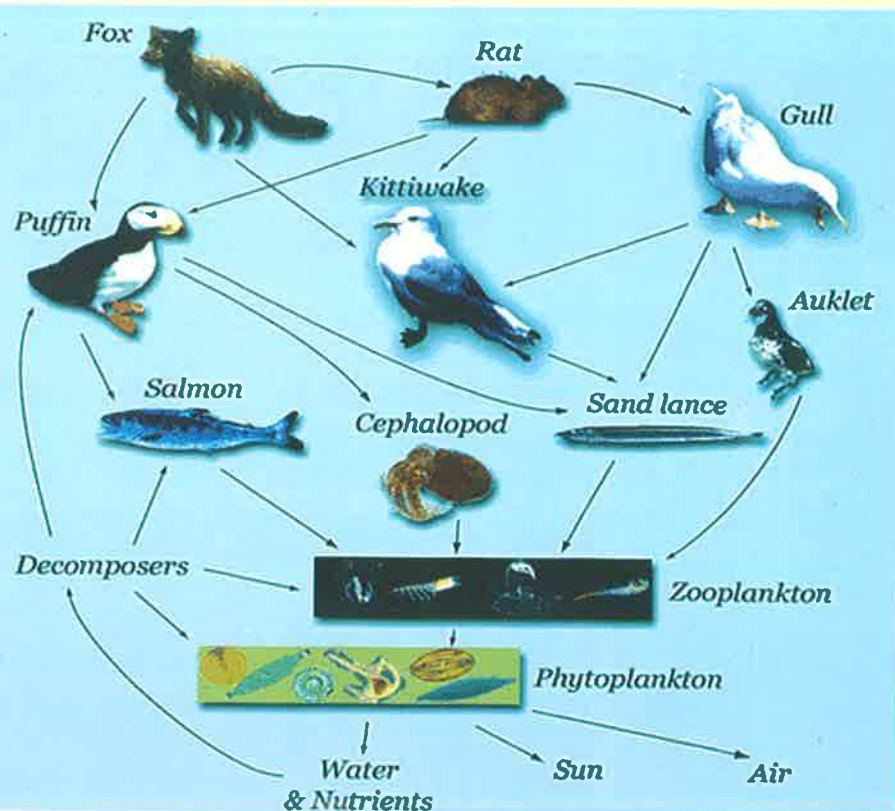


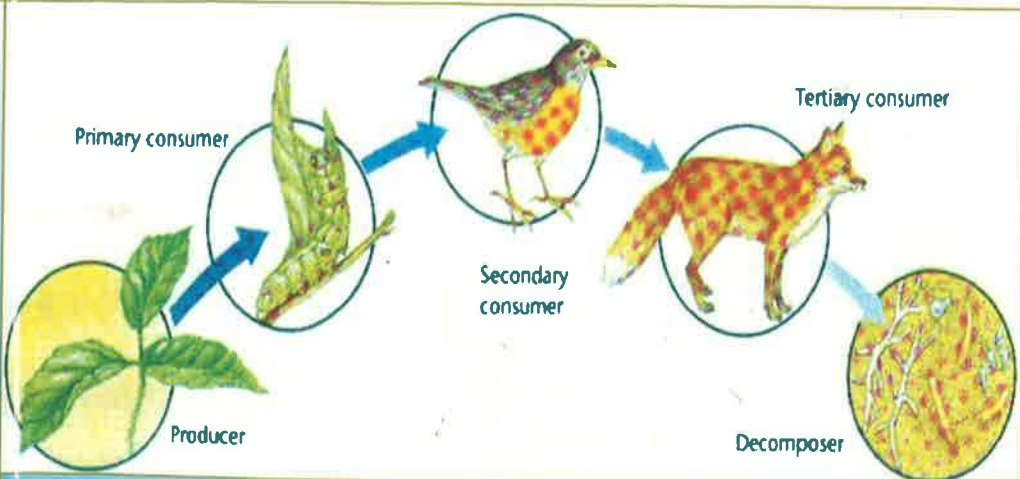
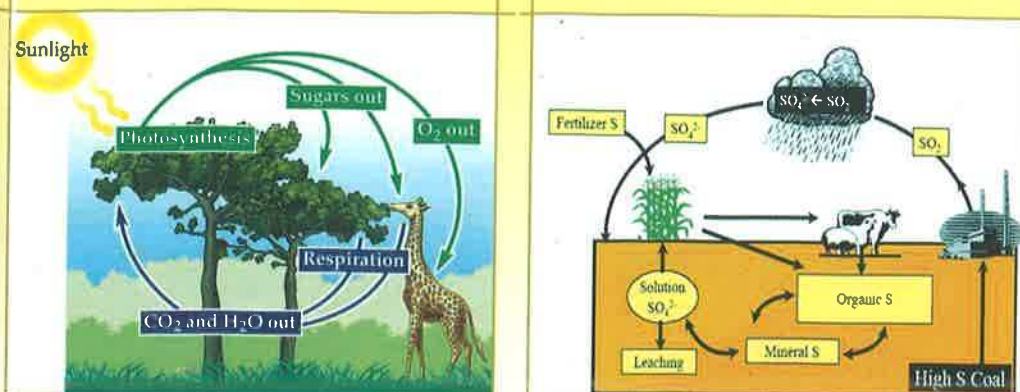


