

# State of the Environment



India



2001



**BLANK PAGE**

---

# India : State of the Environment 2001

---



सत्यमेव जयते



Published by the United Nations Environment Programme

Copyright © 2001, United Nations Environment Programme  
ISBN: 92-807-2014-7

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

#### DISCLAIMER

The contents of this volume do not necessarily reflect the views or policies of UNEP or contributory organizations. The designations employed and the presentations do not imply the expressions of any opinion whatsoever on the part of UNEP or contributory organizations concerning the legal status of any country, territory, city or area or its authority, or concerning the delimitation of its frontiers or boundaries.

Cover designed by Purna Chandra Lall Rajbhandari and Ric Dennis A. Canullas  
UNEP RRC.AP

#### Distributed by

United Nations Environment Programme  
Regional Resource Centre for Asia and the Pacific  
(UNEP RRC.AP)  
Outreach Building, Asian Institute of Technology  
P.O. Box 4, Klong Luang, Pathumthani 12120  
Thailand

## Foreword

The Rio Earth Summit in 1992 formulated an action plan, Agenda 21, a multifaceted process to address the full range of development and environmental issues involving participation of governments, international organizations and major groups in the quest for sustainable development.

The publication of the Global Environmental Outlook series, GEO-1, followed by GEO-2000, the Millennium Report on the Environment, involved a participatory assessment process to review the state of the world's environment and to chart a new process for global environmental policy. The diversity and magnitude of environmental problems are outlined, with a call for more complete and precise analyses of the poorly understood linkages between human actions and environmental outcomes. Although the number of policy responses is growing, low priority continues to be afforded to the environment in national and regional planning. GEO-2000 stressed the need for the development of more comprehensive and long-term mechanisms for monitoring and assessing the effects of environmental policies on environmental quality; and for more integrated policy making and action-based programmes to serve the needs of the people.

The United Nations Environment Programme (UNEP) is mandated to produce a Global State of the Environment Report in 2002 (GEO-3) for the 2002 Earth Summit i.e., Rio + 10, and this global assessment will be enriched by producing State of Environment (SoE) reports at the national, subregional and regional levels. In 1998, the UNEP Regional Resource Centre for Asia-Pacific (UNEP RRC.AP) initiated a process on Strengthening National Capabilities on Environment Assessment and Monitoring towards the Preparation of the Global State of the Environment Report 2002, thus linking national to regional and global initiatives.

This National State of the Environment (SoE) Report of India is the one of several national reports from the above process. The Ministry of Environment and Forests (MoEF), Government of India, the national implementing agency in India, has played a very crucial role in carrying out this participatory assessment process in soliciting input from various government sectoral agencies. Around 25 agencies and 60 individuals were involved in the process. With the substantive support from the Tata Energy Research Institute (TERI), the designated national collaborating centre by the Ministry of Environment and Forests of the Government of India, and regular feedback from the South Asia Cooperative Environment Programme (SACEP), this assessment exercise has been successful and instrumental in providing significant input to the ongoing South Asia SoE preparation. It aims at providing guidelines for environmental action planning, policy setting and resource allocation for the coming decades, based on a sound analysis of the state of, and trends in, the nation's environment.

Five priority key issues for the state of environment report for India have been identified by the Government of India and analyzed following the "pressure-state-impact- response" (PSIR) analytical framework. The same process has been followed by the other countries, leading to the identification of their key environmental issues. These can then be addressed subsequently through action-based programmes in the next phase of the planning process.

The five key environmental issues identified for India are (1) land degradation, (2) biodiversity, (3) air pollution with special reference to vehicular pollution in cities, (4) management of fresh water resources, and (5) hazardous waste management with special reference to municipal solid waste management. Land degradation is taking place through natural and man-made process resulting to loss of invaluable nutrients and lower food grain production. Loss of biodiversity is of great concern since many plant and animal species are being threatened. Air pollution in cities is deteriorating due to vehicular growth and trends of air pollution related diseases are increasing. Availability of fresh water, which is going to be one of the critical problems in the coming decades, needs to be addressed on a priority basis. Generation of large quantity of hazardous waste from industries and also the hospital waste has been affecting the public health and environment.

This SoE assessment for India provides a sound basis for the development of action plans, the next stage of the planning process, as we enter the new millenium. The report aims to provide concrete guidance for action planning, policy setting and resource allocation for the coming decades to improve the state of the environment of India and the welfare of her people.

