

Environmental Science and Engineering

ECOLOGY AND ENVIRONMENTAL STUDIES

SANTOSH KUMAR GARG



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ENVIRONMENTAL SCIENCE AND ENGINEERING

ECOLOGY AND ENVIRONMENTAL STUDIES

*(Covering the UGC Syllabus on "Environmental Studies"
and Syllabuses of Various Engineering and Science Colleges
including VTU and Anna University ; with 790 Objective Type Questions)*

*[For Undergraduate Courses in all branches of Engineering, Science, Medicine, Law, etc.,
covering the UGC syllabus of six-months compulsory core module course in Environmental
Studies for all the Universities / Colleges]*

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Dedication

*This book is dedicated to the memory of those
millions and millions of unknown
people, who have lost their lives in the
world's environmental disasters.*

Foreword

Economic growth and development across the world has caused major impacts on the Earth's ecosystems and natural resources to an extent that can limit the well-being of future generations. There is now serious questioning across the globe of the path that economic activities have expanded along since the advent of the Industrial Revolution. The increase in emissions of greenhouse gases is only one part of a progressive decline in the quality and magnitude of natural resources such as clean air, water, healthy soil, forests and biodiversity. At the same time, the world has attained unprecedented growth in income and wealth measured purely in financial terms. The progress of scientific knowledge and development has been equally impressive. Hence, human civilization today possesses the means by which it can bring about profound and lasting change in the way activities are pursued in the future. Knowledge of options that could be adopted to drive such change provides great promise for growth and development that is truly sustainable.

This book is an extremely useful compilation of current knowledge on ecological and environmental issues, which must form the basis for change in human behaviour and activities that embrace the objectives of sustainable development in the years ahead. Not only does this valuable compilation give us a very clear perspective of ecosystems and the state of natural resources across the globe but also provides useful knowledge underlining solutions such as those involving production of energy from renewable sources. The comprehensive coverage of subjects that underlie conservation of natural resources and strategies for sustainable development would be of relevance not only to developing countries but also to prosperous industrialized nations as well. This book, therefore, would be of great value to students in a number of disciplines as well as the average citizen who is concerned about the future of planet Earth and the direction of human civilization in the years ahead.

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***Dr. R.K. Pachauri** is also heading the Intergovernmental Panel on climate change (IPCC)—A U.N. Scientific body, which has been awarded the **Nobel Peace Prize, 2007**, to be co-shared with Mr. Al-Gore Jr., the former U.S. Vice President for their effort to build up and disseminate greater knowledge about man-made climate change due to *global warming*, and to lay the foundations for the measures that are needed to counteract such changes.

Preface

The excessive growth of human population, increasing from about 1 billion in the year 1800 to about 6.7 billion at the start of the year 2008, has resulted in enormous urbanisation and expansion of agricultural, industrial, and commercial activities on our fragile planet-Earth. The large scale use of fossil fuels (coal, oil and gas) in industries as well as in automobiles have accelerated and resulted in wide spread pollution of our environment, at local, regional, as well as global levels. *Not only our physical environment consisting of air, water, and land, have been polluted, but even the biological bodies such as plants and animals, providing food to humans, have been contaminated.*

The pollution of air, has caused the worst global impacts, affecting the entire human population living on Earth, because air atmosphere is a common connected body over the entire globe. The air pollution caused by the evolution of chlorofluorocarbons from industrial activities has resulted in causing frequent **depletion of ozone** in our outer atmosphere (stratosphere). Since the ozone layer found in the stratosphere helps in absorbing and preventing the harmful ultraviolet (UV) radiations (released by sun rays) from reaching the Earth's surface, the reduction in ozone thickness from the usual about 3.5 mm to as low as about 1.5 mm, have made humans susceptible to U.V. radiations and their harmful effects, such as, skin cancers, cataracts, blindness, and reduction in overall immune efficiency, etc. U.V. radiations, similarly, adversely affect the animals as well as plants, interfering with photosynthesis, leading to reduced crop yields.

The excessive burning of fossil fuels have, similarly, resulted in the increase of carbon dioxide concentrations in the atmosphere by more than 20% during the last about 50 years, causing an overall heating effect on the Earth, leading to what is known as **global warming**. *The gloabl warming will not only increase the sea levels, submerging low levelled land, and contaminating the ground waters by the ingress of salty sea water towards the land, but will also cause large scale changes in climates over the various regions of the world.*

*The uncontrolled global warming may cause the Earth's temperature to go up by 4 to 5°C during the next about 200 years, which will melt all the polar ice caps and glaciers, leading to rise in sea levels by as much as **about 7 metres (22 ft)**, submerging several island countries and low lying coastal regions.*

The climate changes may also very adversely affect various countries, and more particularly the developing and under-developed countries located at lower latitudes, including India. The rainfalls are likely to increase at some places and decrease at some other places. The frquency of floods, droughts and cyclones are likely to increase many fold. There will be alround shortage of water during summer season, as glaciers will no longer be there, eliminating perennial river supplies. There will be acute shortage of food, spread of diseases like malaria and diarrhoea, extinction of several existing species, large scale migration of people-leading to conflicts-disturbing international peace, and various other adverse impacts of global warming on mankind, leading to large scale destruction and catastrophs.

The changing life style of modern man is not only polluting our environment, but is also **over-utilizing our natural resources**, particularly the non-renewable resources, like metals,

minerals, and fossil fuels. *Such lifestyles, involving excessive consumption of resources, is likely to deprive our future generations from the availability of such resources, as their regeneration will take millions of years.*

All such unsustainable human actions are finally likely to cause great damage and harmful effects on humans, and may possibly lead to the extinction of man from this planet. When the changing environments have completely eliminated several biological species, as huge as Dianasurs, and brought several others to the threat of extinction, then why man—also a biological species born out of some favourable environmental factors, will not become extinct, if he himself reverses those favourable conditions to such a large extent that they no longer remain favourable to his continuation or survival.

