

## **Land Degradation-Causes and Threats**

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### **Abstract**

*The land is an important and precious resource for mankind, just like atmospheric air and water. Land degradation—loss of the land's productive capacity for the present and future—is a global problem that affects everyone due to climate change, environmental risks, loss of biodiversity and ecosystem.*

*Land degradation is a growing problem for most countries. It is an issue in which the environment is influenced by one or more combinations of manmade processes acting upon the land. It also means a worsening in the quantity and quality of land or soil. The land degradation not only threatens the viability of agriculture, but also water quality, human health, biodiversity and the fundamental ecological processes on which all life depends.*

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## **Introduction**

One of the most critical environmental problems is land degradation and it will worsen without effective and rapid remedial action. Globally, about 25 percent of the total land area has been degraded (Global Environment Facility). Our land is a precious resource for mankind. It is our soil that sustains life by providing nutrients to the green plants which in turn support life on Earth's surface. It provides passage to groundwater, shelter to microbes and burrowing animals and supports the foundation of buildings and other utility structures. Plant nutrients in the soil are regularly regenerated by decay, decomposition and mineralization of organic matter. A number of microbes are known to produce growth-promoting substances. Mucilage produced by blue-green algae, bacteria and other microbes along with organic matter bind soil particles which prevent excessive leaching and erosion. Fungal hyphae weave a network and keep these aggregates together. (1,2)

We have been cultivating our soils ever since agriculture started thousands of years ago. Living communities in the soil are the basis of its fertility and other properties, which promote growth years after years. In absence of living communities and organic matter, the soil turns into a useless heap of sand, silt and clay. Out of nearly 167.5 million sq km of total available land distributed among five continents and more than 180 countries, only 18.25 million sq km of land may be used for growing food. Near about 44.1 million sq km stand forest with 40% or more of canopy cover and about 105.2 million sq km of land consists of barren wasteland. Large tracts of land are occupied by hilly terrains, barren deserts and ice where food cannot be grown. (3)

The global area used for cereal cultivation was 590 million hectares in the year 1950. It rose to about 720 million hectares by the year 1976. During the last thirty years, in spite of our efforts, crop fields have not extended at all. But there is a decline of about eight million hectares. We have cleared hill slopes, dammed rivers, dug canals to carry water. This makes arable land a scarce commodity and leaves a small area of land for growing food. To feed the ever-lasting global population we shall have to grow more and more food from croplands. (4) The largest area of arable land occurs in South America followed by North America and South Asia.

Faulty agriculture practices, extensive modification of land surface, construction activities, mining and processing operation cause land degradation. The loss of soil as silt and sediments from forested land is negligible, but from grassland, it is about 0.1-0.2 tons per hectare, from agricultural land it is about 32 tons per hectare and from denuded soil and deforested wasteland it is high as about 59 tons per hectare. (5) Desertification is the degradation of land in dry arid, semiarid, or

subhumid areas of the world due to human activities and climatic variations. Today, an increasing area of productive land is being damaged by desertification at a great speed than ever recorded in the history of mankind. Nearly 70% of the global area of arable land has now been affected by degradation and has lost about one-third of its capacity, out of which about 19.85 % is in critical condition. Every year we add an ever rising quality of fertilizers to maintain productivity and the cost of food production is rising every year.

Land degradation may be due to soil salinity & soil alkalinity, soil erosion, waterlogging, soil pollution and desertification.

#### **Soil Alkalinity and Soil Salinity**

In these areas, most crops are grown under irrigation, and to exacerbate the problem, inadequate irrigation management leads to secondary salinization that affects 20% of irrigated land worldwide (Glick et al., 2007). Irrigated agriculture is a major human activity, which often leads to secondary salinization of land and water resources in arid and semi-arid conditions. In regions of the world where evaporation is more than rainfall and sub-surface drainage is poor, salts accumulate in the soil. Roughly about 770,000 square km of global arable land has already been affected by excessive accumulation of salts. On the world database, we are losing about 16,000 square km of the world's irrigated land due to alkalization and salinization.

Among the salts, carbonates and bicarbonates predominate and are deposited in the form of Kankar. Carbonates and bicarbonates of sodium along with sodium chloride and sodium sulfate are present in higher quantities in the soil. Due to the deposition of these salts soil turns saline or alkaline and its fertility is severely hampered. At sufficiently high concentrations, the soil poses a toxic hazard. There are several reports of reduced fertility and salinity due to the use of river water in dams and reservoirs in drier regions of the world.

