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# **Environmental Degradation in India - Causes and Remedial Measures**

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#### Abstract

There are many environmental issues in India. Air pollution, water pollution, garbage and pollution of the natural environment are all challenges for India. Some have cited economic development as the cause regarding the environmental issues. Others believe economic development is key to improving India's environmental management and preventing pollution of the country. Climate is the primary determinant of agricultural productivity. Given the fundamental role of agriculture inhuman welfare, concern has been expressed by federal agencies and others regarding the potential effects of climate change on agricultural productivity. The proposed paper deals with the environmental degradation, causes, different types of environmental degradation, measures to solve the climate change and environmental degradation respectively.

**Key words:** Environmental degradation, climate change, water degradation, food production

### Introduction

There are many environmental issues in India. Air pollution, water pollution, garbage and pollution of the natural environment are all challenges for India. The situation was worse between 1947 through 1995. According to data collection and environment assessment studies of World Bank experts, between 1995 through 2010, India has made one of the fastest progresses in the world, in addressing its environmental issues and improving its environmental quality.

Still, India has a long way to go to reach environmental quality similar to those enjoyed in developed economies. Pollution remains a major challenge and opportunity for India. Environmental issues are one of the primary causes of disease, health issues and long term livelihood impact for India.

### **History**

Yajnavalkya Smriti, a historic Indian text on statecraft and jurisprudence, suggested to have been written before 5th century AD, prohibited the cutting of trees and prescribed punishment for such acts. Kautalya's Arthashastra, written in Mauryan period, emphasised the need for forest administration. Ashoka went further, and his Pillar Edicts expressed his view about the welfare of environment and biodiversity.

British rule of India saw several laws related to environment. Amongst the earliest ones were Shore Nuisance (Bombay and Kolaba) Act of 1853 and the Oriental Gas Company Act of 1857. The Indian Penal Code of 1860 imposed a fine on anyone who voluntarily fouls the water of any public spring or reservoir. In addition, the Code penalised negligent acts. British India also enacted laws aimed at controlling air pollution. Prominent amongst these were the Bengal Smoke Nuisance Act of 1905 and the Bombay Smoke Nuisance Act of 1912. Whilst these laws failed in having the intended effect, British-enacted legislations pioneered the growth of environmental regulations in India.

Upon independence from Britain, India adopted a constitution and numerous British-enacted laws, without any specific constitutional provision on protecting environment. India amended its constitution in 1976. Article 48(A) of Part IV of the amended constitution, read: The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country. Article 51 A (g) imposed additional environmental mandates on the Indian state.

Other Indian laws from recent history include the Water (Prevention and Control of Pollution) Act of 1974, the Forest (Conservation) Act of 1980 and the Air (Prevention and Control of Pollution) Act of 1981. The Air Act was inspired by the decisions made at Stockholm Conference. The Bhopal gas tragedy triggered the Government of India to enact the Environment (Protection) Act of 1986. India has also enacted a set of Noise Pollution (Regulation & Control) Rules in 2000. In 1985, Indian government created the Ministry of Environment and Forests. This ministry is the central administrative organisation in India for regulating and ensuring environmental protection.

Despite active passage of laws by the central government of India, the reality of environmental quality mostly worsened between 1947 to 1990. Most of Indian economy was nationalised and owned by India, and regulations were mostly ignored by state run enterprises. Rural poor had no choice, but to sustain life in whatever way possible. The state governments of India often regarded environmental laws enacted by the central government as a mere paperwork formality. Air emissions increased, water pollution worsened, forest cover decreased. Starting in 1990s, reforms were introduced. Since then, for the first time in Indian history, major air pollutant concentrations have dropped in every 5 year period. Between 1992 to 2010, satellite data confirms India's forest coverage has increased for the first time by over 4 million hectares, a 7% increase.

#### **Causes**

Some have cited <u>e</u>conomic development as the cause regarding the environmental issues. Others believe economic development is key to improving India's environmental management and preventing pollution of the country. It is also suggested that India's growing population is the primary cause of India's environmental degradation. Systematic studies challenge this theory. Empirical evidence from countries such as Japan, England and Singapore, each with population density similar or higher than India, yet each enjoying environmental quality vastly superior to India, suggests population density may not be the only factor affecting India's issues.

