the vegetation and soil type.

Microclimate. The climatic conditions that prevail in an area of limited size, such as the immediate surroundings of plants and animals, constitute **microclimate**. It generally differs from the prevailing regional climatic conditions. For example, in a forest, the ground vegetation receives less light due to dense foliage of tall trees. Tall trees also change the air temperature profile. During the daytime, air temperature inside the forest is lower than outside. Similarly, the interior of a forest is more humid than the surrounding non-forested area. Thus, the microclimate differs in different zones of a forest.

HABITAT

The place occupied by an organism, population or community which is exposed to a particular combination of environmental factors is called **habitat**. In this combination, no environmental factor acts independently but is also interacted by other factors. Habitat is, therefore, also defined as '*the sum total of environmental factors or conditions, which determine the existence of an individual organism, population or community in a particular locality*'. The term habitat is more specific than the environment because it corresponds to a particular combination of its factors. It may be as small as bark of a tree or a burrow or as large as ocean. Each habitat may have several minor variations due to minor change in one of the environmental factors. The habitats with minor variations are called **microhabitat** or **partial habitats**. For example, vertical stratification of temperature produces a number of microhabitats around different parts of a large plant.

Habitats are characterised by conspicuous physical features, which may include the dominant forms of plant and animal life. Plants and animals are influenced by the environmental conditions of a particular habitat, indicate some specific traits. For example, the characteristics of plants growing on saline soils differ from the plants found growing on normal non-saline soils.

COMPONENTS OF ENVIRONMENT

The environment is classified into two components : abiotic (non-living) and biotic (living) components.

Abiotic (Non-living) Components

The abiotic or non-living components include the **climatic** and **edaphic factors**. The climatic factors include temperature, humidity, rain and snowfall etc. The edaphic factors comprise the soil and substratum. The ability of organisms to utilise, tolerate or combat the various abiotic factors are different and it may limit their distribution, behaviour and

relationship with other organisms. Some of the most important abiotic factors are given below:

1. **Temperature.** Living organisms can survive only in a narrow range of temperature which allows their metabolism. The living organisms develop physiological and behavioural adaptations to withstand extremes of temperature. Many animal (such as some birds and mammals) migrate to warmer places in winter to avoid extreme cold. Some desert animals live inside burrows to avoid the intense heat of the desert.

2. **Water.** Water is an essential requirement of life. No life can exist without water. The requirement of water varies from organism to organism. The distribution of organisms depends upon the extent of the need and special adaptations for conserving water.

3. **Light.** Light is essential for photosynthetic organisms for the preparation of food on which the rest of the living world depends. Plants show various adaptations for obtaining optimum light. The activities of a large number of organisms are regulated by light. For example, cockroaches, moths and bats are active during the night.

4. **Humidity.** It is the amount of water vapours present in the atmosphere. Humidity regulates the rate at which water evaporates from the body surface of land organisms by transpiration, perspiration and other means. Different plants and animals show various adaptations to withstand dry conditions.

5. **Wind.** Wind determines the weather condition. It helps in the dispersal of seeds and fruits of many plants.

6. **Mineral Elements.** A large number of minerals are required by organisms for their proper growth. Deficiency or absence of any one results in abnormal growth which may lead to death. High concentration of minerals are equally harmful and can limit the distribution of organisms.

7. **Background.** The background of the habitat also determines the distribution of animals by enabling them to camouflage against the colour, general texture and pattern. For example, desert animals like the lion and the camel are sand coloured.

Biotic (Living) Components

The living organisms form the biotic component of the environment. All organisms require energy for their life processes and materials for the formation and maintenance of body structures. Food supplies both energy and materials for the sustenance of life. Green plants produce carbohydrates by photosynthesis and also synthesise proteins and fats. The green plants are, therefore, called **producers**. The animals that consume this energy as food are called **consumers**. The non-green organisms like the fungi and some bacteria which are incapable of producing their food, live on the dead and decaying plant or animal parts are called **decomposers**.

TYPES OF ENVIRONMENT

Environment can be conveniently divided into two categories: 1. Natural environment and 2. Man-made or anthropogenic environment.

1. **Natural Environment.** The environment that comes into existence without interference of man is called natural environment. It operates through self-regulating mechanism called homeostatic environment mechanism *i.e.*, any change in the natural

ecosystem brought about by natural process is counter balanced by changes in other components of the environment.

2. **Man-made or Anthropogenic Environment.** The environment which has been modified by human activities is called man-made environment. Man is the highest of all the creatures on this earth. He is modifying the environment according to his own needs and ways without taking into account its consequences. Increase in the scientific technologies which are the product of human brain is now deteriorating the environment.

HUMAN INTERFERENCE WITH THE ENVIRONMENT

Every living species of plants or animals influences its environment and in turn gets influenced by it. The magnitude of such influences is not usually high in these species because of the fact that due to natural checks their population cannot rise beyond certain limits and they can also not modify their own way of life. However, man is an exception. With increasing scientific knowledge, man is able to modify the environment to suit his immediate needs much more than any other organism. This enables man to improve the quality of his life.

Since the very beginning of human civilization, some thousand years ago, man started interfering with the environment. He devastated forests by cutting trees for the wood and for other household needs. He removed stretches of forests for bringing land under cultivation. He killed animals—the gentle ones, for food and the fierce ones, for safety. He had polluted the rivers with chemicals from factories, thereby making the water unfit for his needs. All these activities, however did not affect the environment too seriously upto a fairly long time, because the population was not too high and the life style was not so complex. The natural self-purifying and self-cleansing capacity of the environment was undeteriorated.

However, with the scientific and industrial revolution in the recent past, there has been immense impact of man on his environment. Man has failed to realise that any change upsets the balance of the ecosystem as a whole. All the devastating effects of man's effect to control nature have occurred because he has upset the balance relationship of the organisms that make up the environment. Huge industrial installations every year, introduction of faster mode of transport and sprouting up of large crowded cities (urbanization) are the main outcomes of the modern civilization. These and a large number of many others are contributing to what is called environmental pollution. An example of which is also the widespread use of insecticides. The immediate effect was a reduction in the population of pests and an increase in the yield of crops. But these insecticides also poisoned and killed birds which feed on insects. As a result, the next generation of pests multiplied even faster in the absence of their natural enemies, and damage to crops was much more. Increasing industrialization is also causing much danger to man's life by polluting the environment.

NEED FOR PUBLIC AWARENESS

With the advancement in technology, explosive increase in human population, scarcity of space and food, deterioration of hygienic conditions, depletion of natural resources and socio-economic problems, one needs extensive and exhaustive study of the environment, particularly in relation to human survival and benefit. The subject is gaining more popularity with its name as **environmental biology** or **environmental studies**. However, the environmental biology is not a new discipline but simply an extension of ecological approach which stresses upon the study of environment in its totality with special emphasis on the welfare of man.

Environmental Studies ebook



Publisher : **Laxmi Publications** ISBN : 9788131806418

Author : **Dr J P Sharma**

Type the URL : <http://www.kopykitab.com/product/3088>



Get this eBook