UNEP will continue to provide leadership in the region for the preparation of environmental assessment reports at national, subregional, and regional level and the capacity building necessary to support these assessment activities.



A handwritten signature in black ink, appearing to read 'Klaus Töpfer', with a horizontal line above the first few letters.

Klaus Töpfer  
Under-Secretary General, United Nations and  
Executive Director, United Nations Environment Programme  
August 2001

## **Foreword from Government of India**

## ACKNOWLEDGEMENTS

UNEP would like to thank the many individuals and institutions who have contributed to the preparation of *India: State of the Environment 2001*. They included individuals from Government Departments, intergovernmental organizations, academic institutions, and voluntary organizations. A full list of contributors, reviewers and participants of the national State of the Environment consultation, are included in the Appendix. Special thanks are extended to:

### **National Implementing Agency**

Ministry of Environment and Forests (MoEF), India

### **National Collaborating Centre**

Tata Energy Research Institute (TERI), India

### **Funding**

The United Nations Environment Program (UNEP) provided the required financial support needed to the Strengthening Environmental Assessment and Monitoring Capabilities in South Asia and Greater Mekong Subregion (SEAMCAP) Project under which the India: State of the Environment 2001 has been prepared.

### **SEAMCAP Project Facilitator**

Raghunathan Rajamani

### **Project Leader at National Collaborating Centre**

Subrato Sinha

### **Editor**

Yateendra Joshi

K. P. Eashwar

### SEAMCAP Project Team

#### **UNEP RRC.AP**

Surendra Shrestha  
Choudhury Rudra Charan Mohanty  
May Ann Mamicpic-Bernardo  
Mylvakanam Iyngararasan  
Purna Chandra Lall Rajbhandari

#### **SACEP**

Ananda Raj Joshi  
Pradyumna Kumar Kotta

# Table of contents

---

List of tables .....	xii
List of figures and maps .....	xiv
List of photos .....	xv
<b>Part I    Executive summary</b> .....	01
<b>Executive summary</b>	
Land degradation .....	03
Biodiversity .....	04
Air pollution .....	04
Fresh water management .....	05
Hazardous waste management .....	06
<b>Part II    Overview</b> .....	07
<b>1        Human development</b>	
Introduction .....	09
Population growth .....	09
Poverty and human development .....	10
Employment and income .....	10
Education, literacy, and awareness .....	11
Health and mortality .....	12
Policy .....	13
Population policy .....	13
<b>2        An overview of energy sector</b>	
Introduction .....	15
Energy reserves .....	16
Production .....	16
Coal .....	16
Oil and Natural Gas .....	17
Power .....	17
Renewable energy .....	18
Consumption .....	19
Industrial sector .....	19
Transport sector .....	20

	Agricultural sector .....	20
	Domestic sector .....	20
	Environmental concerns .....	20
<b>3</b>	<b>Industry</b>	
	Introduction .....	23
	Industrial growth .....	23
	Environmental concerns .....	25
<b>4</b>	<b>Agriculture</b>	
	Introduction .....	29
	Agricultural inputs .....	30
	Land .....	30
	Water .....	30
	Irrigation .....	30
	High-yielding varieties .....	31
	Fertilizer use .....	31
	Pesticides .....	31
	Sustainable agriculture .....	32
<b>5</b>	<b>Tourism in India</b>	
	Introduction .....	35
	Trends in tourism .....	35
	Benefits from tourism .....	37
	Environmental impacts .....	38
<b>6</b>	<b>Natural disasters</b>	
	Introduction .....	43
	Natural disasters in India .....	43
	Damage caused by natural disasters .....	44
	Disaster management .....	44
	Earthquakes .....	45
	Droughts .....	45
	Floods .....	46
	Cyclones .....	46
	Environmental aspects of natural disasters .....	46
<b>7</b>	<b>Institutional mechanism and environmental policy</b>	
	Institutional mechanisms .....	49
	Environmental policy in India .....	50
<b>Part III</b>	<b>Priority issues</b> .....	<b>59</b>
<b>8</b>	<b>Land degradation</b>	
	Introduction .....	61
	Pressure .....	61
	Direct pressures .....	61
	Indirect or underlying pressures .....	65

