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# Soil and Water Conservation Technologies and the Role of Extension

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**Abstract: -**

*Soil and water conservation has become increasingly important in the context of climate variability, land degradation, and declining agricultural productivity. Sustainable management of these natural resources is needed to ensure long-term food security and livelihood resilience, particularly in rainfed and resource-constrained regions. This presentation highlights major soil and Water conservation technologies, including structural measures such as contour bunding, terracing, check dams, and farm ponds, which effectively reduce runoff and enhance groundwater recharge. Biological practices such as cover mulching, cropping, vegetative barriers, and agroforestry further strengthen soil health and moisture retention. Additionally, agronomic practices and soil health improvement techniques contribute to enhanced soil organic matter and improved water-use efficiency. The role of agricultural extension is central to promoting the adoption of SWC technologies. Despite the proven benefits of soil and water conservation practices, adoption is often constrained by limited awareness, high initial costs, fragmented land holdings, and inadequate community participation. Effective extension, supported by government schemes and participatory watershed approaches, can overcome these barriers and promote long-term conservation outcomes.*

***Keywords:*** *Soil and water conservation, soil health, food security, farmer field school.*

## Introduction:

Soil and Water conservation involves various vegetative, Agronomic, and mechanical measures to prevent soil loss and conserve moisture. Soil erosion, declining fertility, and water scarcity reduce productivity (FAO, 2017). Soil and water are the most

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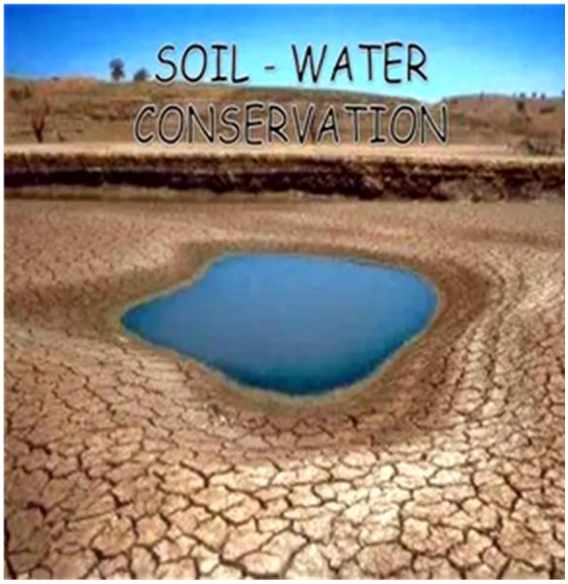
important natural resources and physical bases for all life-supporting systems, as water sustains life, and soil acts as a medium. These two resources are too precious for mankind, as they meet all needs and protect the environment and civilization (Manivannan et al. 2017). Out of a total reported geographical area of 329Mha of India, about 146.8 Mha are degraded by various factors. Water erosion and wind erosion together account for 70% of the total degraded land, and the remaining 30% is due to salinity, acidity, and a combination of other factors. The annual soil loss of India is estimated as 5334 Mt, along with 8.4 MT of major nutrients also lost (Prasad and Biswas, 2000). Annually, 2052 million tonnes of soil are carried by rivers. Of this, nearly 480 million tonnes are deposited in various reservoirs, resulting in a 1-2% loss of storage capacity per year (Dhruva Narayana and Rambabu, 1983).




According to the National Commission on Agriculture, water bodies in India are silting up at a rate of three to four times faster than the designed rates. It is a matter of concern that out of 329 Mha of geographical area, about 145 Mha is under cultivation, and there is no scope to bring more area under cultivation. FAO has reported that the global water withdrawal increased from less than 600 km3 year-1 in 1900 to almost 4000 km3 year-1 in 2010. Further, it is assessed that it will increase to 5100 km3 during 2025 with a rise of 8.4-12.2% from the current rate of withdrawal. In 1995, 76% of the world population had water availability of less than 5100 m 3 per annum per capita, and it is predicted that in 2025, most of the Earth's population will be living under a low water supply.

**Types of Soil Conservation Methods**

**1. Contour Plowing**

This is constructed along contour lines to slow the runoff of up and down. This reduces water runoff, soil loss, and enhances soil moisture retention, benefiting dryland crops, increasing crop yield, especially in

sloped and hilly regions. This method is suitable for 2-6% slopes and moderate rainfall and reduces soil loss by 25-60%.

**2. Terracing**

This is the process in which flat surfaces or terraces convert slopes into leveled steps. These methods minimize erosion and increase water retention. Commonly used in hill agricultural regions like the Himalayan and the North East regions. Terracing also reduces soil loss as the flow of running water is controlled and leads to improved cropping intensity and stability.

**3. Cover Crops and Mulching**

These methods use legumes or grasses as cover crops in the growing seasons to enhance the cover of the soil and consequently reduce soil erosion, with added benefits of improved soil structure due to organic matter left behind. Prevent soil and exposure, add biomass, fix nitrogen, improve soil fertility, and help retain moisture. Mulching reduces evaporation by 30-50%, controls weeds and improves soil structure, and promotes biodiversity, particularly earthworms.

