

LAND AND WATER CONSERVATION: NEED OF THE HOUR

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Agriculture and allied sectors accounted for 13.7% of the GDP (Gross Domestic Product) in 2013 and near about sixty percent of population depend on this sector. All these facts reveals that agriculture plays a significant role in the overall socio-economic development of India, as it is main source of income for people. India exported \$39 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide, but inspite of that economic contribution of agriculture to India's GDP it is steadily declining, which shows there are some gaps in achieving desired output by agriculture sector. Agriculture production depends on land, labour and capital availability. Latter factors are only effective, if land is suitable for cultivation. To overcome this problem there is urgent need of land and water management.

REAL PROBLEM

Land and water management comprises of two components soil conservation and water conservation. Both are regarded as important but soil conservation is of primary concern because in India, nearly 80 million hectare area is exposed to the threat of soil erosion, and 43 million hectares area is actually affected. In states like Madhya Pradesh, Rajasthan, Maharashtra and Punjab, up to 15 per

cent of the total land suffers from soil erosion. It is reported that the annual loss of fertility by erosion is 20 times faster than what is lost by growing crops. Each year more than, 10,000 hectares area is exposed to erosion. Nearly 147 million hectare area in India is in need of conservation measures.

Soil erosion causes undesirable change in physical characteristics of soils and damages plant and crops which directly cause less crop production in India. Data reveals that 130 million hectares of land, that is, 45 % of total geographical surface area, is under soil erosion through gorge and gully, shifting cultivation, cultivated wastelands, sandy areas, deserts and water logging, severe landslides and floods, due to cutting of trees for agricultural implements, firewood and timber; grazing by a large number of livestock over and above the carrying capacity of grass lands, traditional agricultural practices, construction of roads, indiscriminate quarrying and other activities. Wind erosion is important cause for expansion of deserts, dust storms, whirlwinds and destruction of crops. Excessive soil erosion, high rate of sedimentation in the reservoirs and decreased fertility has become major environmental problems with disastrous economic consequences in India.

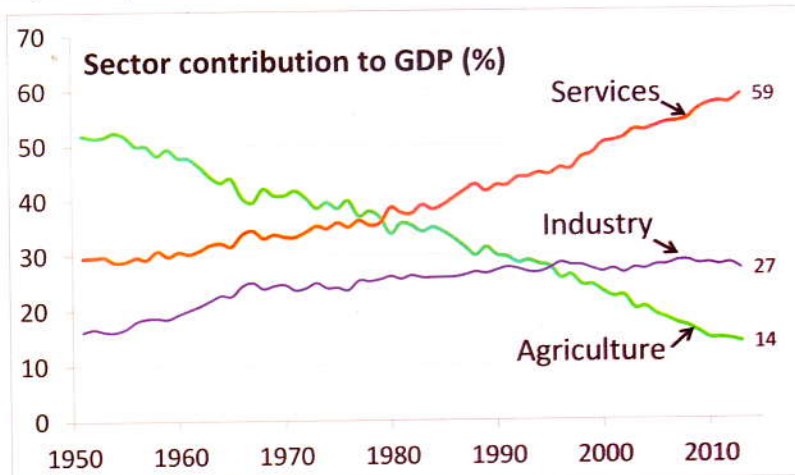


Figure 1. The GDP contribution of various sectors of Indian economy have evolved between 1951 to 2013, as its economy has diversified and developed.

Soil Erosion in Indian Forests

Soil assessment is done dividing soil into different zones which reveals that much erosion is occurring in the central zone and eastern zone of the country. Some problems are common everywhere but others are confined to specific physiographic conditions or in particular geological formations. Northern and central zones have almost identical patterns in the soil eroding and bio-degrading forces. Eastern zone suffers from shifting cultivation and excessive rainfall. Western zone suffers due to aridity. Southern zone suffers from general problems related to aridity, low productivity and shallow soil depth.

Table 1.NBSS&LUP soil degradation classes, derived from 1 : 250,000 soil map (1985–1995)

Classes	Area (in M Ha)
Water Erosion	
Loss of top soil	83.31
Terrain deformation	10.37
Wind Erosion	
Loss of top soil	4.35
Loss of top soil/terrain deformation	3.24
Terrain deformation/Overblowing	1.89
Chemical Deterioation	
Salinization	5.89
Loss of nutrient-acid soils	16.03
Physical Deterioation	
Waterlogging	14.29
Others	
Ice caps/ Rock Outcrops/Arid Mountains	8.38
Total	147.75

Source: NBSS&LUP. 2004

Types of Soil Erosion in India Various types of soil erosion in India is caused by natural factors, like wind and water which are main driving force and artificial factors like deforestation, mining etc. Soil erosion is a process of detachment and transportation of soil by natural agencies of water and wind.

Types of Erosion by Water:

- 1. Splash Erosion:** When falling raindrops splash on the soil, and impact the bare soil into flowing mud.
- 2. Sheet Erosion:** When soil is removed uniformly in a thin layer from the entire surface area, mainly occurs after splash erosion.
- 3. Rill Erosion:** An intermediate stage between sheet erosion and gully erosion which occurs when the run-off water, laden with soil flowing along the slopes, forms fingerlike channels.
- 4. Gully Erosion:** When volume of concentrated run-off increases and attains more velocity on slopes, it converts itself from rill into gullies. Ravines, is an advanced stage, in India ravines cover about 10 million hectares. Gujarat, Maharashtra, Karnataka Madhya Pradesh, Uttar Pradesh are famous for this problem.
- 5. Slip Erosion:** Landslides cause slip erosion—big masses of soil and rock slip down.

6. Stream Bank Erosion: Streams and rivers change their courses by cutting one bank and depositing the silt loads on the others. Meanders and Ox flow lakes sometimes formed in this process.