A TEXT BOOK ON ECOLOGY &
ENVIRONMENTAL SCIENCE

M. PRASANTHRAJAN
P.P. MAHENDRAN



A TEXT BOOK ON ECOLOGY & ENVIRONMENTAL SCIENCE



M. PRASANTHRAJAN
P.P. MAHENDRAN



Agrotech Publishing Academy

11-A, Vinayak Complex-B, Durga Nursery Road,
Udaipur - 313001 INDIA
Mobile : 9414169635

ABC

This book is designed for students who are interested in environmental science. The subject is available in a single volume discussing ecology and environment and comprehensive information intended for an effort has taken to provide information and multiple angles to the reader. This book covers diversity, sphere, pollution, waste, laws, impact, agencies and. Needless to say, it is useful to the understanding of students of science dealing with environmental pollution would find it a reference book. It is meant for students and people who are concerned with the well being of our planet.

The pictures in the book are not just for the subject but are associated with the supplementary material increasing the knowledge. Though it is not possible for each and every aspect of ecology and environment to be made to include the relevant to the understanding of the carefully selected material and to increase the student use of the book, we have written a book that is the basic and fundamental and environment. It is written concisely. Important terms are included within the body of the book and included at the end.

2ND EDITION TEXTBOOK ON ECOLOGY & ENVIRONMENTAL SCIENCE

M. PRASANTHRAJAN
P.P. MAHENDRAN



Agrotech Publishing Academy
Udaipur – 313 002



ISBN: 978-81-8001-111-1
PRICE: Rs. 150.00

This book is a student friendly environmental subject volume ecology and co intended effort I informa multiple the read chapters diversity pollution laws, in agencies Needless useful to students dealing pollution reference meant for people who well being

book are subject associated supplement increasing Though it for each ecology an made to in relevant to understand carefully se and to incre student use concerns, write a book the basic an and environ is written Important to within the t included at the

Acknowledgements

We acknowledge the people who have knowingly or unknowingly helped us to write this text book. Our families and friends continued to give understanding and support as we worked on this book. We acknowledge our students who have given us feedback over the years concerning the material and its relevancy. Also we thank Prof. L.L. Somani and Mrs. Geeta Somani for their excellent work in giving shape to this text book. We greatly acknowledge the Dayal Computers and S.S.S. Printers for the neat execution. Also we thank Sushma Saranya for her excellent contribution in minimizing the errors. The author, Prasanthrajan wish to thank his lovable wife and best friend Mrs. SHALINI PRASANTHRAJAN for her love, affection and constant encouragement.

Authors

Contents

Preface	3
Acknowledgements	4
About the Book	7
About the Authors	8
1. Introduction	9
Environmental Science – Ecology – types - Agro-ecology	
2. Natural Resources	12
Classification – Soil – Water – Food – Forest – Wild life – Energy resources	
3. Biosphere	32
Biosphere – Ecosystem – Concept – Definitions – Structure and Components – Types of Ecosystem – Biomes – Aquatic Biome – Desert Biome – Forest Biome – Grassland Biome – Desert Biome – Tundra Biome – Plant Adaptations – Energy Flow of Ecosystem – Food Chain – Food web – Ecological pyramids	
4. Population Ecology and Community Ecology	77
Concepts in Species – Types – Population – Population Attributes – Principles – Population Interactions – Classification – Importance – Community – Attributes of Community – Principles – Succession – Types – Successional Pattern	
5. Biodiversity	103
Concepts – Definition - Types – Use Value of Biodiversity - Hot Spots – Reason for Biodiversity Loss – Conservation	
6. Spheres of Earth	109
Atmosphere - Layers – Importance – Functions – Components	
Hydrosphere - Hydrological Cycle – Importance – Functions – Components	
Lithosphere - Components – Importance – Bio-geochemical Cycles – Classification – Nitrogen - Phosphorus – Sulphur – Carbon – Oxygen Cycles	

