CHAPTER ONE

Environment and Environment Degradation

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1.1 Introduction

Environment can be defined as the physical surrounding of man/woman of which he/she is a part and on which he/she is dependent for his/her activities like physiological functioning, production and consumption. His physical environment stretches from air, water and land to natural resources like energy carriers, soil and plants, animals and ecosystems. The relationship between physical environment and the well being of individuals and societies is multi-fold and multi-faceted with a qualitative a well as a quantitative aspect to it. The availability and use of natural resources have a bearing on the outcome and the pace of development process. For an urbanized society, a large part of environment is man made. But, even then, the artificial environments (building, roads) and implements (clothes, automobiles) are based on an input of both labour and natural resources. Commonly, the term 'Environment' is restricted to ambient environment. In that view, the indoor environment (home, work place) is regarded as isolated piece of environment to be treated on its own terms.

The indoor environment usually is under the jurisdiction of the Public Health authorities. Health risks are mainly linked to space heating, cooking and lighting: low grade fuels, insufficient ventilation, and low or non-existing chimneys are often the main problems. Additionally, there may be problems connected with moist, light, incidence, hazardous substances from building materials, lacquers and paints. Problems with drinking water, sewage and waste are not linked to the dwelling as such, but rather due to lack of appropriate infrastructure. Statistics on indoor environment may be regarded as a subset of statistics on human settlements and the urban environment.

1.2 Development versus Environment Degradation

Development activities are measured in terms of national products, which in turn are defined as production of goods and services during accounting period. However, certain environmental functions, which are crucial for economic performance and generation of human welfare such as provision of natural resources to production and consumption activities, waste absorption by environmental media and environmental services of life support and other human amenities, are taken into account only partly in conventional accounts. The scarcities of natural resources now threaten the sustained productivity of the economy and economic production and consumption activities. These activities impair environmental quality by over loading natural sinks with wastes and pollutants. The environmental consequence of development tends to offset many benefits that may be accruing to individuals and societies on account of rising incomes. There are direct costs on the health of individuals, their longevity and on quality of life on account of deterioration in environmental quality to mention a few. More importantly, the environmental damage can also undermine future attainments and productivity, if the factors of production are adversely affected. Therefore, the private and social costs of the use of the natural resources and the degradation of the environment may be taken

into account for the *sustainable development* in the conventional accounts.

1.3 Environmental Indicators

List of environmental and related socio-economic indicators

The United Nations Statistical Division (UNSD) developed a list of environmental indicators in collaboration with the Inter-governmental Working Group on the Advancement of Environment Statistics. The fourth meeting of the Working Group (Stockholm, 6 - 10 February 1995) agreed on the List of environmental and related socioeconomic indicators given below. The Statistical Commission, at its twenty-eighth session (New York, 27 February - 3 March 1995), approved this list for international compilation by UNSD. The indicators that are bolded in the list were intended for short-term compilation directly from national statistical services or from other international organizations or specialized agencies.

Framework for Development of Environment Statistics (FDES)
Information categories

Agenda 21 Issues (clusters)	**A. Socioeconomic activities, events**	**B. Impacts and effects**	**C. Responses to impacts**	**D. Inventories, stocks, background conditions**
ECONOMIC ISSUES	Real GDP per capita growth rate Production and consumption patterns Investment share in GDP	EDP/EVA per capita Capital accumulation (environmentally adjusted)	Environmental protection expenditure as % of GDP Environmental taxes and subsidies as % of government revenue	Produced capital stock
SOCIAL/DEMO-GRAPHIC ISSUES	Population growth rate Population density Urban/rural migration rate Calorie supply per capita	% of urban population exposed to concentrations of SO_2, particulates, ozone, CO and Pb Infant mortality rate		Population living in absolute poverty Adult literacy rate Combined primary and secondary school

		Incidence of environmentally related diseases		enrollment ratio Life expectancy at birth Females per 100 males in secondary school
AIR/CLIMATE	**Emissions of CO_2, SO_2 and NO_x** **Consumption of ozone depleting substances**	**Ambient concentrations of CO, SO_2, NO_x O_3 and TSP in urban areas** Air quality index	Expenditure on air pollution abatement Reduction in consumption of substances and emissions	**Weather and climate conditions**
LAND/SOIL	**Land use change** Livestock per km^2 of arid and semi-arid lands **Use of fertilizers** **Use of agricultural pesticides**	**Area affected by soil erosion** Land affected by desertification Area affected by salinization and water logging	**Protected area as % of total land area**	**Arable land per capita**
WATER Fresh water resources	Industrial, agricultural and municipal discharges directly into freshwater bodies **Annual withdrawals of ground and surface water**	**Concentration of lead, cadmium, mercury and pesticides in fresh water bodies** **Concentration of fecal coliform in fresh water bodies**	**Waste water treatment, total and by type of treatment (% of population served)** **Access to safe drinking water (% of population**	**Groundwater reserves**