In India, even in the fertile Gangetic plains, yields have been declined by 40-70% in the command area of Sharda Sahayak Project in U.P. projects on Chambal of M.P. & Rajasthan have destroyed 98,000 hectares and Ghandak of Bihar & U.P. about 2,11,010 hectares of fertile land. (7)

#### **Soil Erosion**

Soil erosion is the most serious precursor of soil degradation that comes with global implications. Nearly 10 million hectares of arable land are lost to erosion and other forms of soil degradation every year. Soil erosion is displacement of soil, sediments and rocks which is caused by air currents, flowing water, movement of land, or ice due to change in gravity. It is a natural process but increased by pattern of human land use.

Today the rivers of the world carry about 18,100 million metric tons of silt and sediment to the sea every year. Ganga alone carries about 411 million tons of soil every year from Uttar Pradesh and Bihar to the Bay of Bengal. River Brahmaputra carries about 402- 710 million metric tons annually. Yellow River and Yangtze rivers of China transport about 1600 million metric tons of silt and sediments to the sea. An enormous quantity of soil is lost along with its precious nutrients, organic matter and soil moisture which prevent rainwater infiltration. With no herbs, shrubs, or trees much of rainwater is quickly lost without recharging the groundwater table. Water that infiltrates the upper layer does not move down due to the impervious layer underneath and cause problem of waterlogging, alkalinity and salinity. (6)

In India in Uttar Pradesh and Madhya Pradesh, the river Yamuna and its tributaries Betwa and Ken develop ravines or Badlands. Similarly, river Mahi in Gujrat and Damodar river in West Bengal form deep impenetrable ravines. The drylands of Rajasthan and Gujrat are severely affected by wind erosion. Nearly, 38.7 million hectares of Indian land are afflicted by wind erosion. (7) On a world basis about 11 million square km of arable land is affected by water erosion and about 5.5 million square km by wind erosion.

### **Waterlogging**

Waterlogging is where soil pores are saturated with water for significant periods of time because of impeded drainage. Waterlogging restricts aeration and gas exchange and thus causes a shut down in many ecosystem functions of soil. Respiration and plant growth are reduced and the plant may die if the waterlogging persists

It is a problem caused by the rise of underground water table very close to the water surface. Waterlogged land loses its strength i.e. the capacity to bear load of buildings. In waterlogged land, salts dissolved in water and damage the concrete and stone structure chemically. Excessive infiltration of surface water due to heavy rainfall, seepage from canal system and influx of water due to over-irrigation are responsible for the development of waterlogged conditions.

All over the world, mainly in areas where large-scale irrigation projects have been taken up, too much productive land is wasted. In India, about 12.7 million hectares of agricultural land were reported to be waterlogged by 1992 (7). The Sri Ram Sagar Project of Andhra Pradesh has a waterlogged area near about sixty thousand hectares. The canal system developed to transfer waters of Amu Darya (central Asia) and Syr Darya (central Asia) from Aral sea and Irtysh- Karagandha canal water logged nearly 0.92 million hectares of productive land. But the project has failed now. The Aral Sea, which had the reputation of being the world's largest

freshwater lake has diminished to one-third of its original volume. The project has been dubbed as "A symbol of planned destruction" by a world bank team. (10) . Indira Gandhi canal in the northwestern Rajasthan has brought about extensive waterlogging of dry land. In areas of southwestern Punjab, intensive irrigation caused a rise of the water table by 20-50 cm/year during 1975-1995 which expand the waterlogged area from 60.1 thousand hectares in 1978 to 104.0 thousand hectares in 1997. (11)

Indira Gandhi Nahar Pariyojna was started in 1960, the project proposed to irrigate 1.87 million hectares of land in the Thar Desert of India. The project was a boon to the people of Ganga Nagar, Jaisalmer, Bikaner and Jodhpur district. Nearly, 6.5% of the area brought under irrigation by canal water was reported to be waterlogged and about 30% of the total was reported to be vulnerable to waterlogging by 2000 AD.

