A Review on Conservation of Indian Soil and its Classification

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ABSTRACT: ***Soil is the uppermost layer of the Earth's crust. The formation of rocks is influenced by the climate, vegetation, relief, and parent rock effect of weathering. The current study looks at the overall state of soil classifications in India as well as the key soil groups. Soil is a combination of rock debris and organic substances that develops on the earth's surface. Soil formation is influenced by relief, climate, vegetation, parent material, and other living forms, as well as time. Agriculture is completely reliant on the land and its condition. If the soil quality is good, agricultural output rises, and farmers' income rises with it, as does the economy. For optimal output, the soil quality must be maintained. In India, the following types of soil may be found: red, black, alluvial, desert, and so on. The quality of the soil is harmed or degraded by soil corrosion, which is extremely damaging to crops and plants in the agricultural sector. The major goal is to reduce this impact, and there are several techniques for controlling or preventing soil corrosion. In the future, this research will assist the reader in gaining a better understanding of soils and their conservation, since soil plays an essential part in farming and forestation. Maintaining the quality of soil is also vital for humans, as well as plant development and crop production.***

KEYWORDS: ***Agriculture, Alluvial Soil, Conservation, Forrest, Red Soil, Soil Erosion.***

1. INTRODUCTION

Soil is the uppermost layer of the earth's crust. The weathering of rocks results in the formation of these soils. Mineral particles, organic components, air, water, and living beings make up the majority of the systems that interact slowly yet continuously. The majority of plants get their nutrients from the earth and are the primary source of food for humans, animals, and birds. As a result, most living things on the ground rely on land to survive. Because the dirt is readily disturbed, weeps away, or blows away, it must be managed carefully. We can avoid harming one of the most important components of our ecology and food security if we understand and treat the soil appropriately. Soil is created on a continual basis, but it takes time because rocks break down due to weathering, which is a biological, chemical, or physical process (Figure 1).

The buildup of materials produced by wind, gravity, and water movements will aid in the creation of the soil, a process that can take decades to complete. Soil development is influenced by five key interacting components. The characteristics of soil change depending on how long it has been exposed to the elements. When minerals in rocks are worn down further, clays, iron, and aluminum oxides are produced. India's soils have been classified into several categories depending on their color, content, origin, and location. Soil is required for the Earth's ecology. Human life would be difficult without dirt. Plants get their roots from the soil, which also stores the nutrients they require to thrive. Soil functions are critical soil capabilities for a wide range of agricultural, environmental, nature preservation, landscape, and urban applications.

The importance of soil functions cannot be overstated. For societies that feed humans, domestic animals, and wildlife, the land is the most fundamental and conditional environment. Because most plants cannot survive without the existence of the earth, it is critical to protect this resource. Because earth-like layers act as natural filters to improve water quality, soil conservation is also important for water supply. Water, on the other hand, is required for nutrient solubility in plants. Soil conservation is necessary for managing soil erosion and improving soil quality. The topography is categorized, and the soil is located in various locations, with different types of soil utilization for various crop types in various locations. [1]–[3].

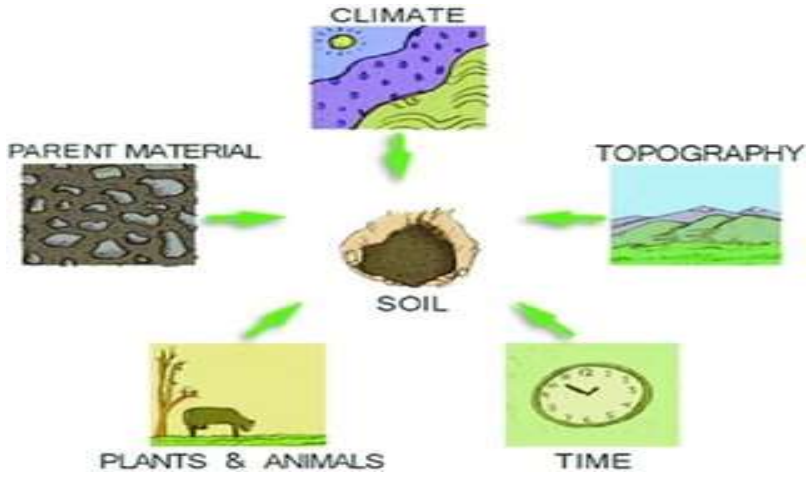

Figure 1: Shows the various factors responsible for the formation of soil [4]**.**

2. LITERATURE REVIEW

T. Bhatacharya et al. discussed diversity of soils exist in the Indian subcontinent, derived from a diverse range of rocks and minerals. Different types of soil have arisen as a result of soil-forming variables such as climate, vegetation, and topography working through time on a variety of rock formations and parent materials. Over the last 30 years, the National Bureau of Soil Survey and Land Use Planning in Nagpur has built a database on soils based on field and laboratory investigations. This resulted in maps and soil data at various scales, displaying the extent and distribution of various soil groups in distinct agro ecological sub regions. For alluvial plains and black soil areas, the 1: 250,000 scale map indicates a threshold soil variation index of 4-5 and 10-25 soil families per m ha, respectively. In terms of soils, their formation in relation to climate, relief, organisms, parent materials, and time, progress on basic and fundamental study in Indian soils has been evaluated [5].