#### Major issues

Major environmental issues are forest and agricultural degradation of land, resource depletion (water, mineral, forest, sand, rocks etc.), environmental degradation, public health, loss of biodiversity, loss of resilience in ecosystems, livelihood security for the poor. The major sources of pollution in India include the rampant burning of fuelwood and biomass such as dried waste from livestock as the primary source of energy, lack of organised garbage and waste removal services, lack of sewage treatment operations, lack of flood control and monsoon water drainage system, diversion of consumer waste into rivers, cremation practices near major rivers, government mandated protection of highly polluting old public transport, and continued operation by Indian government of government owned, high emission plants built between 1950 to 1980.

Air pollution, poor management of waste, growing water scarcity, falling groundwater tables, water pollution, preservation and quality of forests, biodiversity loss and land/soil degradation are some of the major environmental issues India faces today. India's population growth adds pressure to environmental issues and its resources.

### **Environmental degradation**

Environmental degradation is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable. As indicated by the I=PAT equation, environmental impact (I) or degradation is caused by the combination of an already very large and increasing human population (P), continually increasing economic growth or per capita affluence (A), and the application of resource depleting and polluting technology (T).

Environmental degradation is one of the Ten Threats officially cautioned by the High Level Threat Panel of the United Nations. The United Nations International Strategy for Disaster Reduction defines environmental degradation as "The reduction of the capacity of the environment to meet social and ecological objectives, and needs". Environmental degradation is of many types. When natural habitats are destroyed or natural resources are depleted, the environment is degraded. Efforts to counteract this problem include environmental protection and environmental resources management.

#### Water deterioration

One major component of environmental degradation is the depletion of the resource of fresh water on Earth. Approximately only 2.5% of all of the water on Earth is fresh water, with the rest being salt water. 69% of the fresh water is frozen in ice caps located on Antarctica and Greenland, so only 30% of the 2.5% of fresh water is available for consumption. Fresh water is an exceptionally important resource, since life on Earth is ultimately dependent on it. Water transports nutrients and chemicals within the biosphere to all forms of life, sustains both plants and animals, and moulds the surface of the Earth with transportation and deposition of materials. The current top three uses of fresh water account for 95% of its consumption; approximately 85%

is used for irrigation of farmland, golf courses, and parks, 6% is used for domestic purposes such as indoor bathing uses and outdoor garden and lawn use, and 4% is used for industrial purposes such as processing, washing, and cooling in manufacturing centers.

It is estimated that one in three people over the entire globe are already facing water shortages, almost one-fifth of the world's population live in areas of physical water scarcity, and almost one quarter of the world's population live in a developing country that lacks the necessary infrastructure to use water from available rivers and aquifers. Water scarcity is an increasing problem due to many foreseen issues in the future, including population growth, increased urbanization, higher standards of living, and climate change.

# Climate change and temperature

Affects the Earth's water supply in a large number of ways. It is predicted that the mean global temperature will rise in the coming years due to a number of forces affecting the climate, the amount of atmospheric CO<sub>2</sub> will rise, and both of these will influence water resources; evaporation depends strongly on temperature and moisture availability, which can ultimately affect the amount of water available to replenish groundwater supplies.

Transpiration from plants can be affected by a rise in atmospheric CO<sub>2</sub>, which can decrease their use of water, but can also raise their use of water from possible increases of leaf area. Temperature increase can decrease the length of the snow season in the winter and increase the intensity of snowmelt in warmer seasons, leading to peak runoff of snowmelt earlier in the season, affecting soil moisture, flood and drought risks, and storage capacities depending on the area.

Warmer winter temperatures cause a decrease in snowpack, which can result in diminished water resources during summer. This is especially important at mid-latitudes and in mountain regions that depend on glacial runoff to replenish their river systems and groundwater supplies, making these areas increasingly vulnerable to water shortages over time; an increase in temperature will initially result in a rapid rise in water melting from glaciers in the summer, followed by a retreat in glaciers and a decrease in the melt and consequently the water supply

every year as the size of these glaciers get smaller and smaller. Thermal expansion of water and increased melting of oceanic glaciers from an increase in temperature gives way to a rise in sea level, which can affect the fresh water supply of coastal areas as well; as river mouths and deltas with higher salinity get pushed further inland, an intrusion of saltwater results in an increase of salinity in reservoirs and aquifers. Sea-level rise may also consequently be caused by a depletion of groundwater, as climate change can affect the hydrologic cycle in a number of ways. Uneven distributions of increased temperatures and increased precipitation around the globe results in water surpluses and deficits, but a global decrease in groundwater suggests a rise in sea level, even after meltwater and thermal expansion were accounted for, which can provide a positive feedback to the problems sea-level rise causes to fresh-water supply.