	State - Impacts .....	65
	Response .....	70
	Existing response .....	70
	Policy gap .....	71
<b>9</b>	<b>Biodiversity</b>	
	Introduction .....	77
	Pressure .....	78
	State impact .....	81
	Status of biodiversity in India .....	81
	The Biogeographic classification of India .....	82
	Biodiversity hotspots .....	85
	Biodiversity contribution to Indian economy .....	88
	Response .....	89
	Existing policy response .....	90
	Policy gaps .....	94
	Knowledge/information/gap .....	94
	Policy recommendations .....	94
<b>10</b>	<b>Air pollution with special reference to vehicular pollution in urban cities</b>	
	Introduction .....	97
	Pressure .....	97
	Increase in urban population .....	97
	Increase in number of vehicles .....	97
	Increase in industrial activity .....	98
	Increase in power generation .....	99
	Domestic pollution .....	100
	Other sources .....	100
	State .....	100
	Air pollutant emission load .....	100
	Vehicular emissions .....	101
	Ambient air quality .....	101
	Air quality at traffic intersections .....	105
	Air pollution and health impacts .....	105
	Noise pollution .....	106
	Other impacts .....	106
	Response .....	106
	Existing policy response .....	106
	Policy gaps .....	109
	Knowledge/information/data gaps .....	109
	Policy recommendations .....	109
<b>11</b>	<b>Management of fresh waters</b>	
	Introduction .....	115
	Pressure .....	115

- Uneven resource distribution ..... 115
- Declining resource availability ..... 116
- Increasing resource demand ..... 116
- Inequitable water supply ..... 118
- Resource degradation ..... 119
- Inefficient resource utilization ..... 120
- State ..... 121
  - Resource quantity ..... 121
  - Resource quality ..... 122
- Response ..... 125
  - Existing response ..... 125
  - Policy gaps ..... 127
  - Knowledge/information/data gaps ..... 128
  - Recommendations ..... 129

**12 Hazardous waste: special reference - municipal solid waste management**

- Introduction ..... 133
- Pressure ..... 133
  - Industrial and hazardous waste ..... 133
  - Municipal solid wastes ..... 134
- State ..... 134
  - Industrial and hazardous waste ..... 134
  - Municipal solid wastes ..... 136
- Impact ..... 140
  - Industrial and hazardous waste ..... 140
  - Municipal solid wastes ..... 140
- Projections ..... 142
- Response ..... 142
  - Existing policy responses ..... 142
  - Policy gaps ..... 146
  - Knowledge/information/data gaps ..... 146
  - Policy recommendations ..... 147

**Part IV Conclusions ..... 151**

**13 Conclusions and recommendations**

- Land degradation ..... 153
  - Policy/knowledge/information gaps ..... 153
  - Policy recommendations ..... 153
- Biodiversity ..... 154
  - Policy/knowledge/information gaps ..... 154
  - Policy recommendations ..... 155
- Air pollution with special reference to vehicular pollution ..... 155
  - Policy/information/knowledge gaps ..... 155
  - Policy recommendations ..... 155

Fresh water management .....	156
Policy/information/knowledge gaps .....	156
Policy recommendations .....	157
Hazardous waste management .....	158
Policy/information/knowledge .....	158
Policy recommendations .....	158
<b>Part V</b> <b>Annex</b> .....	161
<b>Annex I:</b> Acronyms and abbreviations .....	163
<b>Annex II:</b> Components of the National SoE .....	165
<b>Annex III:</b> List of participants of the National SoE consultation .....	166
<b>Annex IV:</b> Chapter contributors / authors .....	170
<b>Annex V:</b> List of reviewers and contributors .....	171

# List of tables

---

<b>1</b>	<b>Human development</b>	
1.1	Percentage age distribution of the population for 1991 .....	10
1.2	Changes in sector-wise workforce (distribution of male workers / 1000) .....	10
1.3	India's human development performance vis-à-vis some other countries .....	11
1.4	Selected human development indicators: India and all developing countries .....	11
1.5	Education and literacy: indicators for selected Indian states .....	12
<b>2</b>	<b>An overview of energy sector</b>	
2.1	Proven reserves of fossil fuels and reserve-production ratios .....	16
2.2	Production trends in coal, oil, gas, and petroleum products .....	17
2.3	Monthly per capita consumption of selected fuels in rural and urban areas .....	20
2.4	Evolution of energy policy and planning .....	22
<b>3</b>	<b>Industry</b>	
3.1	Annual growth rates in major sectors of industry (%) .....	23
3.2	Progress of industrial production (selected industries) .....	24
3.3	Industrial contribution (%) to pollution by subsector .....	26
<b>5</b>	<b>Tourism in India</b>	
5.1	Major wildlife sanctuaries, reserves and parks in India .....	41
<b>6</b>	<b>Natural disasters</b>	
6.1	Frequently occurring natural disasters in India .....	43
6.2	Annual damage due to natural disasters in India .....	45
6.3	Major natural disasters in India since 1980 .....	48
<b>7</b>	<b>Institutional mechanism and environmental policy</b>	
7.1	Environmental legislation, acts, rules, notification and amendments .....	51
7.2	List of projects requiring environmental clearance .....	55
7.3	Some of the new policy initiatives undertaken by MoEF .....	56
<b>8</b>	<b>Land degradation</b>	
8.1	Soil erosion .....	67