Sustainable life styles and sustainable developments of the countries and of the entire world in this context, assumes a great significance, and has become the prime necessity of today. The **sustainable development**, as you will read in this book, is defined as “*the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.*” All our developmental activities will, therefore, have to keep the well-being of our environment in mind. This can be done only when there is a public pressure on the industry, trade, and above all on the governments in power. *The public pressure, on the other hand, will be developed only when the public knows the values and the importance of the environment, and of the harmful effects being caused by the ‘environmental degradations’.* It is this context, in which it has become extremely necessary for all the vigilant societies, to impart atleast the basic knowledge of the environmental studies to all its people, and more particularly to the coming generation of the student community.

Keeping in mind this necessity and importance of environmental knowledge to be given to our student generation, Sh. M.C. Mehta, a Delhi based advocate, filed a writ petition in the Hon. Supreme Court of India in the year 1991, requesting the Court to issue appropriate directions to all the educational institutions for making it compulsory to impart sufficient knowledge of all environmental issues to all the college and school students in the country. This petition was accepted and listed as **W.P.(C) No. 860 of 1991-titled M.C. Mehta Vs UoI & Others.** In persuance to this petition, the Hon. Supreme Court Bench consisting of Justice Ranganath Misra CJI, G.N. Ray and A.S. Anand JJ, vide order dated **22.11.1991**, stated that “*we accept the principle that through the medium of education, awareness of the environment and its problems related to pollution should be taught as a compulsory subject*”. This order also noted down the submissions of the Attorney General of the GoI, that the Union Govt. is associated with only higher education, and that the U.G.C. (University Grants Commission) will take appropriate immediate steps to give effect to the above mentioned principle of requiring the universities to prescribe a course on environment, and would consider the feasibility of making this a compulsory subject at every level in college education [1991 (2) SCALE].

The U.G.C., thus, took upon itself the responsibility of introducing a new compulsory subject on “Environmental Studies” in all the colleges and universities at all the undergraduate levels. The U.G.C., then, appointed a Committee of Experts to advise it on the curriculum for introducing such a compulsory subject at all the undergraduate courses. This Committee came out with a **model syllabus for the Core Module Course in Environmental Studies**, which was circulated by UGC to various universities and institutions. The U.G.C., vide D.O. No. F-13-1/2000 (EA)/ENV/Cos-I/Dt 24.07.2002, also requested all the institutions and universities to introduce such a compulsory subject on Environmental Studies in all their undergraduate courses, irrespective of the stream of education. When all these facts were brought

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out before the Hon. Supreme Court, the Bench of Justice N. Santosh Hegde J and Justice B.P. Singh J, passed an order on **18.12.2003**, directing all the respondents—States and other authorities (*i/c AICTE*) concerned, to take steps to see that all educational institutions under their control do introduce such a compulsory subject, starting from the next academic year, *viz.*, 2004-05 atleast, if not already implemented. ***The Court also stated that non compliance of the same by any of the institution should be treated as a disobedience, calling for instituting disciplinary action against such institutions [2003 (9) SCALE].*** The specified Core module syllabus of UGC is given on page (xxi) to (xxiii).

As a consequence to this, many of the universities and colleges, including the engineering colleges, have introduced this subject in the first or second year of their undergraduate courses. Many of the universities and collges have accepted and implemented the *standard core module U.G.C. syllabus*, with the exception of certain others, who have drawn their own syllabuses. Some other universities & colleges are still in the process of introducing the subject in their undergraduate courses.

The Visveshwariaya Technological University (VTU) of Karnataka, controlling several engineering colleges in the State, have prescribed a *totally Objective Question Type of paper for the subject, and with their own syllabus*. The VTU's syllabus is given on page (xxiv). ***This book fully covers the UGC as well as the VTU syllabuses, with 790 Objective Type Questions.***

The Author shall welcome and acknowledge all constructive suggestions, for future improvement of this book. Considering the fact that this new subject has been introduced under different names in various Colleges/Universities such as “*Environmental Science and Engineering*”, “*Environmental Studies*”, “*Ecology and Environment*”, etc. ; the title of the book was slightly modified in the 3rd edition. The present 4th edition has further been revised and updated with addition of certain additional photo figs of *Jharia Coal Mines* and *Knysna Estuary (South Africa)* along with their description.

It is expected that this book will fill the presently existing gap of non-availability of any simple and knowledgeable book on this new subject.

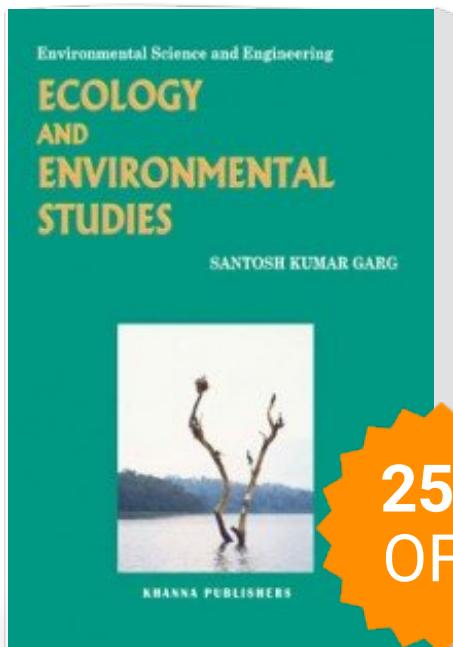
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