### **Desertification**

It is the degradation of land due to human activities and climatic variation. It involves the depletion of vegetation and soil to fulfill the demands of an increased population that settle on the land to grow crops and graze animals. New deserts could be developed at any place where it has become useless for growing crops. Desertification is due to cutting down forests and trees, over-cultivation of soil and over-grazing. Today nearly, 75% of dried land is affected by desertification. The Sahara Desert is expanding southwards at the rate of about 5-10 km per year. It has been estimated that about 35% of the Earth's land surface is threatened by desertification and affects the livelihood of about 850 million people.

### **Soil Pollution**

Soil pollution means the presence of toxic elements, chemicals, salts, radioactive material and disease-causing organisms in the soil. They all cause an adverse effect on plant growth and animal health. This type of contamination arises by the use of pesticides, percolation of contaminated surface water to lower layers, leaching of wastes from landfills and direct discharge of industrial wastes to the soil.

In some areas of China, soil pollution presents a genuine threat to food security with various degrees of pollution. According to a scientific search, 100,000 sq km of China's cultivated land have been polluted. An estimated 12 million metric tons of grain are contaminated by heavy metals every year, causing a loss of about 2.57 billion US dollars. Soil pollution damage the ecosystem and ultimately threatens their safety. (12)

Reckless growth of industrialization and urbanization ignores the norms to treat and dispose of liquid and solid wastes. In most of the large cities, huge dumps

of solid waste can be seen. Effluent discharged by industries, wastes from mining, pesticides used for crop protection pollute an everincreasing area of fertile soil. Effluent from industries of Kanpur and Unnao in Uttar Pradesh added heavy metal concentration in the silt and sediments transported by Ganga as 23.6 ppm of Chromium, 14.7 ppm of Cadmium, 12.2 ppm of Tin, 3.2 ppm of Zinc, 2.6 ppm of Copper and 1.6 ppm of Nickel cons. have been detected. (13)

### **Land Degradation**

Today land degradation is seen as a serious threat to global food security. Land degradation has put the world's ecosystems under intense pressure, and their capacity to provide vital services is declining while at the same time the demand for these services is growing. Land degradation resulting from various natural and human-made activities including the loss of organic matter, decline in soil fertility, erosion, and the effects of toxic chemicals is a serious global environmental problem and it may be triggered by climate change. In other words, it can be as a consequence of poor management of our natural capital (soils, water, vegetation, etc.).

A survey of the rise and fall of ancient civilizations suggests that cropland soil has had a major role in determining how long past civilizations survived. Historical records of the past six thousand years show that civilized man was never able to flourish civilization in one locality more than 30-80 generations. The three exceptions are the Nile Valley, Mesopotamia and Indus valley. (14). These three civilizations had large river valleys that replenish the soil and its fertility and lasted over 150 generations. The reasons for the collapse of ancient civilizations may be soil erosion, deforestation, overgrazing, irrigation and desertification. Deforestation and overgrazing in Armenian highlands are believed to be due to silt which was carried to Tigris - Euphrates into Mesopotamia. Many other irrigation-dependent civilizations may be collapsed due to salinization and waterlogging. When irrigators first recognized the problem, they changed to soil-resistant crops to prolong the civilization's time.

Globally, 4.6 million of the world's land, 12.3 million sq km of rainfed croplands are classified as drylands and are at the risk of abandonment due to wind erosion. Wind erosion created a dust bowl in the 1930s in Oklahoma and in some states of the US, creating wretched "environmental refugees". During 1954-62 the former Soviet union embarked on the "virgin Land" program, converting 300,000 sq km of grazing land into semi-arid croplands. Which results in windstorms wiped out increase in soil productivity. The virgin land program was declared a disaster and abandoned. (15)

### **Conclusion**

Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes. It is viewed

as any change to the land perceived to be deleterious or undesirable. A temporary or permanent decline in the productive capacity of the land can be seen through a loss of biomass, a loss of actual productivity, or a change in vegetative cover and soil nutrients. According to the world's leading scientists, about 1.2 billion hectares of land has experienced moderate to extreme soil deterioration since world war II due to human activities. Over three-fourth deterioration has occurred due to overgrazing, land clearing, deforestation, increased soil salinity, waterlogging, and largely from irrigation. Other environmental threat to the agriculture resource includes loss of water through contamination, loss of genetic resources, habitat, species, greater resistance of plant diseases and climate change, both local and global. This is considered to be an important topic of the 21st century because land degradation has an effect upon agricultural productivity, the environment, and on food security. It is estimated that up to 4% of the world's agricultural land is seriously degraded.

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