7.	Environmental Pollution	126
	Pollution – Pollutant – Types of Pollution – Air pollution - Major Air pollutants - Sources – Effects – Control Measures – Automobile Emission – Global Air Pollution – Important Air Pollution Episodes – Natural Ambient Air Quality Standards – Particulate Pollution – Smog – Classification – Acid Rain – Noise Pollution – Causes - Source – Measurement – Effects – Control Measures – Green House Effect – Global Warming – Effect and Control measures – Ozone Layer – Formation - Depletion – Water Pollution – Classification of Water Pollutants – Sources – Effects – Control Measures – Eutrophication – Water Quality Standards – Waste Water Treatment Methods and Disposal – Soil Pollution – Soil Pollutant - Classification – Sources – Effects – Control Measures – Bio-magnification – Radioactive Pollution – Thermal Pollution – Bio-indications.	
8.	Agricultural and Industrial Pollution	194
	Agricultural Pollution – Source – Effects – Control Measures – Ecofriendly Techniques in Agriculture – Role of Eco-safe Inputs – Industrial Pollution - Leather Industry - Sugar and Distillery Industry – Paper Mill – Textile Mill – Mining Industry.	
9.	Waste management and Recycling	227
	Solid Wastes – Classification – Composting – Sanitary Land Filling – Thermal Process – Recycling	
10.	Environmental Impact Assessment and Environmental Protection	246
	Environmental Impact Assessment - Global Treaties - Organisations and Environmental Acts - Global Treaties – Agreements – Convention on the Environment – Organizations and Agencies - Environmental Acts – Policy – Laws Enforcement and Regulations – Environmental Education.	
	Glossary	262
	Subject Index	285

About the Book

This book is designed to meet the needs of students who enroll ecology and environmental science. A vast literature on this subject is available but this book is a single volume discussion covering all the aspects of ecology and environment. This book is a current and comprehensive, yet not encyclopedic, intended for an introductory audience. Much effort has taken to provide all possible information and the subject is discussed in multiple angles to cater the diverse interests of the reader. This book is divided into eleven chapters covering ecology, ecosystem, bio-diversity, spheres of earth, environmental pollution, wastes management, environmental laws, impact assessment, environmental agencies and environmental organization. Needless to say this book would be highly useful to the under graduate and post graduate students of science subject. University faculty dealing with ecology and environmental pollution would find this book as an invaluable reference book. In fact this book is not only meant for students and teachers but also for the people who are very much concerned with the well being of our environment.

The pictorial representations in this book are not just concerned with the related subject but provide extra information associated with particular subject, in providing supplementary knowledge and hence increasing the knowledge by leaps and bounds. Though it is not possible to include the pictures for each and every terms associated with ecology and environment but effort has been made to include the pictures, which are more relevant to the subject and will help in understanding the subject. The photos were carefully selected to add realism to the subject and to increase the interest of the reader. Since student use of the text was one of our primary concerns, we made a concentrated effort to write a book that is highly usable to understand the basic and fundamental concepts of ecology and environment. To achieve this goal the book is written concisely and well illustrated. Important terms are printed in boldface type within the body of the text and a glossary is included at the end of the text for easy reference.

Xenobiotic: Compound foreign to biological systems. Often refers to human-made compounds that are resistant or recalcitrant to biodegradation and decomposition.

Xerophile: Organism adapted to grow at low water potential, i.e., very dry habitats.

Yard Waste: The part of solid waste composed of grass clippings, leaves, twigs, branches, and other garden refuse.

Yellow-Boy: Iron oxide flocculant (clumps of solids in waste or water); usually observed as orange-yellow deposits in surface streams with excess iron content.

Zero Air: Atmospheric air purified to contain less than 0.1 ppm total hydrocarbons.

Zero-emission vehicle: An alternative to vehicles powered by internal combustion engines, such as solar powered or electric vehicles.

Zooplankton: Tiny, free-floating animals in water, which serve as food for fish and other organisms.