A rise in air temperature results in a rise in water temperature, which is also very significant in water degradation, as the water would become more susceptible to bacterial growth. An increase in water temperature can also affect ecosystems greatly because of a species' sensitivity to temperature, and also by inducing changes in a body of water's self-purification system from decreased amounts of dissolved oxygen in the water due to rises in temperature.

## Climate change and Precipitation

A rise in global temperatures is also predicted to correlate with an increase in global precipitation, but because of increased runoff, floods, increased rates of soil erosion, and mass movement of land, a decline in water quality is probable, while water will carry more nutrients, it will also carry more contaminants. While most of the attention about climate change is directed towards global warming and greenhouse effect, some of the most severe effects of climate change are likely to be from changes in precipitation, evapotranspiration, runoff, and soil moisture. It is generally expected that, on average, global precipitation will increase, with some areas receiving increases and some decreases.

Climate models show that while some regions should expect an increase in precipitation, such as in the tropics and higher latitudes, other areas are expected to see a decrease, such as in the subtropics; this will ultimately cause a latitudinal variation in water distribution. The areas receiving more precipitation are also expected to receive this increase during their winter and

actually become drier during their summer, creating even more of a variation of precipitation distribution. Naturally, the distribution of precipitation across the planet is very uneven, causing constant variations in water availability in respective locations.

Changes in precipitation affect the timing and magnitude of floods and droughts, shift runoff processes, and alter groundwater recharge rates. Vegetation patterns and growth rates will be directly affected by shifts in precipitation amount and distribution, which will in turn affect agriculture as well as natural ecosystems. Decreased precipitation will deprive areas of water, causing water tables to fall and reservoirs and wetlands, rivers, and lakes to empty, and possibly an increase in evaporation and evapotranspiration, depending on the accompanied rise in temperature. Groundwater reserves will be depleted, and the remaining water has a greater chance of being of poor quality from saline or contaminants on the land surface.

### **Population growth**

The available fresh water being affected by climate is also being stretched across an everincreasing global population. It is estimated that almost a quarter of the global population is living in an area that is using more than 20% of their renewable water supply; water use will rise with population while the water is also being aggravated by decreases in streamflow and groundwater caused by climate change. Even though some areas may see an increase in freshwater supply from an uneven distribution of precipitation increase, an increased use of water supply is expected.

An increased population means increased withdrawals from the water supply for domestic, agricultural, and industrial uses, the largest of these being agriculture, believed to be the major non-climate driver of environmental change and water deterioration. The next 50 years will likely be the last period of rapid agricultural expansion, but the larger and wealthier population over this time will demand more agriculture.

Population increase over the last two decades, at least in the United States, has also been accompanied by a shift to an increase in urban areas from rural areas, which concentrates the demand for water into certain areas, and puts stress on the fresh water supply from industrial and human contaminants. Urbanization causes overcrowding and increasingly unsanitary living

conditions, especially in developing countries, which in turn exposes an increasingly number of people to disease. About 79% of the world's population is in developing countries, which lack access to sanitary water and sewer systems, giving rises to disease and deaths from contaminated water and increased numbers of disease-carrying insects.

# Agriculture

Agriculture is dependent on available soil moisture, which is directly affected by climate dynamics, with precipitation being the input in this system and various processes being the output, such as evapotranspiration, surface runoff, drainage, and percolation into groundwater. Changes in climate, especially the changes in precipitation and evapotranspiration predicted by climate models, will directly affect soil moisture, surface runoff, and groundwater recharge.

In areas with decreasing precipitation as predicted by the climate models, soil moisture may be substantially reduced. With this in mind, agriculture in most areas needs irrigation already, which depletes fresh water supplies both by the physical use of the water and the degradation agriculture causes to the water. Irrigation increases salt and nutrient content in areas that wouldn't normally be affected, and damages streams and rivers from damming and removal of water. Fertilizer enters both human and livestock waste streams that eventually enter groundwater, while nitrogen, phosphorus, and other chemicals from fertilizer can acidify both soils and water.