Marine water resources	**Domestic consumption of water per capita** Industrial, agricultural water use per GDP Industrial, agricultural and municipal discharges directly into marine water bodies Discharges of oil into coastal waters	**bodies** **Acidification of fresh water bodies** **BOD and COD in fresh water bodies** Water quality index by fresh water bodies Deviation in stock from maximum sustainable yield of marine species Loading of N and P in coastal waters	**served)**	
OTHER NATURAL RESOURCES Biological resources Mineral (incl. energy) resources	**Annual roundwood production** **Fuelwood consumption per capita** **Catches of marine species** **Annual energy consumption per capita** **Extraction of**	**Deforestation rate** **Threatened, extinct species** **Depletion of mineral resources (% of proven reserves)** Lifetime of	**Reforestation rate** **Protected forest area as % of total land area**	**Forest inventory** Ecosystems inventory Fauna and flora inventory Fish stocks **Proven mineral reserves**

	other mineral resources	proven reserves		**Proven energy reserves**
WASTE	**Municipal waste disposal** Generation of hazardous waste **Imports and exports of hazardous wastes**	Area of land contaminated by toxic waste	Expenditure on waste collection and treatment Waste recycling	
HUMAN SETTLEMENTS	**Rate of growth of urban population** **% of population in urban areas** **Motor vehicles in use per 1000 habitants**	**Area and population in marginal settlements** Shelter index **% of population with sanitary services**	Expenditure on low-cost housing	Stock of shelter and infrastructure
NATURAL DISASTERS	**Frequency of natural disasters**	Cost and **number of injuries and fatalities related to natural disasters**	Expenditure on disaster prevention and mitigation	Human settlements vulnerable to natural disasters

TABLE 1.1: SOME IMPACTS OF DEVELOPMENT ACTIVITIES ON ENVIRONMENT

Development Activities	Major Impacts on Environment
Forest clearing and land resettlements	Extinction of rare species of flora and fauna, creation of condition for mosquito breeding leading to infectious diseases such as malaria, dengue etc.
Shifting cultivation in upland agriculture	Soil erosion in upland areas, soil fertility declines due to shorter cultivation cycle, which is practiced due to population pressure, flooding of low land areas. The problems could be resolved by terraced cultivation.
Agro industries	Air pollution due to burning of bagasse as fuel in sugar mills, large amount of highly polluting organic wastes, surface water pollution .
Introduction of new varieties of cereals	Reduction of genetic diversity of traditional monoculture resulting in instability, danger of multiplication of local strains of fungus, bacteria or virus on new variety
Use of pesticides	Organism develops resistance and new control methods are needed (e.g. in malaria, widespread use of dieldrin as a prophylactic agent against pests of oil palms made the problem worse), creation of complex and widespread environment problems. The pesticides used in agriculture sometimes go into food chain or in water bodies which may result in harmful health hazards.
Timber extraction	Degrades land, destroys surface soil, reduces production potential of future forests.
Urbanisation and industrialization	Concentration of population in urban centers make huge demands on production in rural areas and put pressures on land, air and water pollution.
Water resource projects, e.g. Dam, extensive irrigation	Human settlement & resettlement, spread of waterborne diseases, reduction of fisheries, siltation, physical changes e.g. temperature, humidity.

1.4 Emissions, Discharges and their Sources

1.4.1. The environmental stress caused by developmental activities emanating from emissions and discharges of various substances into air, water and soil. These emissions and discharges have not only local effects but regional and global effects too.

TABLE 1.2: LOCAL, REGIONAL AND GLOBAL EFFECTS OF POLLUTION

Local effects	Regional	Over Marine Water and Continents	Global
Heavy metals in air, soil, water and plants, e.g. From industrial emissions and Discharges Noise, Smell, Air pollution.	Eutrophication, Contaminants in the soil & water, Landscape changes due to mining or agriculture.	Eutrophication, Acidification, Environment Contamination due to Radioactivity	Changes the climate due to ozone depletion and the greenhouse effect.

1.4.2 Acidifying emissions

Sulphur dioxide and nitrogen oxides emitted into the air are converted into acids. At their deposition, they have an acidifying effect on soil and water. The emission of ammonia also contributes to the acidification. Main sources of emission of sulphur dioxide in the air are due to burning of Sulphur containing fuel like coal mine, power plants, oil by vehicles, and also due to refining of oils in refineries.