Subject Index

- | | |
|-------------------------------------|--|
| abiotic 44-50 | bio-oxidation 177 |
| abiotic components 34,35,54, 59, 63 | bio-reduction 177 |
| acetogenesis 242 | biosphere 34 |
| acid deposition 139 | bio-stimulation 187 |
| acid rain 141 | biotic 45,50 |
| aesthetic value 27 | biotic component 34,54,59, |
| age structure 80 | birth rate 80 |
| agricultural pollution 194 | BOD 162 |
| agricultural waste 164 | body fat 20 |
| agro-ecology 11 | boreal forests 53 |
| agro-ecosystems 95 | breeding potential 83 |
| agro-forestry 24 | bromeliads 76 |
| air pollution 127 | buttresses 75 |
| Allee's principle 84 | cadmium 164 |
| alpine tundra 61 | canopy 52 |
| amensalism 91 | carbon cycle 120, 123 |
| antibiosis 90 | carbon tetrachloride (CCl ₄) 153 |
| aphotic zones 38 | carnivorous mammals 60 |
| aquatic 34 | CFC 128 |
| arctic tundra 60 | chemical treatment 174 |
| assimilation 66 | chlorofluorocarbon (CFC) 154 |
| automobile emissions 131 | chromium 215 |
| autotrophs 35 | climatic savannas 55 |
| bagasse 216 | CO 127, 130 |
| bagasse pith composting 222 | CO ₂ 128, 148 |
| benthic zone 41 | coal resources 20 |
| biocontrol agents 210 | coastal desert 48 |
| biodegradable plastic 180 | COD 162 |
| biodiversity benefits 103 | cold desert 49 |
| biodiversity loss 106 | commensalisms 87 |
| biofertilizers 208 | commercial forestry 23 |
| bio-filters 177 | commercial products 26 |
| biogas 30 | community 32 |
| biogeochemical cycle 114, 115 | community ecology 11,77,91 |
| biological magnification 184 | community woodlots 24 |
| biomass 79 | competition 90,230 |
| biome 36 | conservation strategy 27 |
| bio-mining 176 | consumers 45,50,54,59,63,91 |
| | coral reefs 42 |

- decomposers 45, 50, 54, 92
 deforestation 21, 22
 derived savannas 55
 desert 45
 desert biome 44
 destruction of habitat 26
 detritus food chain 67
 development project 22
 dissolved oxygen 162
 distillery effluent 219
 Dobson unit 154
 drip tips 75
 dry conifer 53
 earth scan 252
 earthwatch programme 255
 earthworms 234
 ecological equivalents 93
 ecological indicators 191
 ecological niches 93
 ecological pyramid 67, 69
 ecological stratification 92
 ecological succession 93
 ecology 10
 economic benefit 27
 eco-safe inputs 208
 eco-social 22
 ecosystem concept 32
 ecosystem ecology 11
 ecosystem stability 27
 ecotone effect 92
 edaphic savannas 55
 edge effect 92
 endangered species 25
 energy efficiencies 65
 energy flow 61
 environmental acts 257
 environmental impacts 22, 246
 environmental laws 257, 259
 environmental legislation 259
 environmental problem 9
 environmental research 9
 environmental resistance 83
 environner 9
 EPA 1986, 258
 EPA 253
 epilimnion 38
 epiphytes 76
 ethanol 244
 euphotic zones 38
 estuaries 44
 eutrophication 165
 exhaustible 12
 exosphere 113
 exotic species 26
 exploitative forestry 23
ex-situ conservation 107
 farm forestry 24
 fertilizer runoff 195
 firewood 22
 flood 21
 fluoride 163
 food chain 67, 68
 food problems 18
 food resources 17
 food web 67, 69
 forest biome 49
 forest fire 22
 forest management 23
 forest resources 20
 fossil fuel 20
 freshwater regions 36
 fuels 244
 functional diversity 104
 fundamental niche 33
 game value 27
 Gause's principle 84
 generalist niche 33
 genetic diversity 104
 geo-thermal energy 31
 global air pollution 135
 global treaties 248
 global warming 146, 149
 greenhouse effect 146, 127
 growth curve 81
 growth rate 80
 HEAL 253
 health effects 132
 heart disease 20
 heavy metals 180, 186
 herbivorous mammals 60
 heterotrophs 35
 Himalayan ecosystem 23
 horizontal stratification 92
 hornesstasis 79
 hot spots 105
 hydrologic cycle 113