**4. Agroforestry**

Integrated trees, shrubs, and grasses as cover crops in the growing season to enhance the cover of soil and reduce soil erosion, with added benefits of improved soil structure due to organic matter left behind. The cover crops enhance soil fertility and ameliorate some of its deficiencies by fixing atmospheric nitrogen. Cost-effective for smallholder farmers because agroforestry provides fuelwood, fodder, and carbon sequestration benefits.

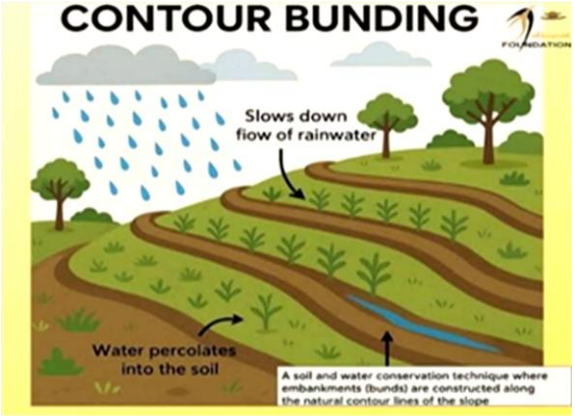
**5. Conservation Tillage**

This is an agricultural practice that minimizes the disturbance of soil through either partial or complete avoidance of tilling or ploughing. This promotes the retention of moisture in soil, reduces soil erosion, and improves the soil health, structure of soil, and biodiversity.

**Types of Water Conservation Methods**

**1. Contour Bunding**

Small earth or stone embankments are built along the natural contours of sloping farms as part of the sustainable soil and water conservation practice known as contour bunding. These bunds increase crop yields by reducing runoff velocity, preventing erosion, and improving water infiltration by dividing lengthy slopes into smaller portions. This method increases the time for water to seep into the ground, enhancing soil moisture for crops.




**2. Nala Bunding**

Reducing soil loss, conserving water, and improving agriculture in arid regions are the main objectives. They are made from rubble masonry constructed across the slope of a gully or stream or a uniform earthen embankment, frequently with a stone waste weir. These structures increase agricultural output, prevent sedimentation in downstream areas, and transform sporadic rainfall into long-term water security. Often constructed with a 5-meter width and 0.6-meter depth to store water and allow overflow safely.

**3. Rainwater Harvesting**

The sustainable process of gathering, purifying, and storing rainwater from surfaces like rooftops or ground catchments for consumption right away or groundwater recharge is known as rainwater harvesting. Catchments, gutters, filters, and storage tanks are essential elements that lessen runoff, fight water scarcity, and offer a reliable supply of water for homes and farms.

**4. Cheak Dams**

A check dam is a low-height, small barrier (2-3 feet high), sometimes temporary, dam constructed across a swale, drainage ditch, or waterway to counteract erosion by reducing water flow velocity. Check dams themselves are not a type of new technology; rather, they are an ancient technique dating

from the second century AD. Check dams are typically, though not always, implemented in a system of several dams situated at regular intervals across the area of interest. Its benefits include increased water availability for irrigation, boosting crop yields, restoring vegetation and biodiversity around the structure, stabilizing gullies, and improved land quality, Improved food security for rural communities.

**5. Percolation tank**

They are made to catch surface runoff and allow it to gradually seep into the ground through porous materials, replenishing aquifers. They are typically small to medium-sized, shallow dams with a water column of 3 to 4.5 meters and a capacity of 0.1 to 0.5 million cubic meters. Usually constructed of dirt, they have brick spillways to prevent overflow. Ideal locations are those with very permeable soil or cracked rock. Primarily raises the local water table. increases the amount of water available for residential and agricultural usage during times of low flow.

**Role of Extension in Soil and Water Conservation**

As an important link between academic institutions and the farming community, agricultural extension is essential to the conservation of soil and water. It makes it easier for farmers to adopt practices including effective irrigation techniques, soil fertility enhancement, erosion control, watershed management, and pollution reduction by facilitating the transfer of knowledge and technologies linked to sustainable land and water management. Extension assists farmers in comprehending not just how to apply these techniques but also why they are crucial for long-term productivity and environmental sustainability through training, demonstrations, field visits, and consulting services. Across a variety of stakeholders, such as farmers, rural communities, legislators, and non-farm audiences, extension is important for creating awareness and developing capacity. It fosters collaborative action and behavioural change in the direction of sustainable resource management. Extension specialists must

always improve their abilities, use cutting-edge communication techniques, and make appropriate use of contemporary technologies in order to stay productive. Additionally, by putting farmers in touch with researchers, organisations, and service providers, extension fortifies ties within the agricultural innovation system and makes it easier for conservation technologies to be adopted.

**Conclusion**

Soil and Water conservation is essential for sustainable agriculture, climate resilience, and water security. Integrated use of structural, biological, and agronomic practices is necessary in the long term. Strengthening extension services, digital tools, and participatory approaches is necessary. Encouraging community-driven watershed management leads to lasting outcomes. SWC must be mainstreamed into development, climate, and agricultural policies

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