Certain agricultural demands may increase more than others with an increasingly wealthier global population, and meat is one commodity expected to double global food demand by 2050, which directly affects the global supply of fresh water. Cows need water to drink, more if the temperature is high and humidity is low, and more if the production system the cow is in is extensive, since finding food takes more effort. Water is needed in processing of the meat, and also in the production of feed for the livestock. Manure can contaminate bodies of freshwater, and slaughterhouses, depending on how well they are managed, contribute waste such as blood, fat, hair, and other bodily contents to supplies of fresh water.

The transfer of water from agricultural to urban and suburban use raises concerns about agricultural sustainability, rural socioeconomic decline, food security, an increased carbon

footprint from imported food, and decreased foreign trade balance. The depletion of fresh water, as applied to more specific and populated areas, increases fresh water scarcity among the population and also makes populations susceptible to economic, social, and political conflict in a number of ways; rising sea levels forces migration from coastal areas to other areas farther inland, pushing populations closer together breaching borders and other geographical patterns, and agricultural surpluses and deficits from the availability of water induce trade problems and economies of certain areas. Climate change is an important cause of involuntary migration and forced displacement.

## Water management

The issue of the depletion of fresh water can be met by increased efforts in water management. While water management systems are often flexible, adaptation to new hydrologic conditions may be very costly. Preventative approaches are necessary to avoid high costs of inefficiency and the need for rehabilitation of water supplies, and innovations to decrease overall demand may be important in planning water sustainability.

Water supply systems, as they exist now, were based on the assumptions of the current climate, and built to accommodate existing river flows and flood frequencies. Reservoirs are operated based on past hydrologic records, and irrigation systems on historical temperature, water availability, and crop water requirements; these may not be a reliable guide to the future. Reexamining engineering designs, operations, optimizations, and planning, as well as re-evaluating legal, technical, and economic approaches to manage water resources are very important for the future of water management in response to water degradation. Another approach is water privatization; despite its economic and cultural effects, service quality and overall quality of the water can be more easily controlled and distributed. Rationality and sustainability is appropriate, and requires limits to overexploitation and pollution, and efforts in conservation.

## **Forests and Conservation**

Ecological issues are an integral and important part of environmental issues challenging India. Poor air quality, water pollution and garbage pollution — all affect the food and environment quality necessary for ecosystems. India is a large and diverse country. Its land area

includes regions with some of the world's highest rainfall to very dry deserts, coast line to alpine regions, river deltas to tropical islands. The variety and distribution of forest vegetation is large. India is one of the 12 mega biodiverse regions of the world.

Indian forests types include tropical evergreens, tropical deciduous, swamps, mangroves, sub-tropical, montane, scrub, sub-alpine and alpine forests. These forests support a variety of ecosystems with diverse flora and fauna. Until recently, India lacked an objective way to determine the quantity of forests it had, and the quality of forests it had. Forest cover measurement methods prior to 1980s, India deployed a bureaucratic method to estimate forest coverage. A land was notified as covered under Indian Forest Act, and then officials deemed this land area as recorded forest even if it was devoid of vegetation.

By this forest-in-name-only method, the total amount of recorded forest, per official Indian records, was 71.8 million hectares. Any comparison of forest coverage number of a year before 1987 for India, to current forest coverage in India, is thus meaningless; it is just bureaucratic record keeping, with no relation to reality or meaningful comparison. In the 1980s, space satellites were deployed for remote sensing of real forest cover. Standards were introduced to classify India's forests into the following categories:

**Forest Cove**: defined as all lands, more than one hectare in area, with a tree canopy density of more than 10 percent. (Such lands may or may not be statutorily notified as forest area).

Very Dense Forest: All lands, with a forest cover with canopy density of 70 percent and above

**Moderately Dense Forest**: All lands, with a forest cover with canopy density of 40–70 percent

Open Forest: All lands, with forest cover with canopy density of ten to forty percent

**Mangrove Cover**: Mangrove forest is salt tolerant forest ecosystem found mainly in tropical and sub-tropical coastal and/or inter-tidal regions. Mangrove cover is the area covered under mangrove vegetation as interpreted digitally from remote sensing data. It is a part of forest cover and also classified into three classes viz. very dense, moderately dense and open.