- hydrophytes 75
 hydropower 31
 hydrosphere 113
 ICSU 253
 IMCO 254
 immigrant species 77
 incineration 238
 indicator species 77
 industrial agriculture 101
 industrial effluents 183
 industrial smog 138
 industrialized agriculture 17
 inexhaustible 12
 ingestion 66
in-situ conservation 107
 intertidal zone 40
 inverted pyramid 71
 IUCN 253
 key stone species 77
 Lead 128, 131
 lead 164
 legal measures 28
 lentic ecosystem 39
 lianas 75
 lignite 29
 limnetic zone 37
 lithosphere 114
 littoral zone 37
 MAB 255
 macro consumers 35
 mangrove 76
 marine biota 42
 marine regions 40
 marking 79
 mercury 163
 mesophytes 75
 mesosphere 112
 metallurgy 224
 methane 148
 methane emission 196
 methanogenesis 242
 micro consumers 35
 migratory birds 61
 mining industry 123
 mining operation 22
 moist conifer 53
 molasses 216
 mortality 80
 mutualism 85
 native species 77
 natural ecosystem 206
 natural gas 30
 natural genetic stock 27
 natural resources 12
 negative interaction 88
 nekton 42
 nepenthes 76
 neuston 42
 nitrate pollution 164
 nitrogen cycle 122, 125
 noise pollution 142
 nomadic pastoralism 98
 non-conventional 30
 NOx 128, 129, 148
 nuclear power 31
 obysal zone 41
 ocean 40
 organic farming 205
 organic fertilizers 15
 organic pesticides 20
 oxygen cycle 112, 124
 Ozone 128, 150, 151, 152
 ozone depletion potential 154, 156
 paper mill 221
 parasitic food chain 69, 71
 parasitism 89
 particulate pollution 136
 pelagic zone 41
 permafrost 60
 pesticide residue abatement 202
 pests and predators 26
 petroleum 29
 phosphorus cycle 117, 119
 physical methods 174
 physical pollutants 166
 physiological ecology 10
 phytoremediation 186
 plant adaptation 74
 plastics 179
 pollution 126
 pollution 26
 ponds and lakes 37
 population ecology 10, 77
 population equilibrium 81
 population fluctuation 81
 population interaction 85

- positive interaction 85
- predation 89
- pressmud 216
- prey predator food chain 69
- primary succession 94
- producer 45,50,54,59,63
- producer 91
- productivity 66
- profundal zone 37
- project earth 255
- protection forestry 23
- proto-cooperation 88
- pyramid of biomass 73
- pyramid of energy 73
- pyramid of number 71
- pyrolysis 239
- quadrant sampling 79
- radioactive pollution 187
- rare species 25
- realized niche 33
- recycling of wastes 168
- removal of pollutants 168
- removal sampling 79
- SACEP 254
- sanitary land filling 238
- secondary succession 95
- semi-arid desert 47
- shifting agriculture 96
- shifting cultivation 22
- sigmoid curve 81
- single cell protein 242
- sludge management 239
- smog 137
- SO₂ 128, 129
- social forestry 23
- soil erosion 14,195
- soil formation 14
- soil pollution 178
- soil resources 12
- solar energy 18,30
- solid waste 227
- specialist niche 33
- spent wash 220
- SPM 128
- SPV 30
- steppes 57
- stratification 109
- stratosphere 111
- streams & rivers 38
- subsistence agriculture 17
- succession 94
- sulphur cycle 120
- surround 9
- temperate forest 52
- temperate grassland 57
- terrestrial 34
- tertiary consumers 50, 54
- textile mill 222
- thermal pollution 189
- thermoclinia 38
- threatened species 25
- toxic organic chemicals 160
- trophic level 64
- tropical forest 51
- tropical grasslands 55
- troposphere 109
- tundra biome 59
- types of soil 13
- ultraviolet radiation 151
- UNEP 254
- UNESCO 254
- UNICEF 19
- value added products 240
- vermicomposting 232
- vermiwash 236
- vertical stratification
- vulnerable species 25
- waste management 227
- waste water 171
- water cycle 118
- water holding capacity 21
- water pollution 158
- water quality 169
- water resources 15
- WCED 254
- wet organic layering 235
- wetlands 39
- wildlife conservation 27
- wildlife resources 24
- wind energy 31
- wood residues 20
- woodlots 24
- xenobiotics 201
- xerophytes 75
- zoo 26

**DRS**

Assistant
nces) has
on (1994-
2001) and
at Tamil
with an
78 out of
during his
He has
mission
nd ARS-
has been
rofessor
December
olved in
arch and
iled 10
ciated for
He has
d wastes
sting,
working
d and air
cipated in
national
nce and
ne area of
lished 15

ssociate
gricultural
erience in
xtension
sively on
cling of
blem soil
shed 45
obtained
niversity.
M.Sc(Ag)
gricultural
gricultural
ear 1991
ipient of
(2003)
ouncil for