1.4.3 Emissions of volatile organic substances

Volatile organic substances may also effect health. Many of such substances are carcinogenic. In combination with nitrogen oxides and in sunlight, some of them might form ozone and other photochemical oxidants. These are harmful to plants.

1.4.4 Gases affecting the climate

The greenhouse gases (carbon dioxide, methane etc.) prevent some of the heat radiation from the earth into space. The concentration of green house gases is responsible for raising the temperature of the earth in a long term. Eighty percent of the effect of the greenhouse gases is caused by carbon dioxide itself.

1.4.5 Eutrophicating discharges into water

Nutrients, mainly nitrogen and phosphorus, contribute to the eutrophication of lakes, rivers and marine waters. Approximately, half of the nitrogen discharges are estimated to originate from agricultural land. A considerable proportion of the phosphorous discharge derives from waste water not passing through sewage treatment plants. In addition to discharges

from human activities, there is a natural leaching from various types of soil. The quantities are estimated to be of about the same magnitude as those originating from human activities.

1.4.6 Emissions of heavy metals

Discharges and emissions of heavy metals are difficult to estimate. A large proportion of emissions/discharges of heavy metals into air originates from the iron and steel industry. Vehicular traffic is the main source of lead emissions. Mines and mining wastes account for the major part of the discharges of heavy metals into water. Besides, Cadmium depositions originate from commercial fertilizers containing phosphorus.

TABLE 1.3: SOME MAJOR POLLUTANTS AND THEIR SOURCES

Pollutant	Source
Carbon monoxide	Incomplete fuel combustion (e.g. two/four stroke engines)
Sulphur dioxide	Burning of sulphur containing fuel like coal in Power Plants and emission by vehicles
Suspended particulate matter	Smoke from domestic, industrial and vehicular sources.
Oxides of nitrogen	Fuel combustion of motor vehicles, emission from power stations and industrial furnaces
Volatile hydrocarbons	Partial combustion of carbonaceous fuels (two stroke engines, industrial processes, disposal of solid wastes).
Oxidants and ozone	Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons
Lead	Emissions from motor vehicles

TABLE 1.4: POLLUTANTS AND THEIR RELATED HEALTH HAZARDS

Pollutants	Health Effects
Carbon Monoxide (from gasoline cars, 2-wheelers, 3-wheelers)	Fatal in case of large dose: aggravates heart disorders; effects central nervous system; impairs oxygen carrying capacity of blood
Nitrogen Oxides (NO_x) (from diesel vehicles)	Irritation of respiratory tract

Ozone	Eye, nose and throat irritation; risk asthmatics, children and those involved in heavy exercise
Lead (from petrol vehicles)	Extremely toxic: effects nervous system and blood; can impair mental development of children, causes hypertension
Hydrocarbons (mainly from 2-wheelers and 3-wheelers)	Drowsiness, eye irritation, coughing
Benzene	Carcinogenic
Aldehydes	Irritation of eyes, nose and throat, sneezing, coughing, nausea, breathing difficulties; carcinogenic in animals
Polycyclic Aromatic Hydrocarbons PAH (from diesel vehicles)	Carcinogenic

1.4.7 Health Aspects of Water Quality

Water borne diseases are single most important factor responsible for nearly 80% of human mortality in India. Children are worst affected, especially in rural areas and urban slums. Typical water born diseases and their causative factors are summarised in the Table l.5

TABLE 1.5: WATER BORN DISEASES AND THEIR CAUSATIVE FACTORS

Name of the Disease	Causative Organism
1. Water-borne diseases Bacterial ➢ Typhoid ➢ Gastroenteritis ➢ Paratyphoid ➢ Cholera ➢ Bacterial dysentery	 Salmonella typhi Vibrio cholerae Slmondlla parayphi Enterotoxigenic Escherichia coli Variety of Escherichia coli
Viral ➢ Infectious hepatitis ➢ Pliomycetis ➢ Diarrhea Diseases ➢ Other symptoms of enteric diseases	 Hepatitis-A-virus Polio-virus Rota-virus, Norwalk agent, Other virus Echono-virus, Coxsackie-virus
Protozoan Amoebic dysentery	 Entamoeba hystolitica

2. Water-washed diseases ➢ Scabies ➢ Trachoma ➢ Bacillary dysentery	Various skin fungus species Trachoma infecting eyes E. coli
3. Water-based diseases ➢ Schistosomiasis ➢ Guinea worm	Schistosoma sp. Guinea worm
4. Infecton through water related insect vectors ➢ Sleeping sickness ➢ Malaria	Trapanosoma through tsetse fly Plasmodium through Anaphelis
5. Infection primarily due to defective sanitation ➢ Hookworm	Hook worm, Ascaris