<b>9</b>	<b>Biodiversity</b>	
9.1	Comparative statement of recorded number of plant species in India and the World (endemic species of plants for India are also shown) .....	80
9.2	Wild relatives of some crops and medicinal plants .....	81
9.3	Wild relatives of domesticated animals .....	81
9.4	Forest types - distribution and percentage .....	83
9.5	Biosphere reserves set up .....	90
9.6	World heritage sites .....	91
<b>10</b>	<b>Air pollution with special reference to vehicular pollution in urban cities</b>	
10.1	Estimated vehicular emission load in metropolitan cities, 1994.....	101
10.2	Details of epidemiological studies undertaken / under progress .....	113
<b>11</b>	<b>Management of freshwater resources</b>	
11.1	Mean flow utilisable surface and ground water resource – basin-wise (in BCM) .....	117
11.2	Water requirement for different uses (in BCM) .....	119
11.3	Disparity in per capita water supply in class-I cities and class-II towns .....	119
11.4	Statewise of wastewater generation (w/w), collection, and treatment in class-I cities and class-II towns (million litres per day) .....	120
11.5	Statewise of wastewater (w/w) generation, collection, and treatment in major contributing states (million litres per day) .....	120
11.6	List of polluted river stretches .....	123
11.7	Water quality status in India (1998) .....	124
<b>12</b>	<b>Hazardous waste: special reference - municipal solid waste management</b>	
12.1	Status of hazardous waste generation .....	135
12.2	Sources and quantum of waste generated from major industrial sources .....	136
12.3	Physico-chemical characteristics of MSW .....	137

# List of figures and maps

---

<b>1</b>	<b>Human development</b>	
	Figure 1.1 Population of India: 1901-2011 .....	09
<b>2</b>	<b>An overview of energy sector</b>	
	Figure 2.1 Share of energy sources in commercial energy consumption (1997/98) .....	15
	Figure 2.2 Gross generation (utilities and non-utilities) .....	17
	Figure 2.3 Sectoral shares of final commercial energy consumption - 1996/97 .....	19
<b>3</b>	<b>Industry</b>	
	Figure 3.1 Annual industrial growth rate .....	25
<b>5</b>	<b>Tourism in India</b>	
	Figure 5.1 Foreign exchange earnings from tourism .....	37
<b>6</b>	<b>Natural disasters</b>	
	Figure 6.1 Human lives lost due to natural disasters .....	44
	Map 6.1 Earthquake Zoning Map .....	45
<b>7</b>	<b>Institutional mechanism and environmental policy</b>	
	Figure 7.1 Protection and management of environment .....	49
<b>8</b>	<b>Land degradation</b>	
	Map 8.1 An overview of soil degradation in India .....	67
<b>9</b>	<b>Biodiversity</b>	
	Figure 9.1 Biodiversity loss: proximate and socio-economic root causes .....	79
	Map 9.1 National forest vegetation map of India with biodiversity hotspots .....	86
<b>10</b>	<b>Air pollution with special reference to vehicular pollution in urban cities</b>	
	Figure 10.1 Vehicular growth in India .....	98
	Figure 10.2 Range and mean of annual averages (1990-98) of SPM in various cities .....	102
	Figure 10.3 Range and mean of annual averages (1990-98) of SO <sub>2</sub> in various cities .....	103
	Figure 10.4 Range and mean of annual averages (1990-98) of NO <sub>2</sub> in various cities .....	103
<b>11</b>	<b>Management of freshwater resources</b>	
	Map 11.1 Per capita resource availability in the country's river basins .....	118
	Map 11.2 Water quality profile of major Indian rivers .....	125