7. Sea Shore Erosion: Caused by striking action of strong waves.

Factors Influencing Soil Erosion

- 1. Rainfall:** Erosion is dependent on the amount, duration, intensity and frequency of rainfall. In short, by action of rain drops on soil, soil granules are loosened, detached and separated into fine particles. Short time period rainfall with high intensity cause more erosion.
- 2. Slope:** Erosion increases with slope.
- 3. Vegetation cover:** Vegetative cover protects the soil from the impact and dispersing action of the raindrops and acts as a mechanical obstruction to flowing water structure, in addition to absorption and reduction of surface run-off.
- 4. Tillage:** Infiltration and permeability of the soil is improved by the practice of proper tillage but excessive tillage expose soil to wind erosion.
- 5. Nature of the Soil:** Erodability of the soil depends on nature of the soil, particularly its texture, structure, organic matter, amounts and combination of salts present, presence of hard pan in the soil and presence of high water table.
- 6. Soil Moisture:**
High water table means low infiltration and permeability, resulting in more surface runoff, and more erosion but on other part deficit rainfall cause loosening of soil enhancing rate of erosion by wind.
- 7. Wind Velocity:**
Greater erosive potential, is due to strong wind with high velocity

Causes of Soil Erosion

Main causes of soil erosion are directly related to improper land use (entirely man-made factor), deforestation, faulty cultivation methods, shifting cultivation, overgrazing, diversion in natural drainage

channels by railway embankments and roads, infrastructure development, over exploitation of land, more use of fertilizers, lack of proper surface drainage, denuding forest fires.

Effects of Soil Erosion

Loss of top Soil (most important for crop production), harmful effects of erosion on organic matter and soil structure, decline in soil capacity, increase in salinity and alkalinity of soil, siltation and sedimentation in dams and water storage reservoirs, deposition of sand and gravel on agricultural lands, flooding of Streams.

Methods to Check Soil Erosion

Stubble Mulching:

Leaving or putting crop residue or vegetative litter on the land to protect surface against erosion and to increase infiltration and reducing evaporation.

Strip Cropping

Growing erosion-permitting crops (jowar, bajra, maize) in alternate strips with erosion checking close-growing crops (grasses, pulses).

Organic Manures

Organic manures like cowdung, green manure, farmyard manure etc., to improve soil structure which in turn also increase infiltration and permeability and conserve soil moisture.

Contour Bunding

Dividing slope of the land into smaller, more level strips by constructing mechanical structures of suitable size along contours. Each bund thusholds rainwater within each division.

Terracing:

On steeper slopes, terraces or flat platforms are constructed in steps in a series along the slope. This way water is retained on each terrace which can be used to raise crops.

Constructing Proper Drainage Channels and Plugging the Gullies: These are mainly check dams, to prevent sediment, erosion and sometimes pollutant in flow.



Figure 2. Contour Bunding



Figure 3. Terracing

Basin Listing:

Process of making out small basins at regular intervals on slopes which help in checking the run-off and in conservation of water.

Water Harvesting:



Figure 4 Gully Plugging.

Collection, conveyance and storage of water is termed as water harvesting, which helps in checking the run-off and is part of flood control measure.

Scientific Slope Management:

If the slope is more than normal range, prefer pastures; if still more, forestry; if it is still greater, go ahead with terracing, as part of conservation measure.

OTHER MEASURES: Construction of drop spillways, chute spillways, dams, earthen embankments etc, are some measures to retard flow and reduce erosive velocity.

GOVERNMENT MEASURES : In India one of the major problem is small land holding among farmers which make their economic condition weak and hence they are not able to use new techniques or to change new model for production in their sector. Government of India from time to time initiated new policies and programs to overcome impediments in agriculture and allied sectors.

Summing Up:

From agricultural production to food security, and to uplift economic condition of farmers, it is much important to take measures for soil conservation and for soil health in such a country of small land holdings. Some of the suggested measures are:

1. Linking of **MNREGA** and **SansadAdarsh Gram Yojana** type schemes to grass root level more efficiently to cover conservation measures on broad scale.
2. Linking new initiatives like **Soil Health Card** to **KCC** accounts and credit should be given after testing soil health in proportion to its production capacity which avoid inefficiency of farmers to pay back over burden amount.
3. Availability of human resource power from state agriculture universities and central universities like agricultural engineers and soil water conservation experts and engineers to grass root level of village panchyats to achieve total decentralization in form of grass root inclusion as part of development.
4. Research and extension work should be broad based. Use of more and more biological and mechanical techniques.
5. Where capital inefficiency is present in farmers, direct cash transfer benefits should be given to land holders for farm management practices inspite of supplying subsidies on fertilizers, energy and power resources etc.
6. Farmers' temperament can be changed by engaging them in participation rather than demonstration by extension.
7. Funds should be allocated for different problems in different areas as India has vast diversity in topography and culture, tradition etc.
8. Cooperative associations among farmers should be formed to overcome small land holding problem. Factors among farmers should immediately be removed by expert agencies which are responsible for baulk in forming such associations.
9. Administrative machinery should apply their role strongly for effective management and profit earned by such plans should be distributed among farmers according to their land holding which is best confidence building measure among particular community.
10. Land survey and data should be collected regularly with suitable provision of its monitoring during specific time period. Land should be used according to land capability classification.
11. River watershed should be monitored for erosion individually as it is main source of siltation in conservation structures like spillways, dams etc. Restriction should be placed on more sensitive areas by government is also need of hour.
12. States association should be formed as most rivers in India flows from one or more states. This step reduce dispute on different issues between states.
13. Lastly, reconstruction and rehabilitation work should be performed with priority for those whose rights are affected by any conservation measures.

(The author is a Ph. D scholar and writes on agricultural issues.)