**Non Forest Land**: defined as lands without any forest cover Scrub Cover: All lands, generally in and around forest areas, having bushes and or poor tree growth, chiefly small or stunted trees with canopy density less than 10 percent Tree Cover: Land with tree patches (blocks and linear)

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outside the recorded forest area exclusive of forest cover and less than the minimum mapable area of one hectare

**Trees Outside Forests**: Trees growing outside Recorded Forest Areas

The first satellite recorded forest coverage data for India became available in 1987. India and the United States cooperated in 2001, using Landsat MSS with spatial resolution of 80 metres, to get accurate Indian forest distribution data. India thereafter switched to digital image and advanced satellites with 23 metres resolution and software processing of images to get more refined data on forest quantity and forest quality. India now assesses its forest distribution data biennially. The 2007 forest census data thus obtained and published by the Government of India suggests the five states with largest area under forest cover as the following:

Madhya Pradesh: 7.64 million hectares

Arunachal Pradesh: 6.8 million hectares

Chhattisgarh: 5.6 million hectares

Orissa: 4.83 million hectares

Maharashtra: 4.68 million hectares

India hosts significant biodiversity; it is home to 7.6% of all mammalian, 12.6% of avian, 6.2% of reptilian, and 6.0% of flowering plant species.

In recent decades, human encroachment has posed a threat to India's wildlife; in response, a system of national parks and protected areas, first established in 1935, was substantially expanded. In 1972, India enacted the Wildlife Protection Act and Project Tiger to safeguard crucial habitat; further federal protections were promulgated in the 1980s. Along with over 500 wildlife sanctuaries, India now hosts 14 biosphere reserves, four of which are part of the World Network of Biosphere Reserves; 25 wetlands are registered under the Ramsar Convention.

These laws did not have the effect they intended.

In 1985, India created the Ministry of Environment and Forests. This was followed by a National Forest Policy and the major government reforms of early 1990s.

Over the last 20 years, India has reversed the deforestation trend. Specialists of the United Nations report India's forest as well as woodland cover has increased. A 2010 study by the Food and Agriculture Organisation ranks India amongst the 10 countries with the largest forest area coverage in the world (the other nine being Russian Federation, Brazil, Canada, United States of

America, China, Democratic Republic of the Congo, Australia, Indonesia and Sudan). India is also one the top 10 countries with the largest primary forest coverage in the world, according to this study. From 1990 to 2000, FAO finds India was the fifth largest gainer in forest coverage in the world; whilst from 2000 to 2010, FAO considers India as the third largest gainer in forest coverage.

# **National Forest Commission and India's afforestation programme**

In 2003, India set up a National Forest Commission to review and assess India's policy and law, its effect on India's forests, its impact of local forest communities, and to make recommendations to achieve sustainable forest and ecological security in India. The report made over 300 recommendations including the following:

India must pursue rural development and animal husbandry policies to address local communities need to find affordable cattle fodder and grazing. To avoid destruction of local forest cover, fodder must reach these communities on reliable roads and other infrastructure, in all seasons year round. The Forest Rights Bill is likely to be harmful to forest conservation and ecological security. The Forest Rights Bill became a law since 2007.

The government should work closely with mining companies. Revenue generated from lease of mines must be pooled into a dedicated fund to conserve and improve the quality of forests in the region where the mines are located.

Power to declare ecologically sensitive areas must be with each Indian state.

The mandate of State Forest Corporations and government owned monopolies must be changed. Government should reform regulations and laws that ban felling of trees and transit of wood within India. Sustainable agro-forestry and farm forestry must be encouraged through financial and regulatory reforms, particularly on privately owned lands.

India's national forest policy expects to invest US\$ 26.7 billion by 2020, to pursue nationwide afforestation coupled with forest conservation, with the goal of increasing India's forest cover from 20% to 33%.

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#### Conclusion

India's capacity to cope with (or adapt to) climate is severely limited by the fact that is a low-income country, facing serious resource constraints. These deficiencies in adaptive capacity can be overcome only through rapid development. Without accelerated economic and social development, futures generations in India would remain extremely vulnerable to the impacts of climate change. At the same time India should continue to contribute to the global mitigation efforts by implementing "win win" measures.

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