# List of photos

---

<b>2</b>	<b>An overview of energy sector</b>	
2.1	Coal production from mines .....	16
2.2	Oil and natural gas production .....	17
2.3	Thermal power generation .....	18
2.4	Hydro power generation .....	18
2.5	Solar power generation .....	18
2.6	Wind power generation .....	18
2.7	Biogas plant .....	19
<b>3</b>	<b>Industry</b>	
3.1	Mining industry .....	24
3.2	Ramagundam super thermal power project .....	24
3.3	Brick industry .....	25
3.4	Glass industry .....	26
<b>4</b>	<b>Agriculture</b>	
4.1	Agricultural land .....	29
4.2	Food grain production in India .....	29
4.3	Fertiliser use in agricultural field .....	31
4.4	Pesticide use in agricultural field .....	31
4.5	Rain feed farming system .....	32
4.6	Agro-forestry .....	32
<b>5</b>	<b>Tourism in India</b>	
5.1	Har-ki-pauri at Haridwar .....	35
5.2	Rohtang Pass, Manali .....	36
5.3	Calangute beach at Goa .....	36
5.4	Rafting in river Ganga .....	36
5.5	Gateway of India, Mumbai .....	36
5.6	Taj Mahal at Agra .....	37
5.7	Qutab Minar at Delhi .....	37
<b>8</b>	<b>Land degradation</b>	
8.1	Land degradation due to deforestation .....	62
8.2	Land degradation due to erosion .....	62

8.3	Firewood extraction .....	62
8.4	Extraction of fodder .....	63
8.5	Land degradation due to mining activities .....	64
8.6	Overburden dumps in forests .....	64
8.7	Soil erosion .....	66
8.8	Forest degradation and soil erosion in West Khasi hills - Meghalaya .....	66
<b>9</b>	<b>Biodiversity</b>	
9.1	Adhotoda zeylanica: a medicinal plant .....	78
9.2	Lioness with family at Gir forest, Gujarat: needs conservation .....	79
9.3	Mixed coniferous forest .....	82
9.4	Wetlands of West Bengal .....	84
9.5	Waterway in the Pitchavaram mangrove forest flanked by Avicennia and Rhizophora trees .....	84
9.6	Soft corals (Sinularia sp.) of Andaman and Nicobar Islands .....	84
9.7	The Malabar Tree Nymph (Idea malabarica) found only in wet evergreen forest of the Western Ghats .....	87
9.8	Renanthera imschortians: a highly threatened species of orchid commonly known as “Red Vanda” .....	88
9.9	Lion-tailed Macaque: an endangered species .....	88
9.10	Black buck: needs conservation .....	89
9.11	Pitcher plant: an endangered species .....	89
9.12	A herd of Cheetal at Bandipur Wildlife Sanctuary .....	90
9.13	Den of the Royal Bengal Tiger of Sundarbans biosphere reserves .....	91
9.14	Herd of elephants of North-east India .....	92
9.15	Joint Forest Management .....	93
<b>10</b>	<b>Air pollution with special reference to vehicular pollution in urban cities</b>	
10.1	Vehicular growth in Delhi .....	98
10.2	Air pollution from TPP .....	99
10.3	Indoor air pollution .....	100
10.4	Vehicular pollution in urban cities .....	102
<b>11</b>	<b>Management of freshwater resources</b>	
11.1	Delhi’s Viswas Nagar Drain carrying a mix of domestic and industrial wastewater to the Trans-Yamuna drain .....	121
11.2	Water overflow from the conduit carrying freshwater to the Bhagirathi Water Treatment Plant .....	121
11.3	45 MLD capacity sewage treatment plant under Yamuna Action Plan at Faridabad, Haryana .....	127
11.4	Farm pond created in a farmer field in Manoli watershed .....	130
11.5	Masonry gully control structure having harvested water in Parua Nala watershed .....	130

<b>12</b>	<b>Hazardous waste: special reference - municipal solid waste management</b>	
12.1	Secured landfill for disposal of hazardous waste under construction .....	137
12.2	Disposal of plastic bags .....	138
12.3	Municipal waste being compacted at the dumpsite .....	138
12.4	Vermi Compost plant for treatment of solid waste .....	138
12.5	Primary municipal waste collection centre .....	139
12.6	Transportation of municipal solid waste .....	139
12.7	Co-disposal of biomedical waste with municipal waste .....	139
12.8	Hospital waste incinerator at Safdarjung hospital .....	139