R. Bhattacharya et al. discussed that soil erosion is still a serious environmental concern in India and other parts of the world, despite years of research and significant expenditure in repair and prevention. Furthermore, the situation is being exacerbated by changing climate and/or weather patterns. Our aim was to analyze historical and present soil conservation projects in India to better understand how production-, environmental-, social-, economic- and policy-related concerns have influenced soil and water conservation and the incentives needed to solve the most urgent challenges. Institutions and operations must be coordinated using a comprehensive approach to ensure success in soil and water conservation programs, we discovered. Watershed programs have been proven to be one of the most effective ways for bringing socioeconomic development to India's various regions. Within both dryland and rainfed areas, watershed management has quietly transformed agriculture by aligning diverse sectors through technical soil and water conservation measures and land-use diversification. Significant outcomes from various watershed-scale soil and water conservation programs and interventions that were effective in decreasing land degradation and enhancing productivity in various regions of the country are presented [6].

P. Bhattacharya et al. discussed the threshold upper limit of soil erosion that may be tolerated without decreasing long-term productivity of certain soils is known as the soil loss tolerance limit. For planning soil conservation operations in India, a default soil loss tolerance limit (SLTL) of 11.2 Mg ha-1 yr-1 is used. The goal of this study is to develop a methodology for estimating quantitative SLTL in the Shivalik-Himalayan area of India in order to recommend appropriate soil conservation strategies. To assess soil quality governing soil resistibility to erosion, a quantitative model was used to integrate potential soil indicators such as infiltration rate, bulk density, water stable aggregate, organic carbon, and fertility status. To convert soil parameters to units other than the 0 to 1 scale, scaling functions were used. Normalized soil parameter values were then multiplied by weights based on each indicator's relative relevance and sensitivity analysis. Soils were categorised into one of three groups based on their overall additive score: 1, 2, or 3. The USDA's Natural Resource Conservation Service (NRCS) created a basic guideline for estimating SLTLs, which was followed with some adjustments in the depth category. Soil loss tolerance limits varied from 2.5 to 12.5 Mg ha- 1 yr - 1 compared to single value of 11.2 Mg ha- 1 yr - 1 being followed earlier. In India, taking into account the newly estimated SLTLs would help with site-specific conservation planning and prioritising areas for watershed management [7].

3. TYPES OF SOIL

The various types of soils are as follows**:**

3.1. Alluvial Soil:

Alluvial soils are deposited on the water's surface. These soils vary from other types of soils in that they are created through a protracted process of rock alteration. This soil covers forty percent of the country's entire area. This soil's composition varies, ranging from loam to clay. Alluvial soil is India's largest and most significant soil type. Potash is abundant in these soils, while phosphorus levels are quite low. It served several purposes, the most important of which was to serve as the earth's kidneys. The sediments and nutrients in the nearby water are removed by this soil. It enhances the river's water quality. Flooding is the most important factor in the development of alluvial soil. Alluvial soils come in a variety of colors, ranging from light grey to ash grey. This soil may be found in the deltaic alluvium from the western end of Punjab in Bengal to the east of Assam. The alluvial soil is classified into two types as shown in Figure 2.

Figure 2: The above figure shows the Classification of the Alluvial Soils i.e., khadar and bhangra.

The Khadar soils are located in the low portions of the valley bottom, which are inundated practically every year. They are drier and less kankary, with less calcareous and carbonate pale brown sandy clays and loams. Bhangar, on the other hand, is an older alluvium system that was deposited further away from the floodplains. Both the Khadar and Bhangar soils include calcareous concretions (Kankars). More loamy and clayey soils may be found in the lower and middle Ganga plains, as well as the Brahamaputra valley. The sand concentration decreases from west to east.

3.2. Black soil:

Metals, minerals, magnesium, and aluminium are abundant in the soil of India. It covered the most of the Deccan plateau, as well as parts of Gujarat and Tamil Nadu. These soils are known as Regur soil or Black cotton soil because the black is so deep. The black soils have clayey, deep, and impermeable soils. They expand and become sticky when wet, then shrink when dry. As a result, during the dry season, these soils develop huge cracks. As a result, self-plowing has developed. Because of its sluggish absorption and lack of moisture, black soil retains moisture for longer, allowing plants, particularly plant-grown plants, to thrive during the dry season. Black soils are chemically rich in lime, iron, magnesium, and alumina. Potash is also present in them. Phosphorus, nitrogen, and organic elements are all in short supply. The soil is dark grey to black in colour.

Features of the black soil as follows:

- Black soil covers the majority of the Deccan.
- The water retaining capacity is higher.
- The colour is light black to deep black it varies.
- It consists of iron, organic substance, calcium etc.
- The black soils are deficient in nitrogen as well as phosphorous.

3.3. Red soil:

The hue of these soils is typically reddish to brownish, as a result of granite weathering. Red dirt is primarily found in areas where the temperature is warm and the environment is humid. It may be found in mixed woods, and it is made up of sedimentary rocks that contain a lot of iron. Because the red soils lack adequate nutrients, they are unsuitable for cultivation. In India, it spans roughly a quarter of the country. The overall soil cover is 29 percent. These soils may be found in places like Uttar Pradesh, Goa, Kerala, Tripura, and Madhya Pradesh. The hue shifts from red to yellow due to ferric oxide coatings on soil particles. These soils have a wide range of textures, from loam to clay loam. They are nitrogen, phosphorus, and humus poor, and their soil depth varies from shallow to deep. Figure 3 illustrates the types of red soil.

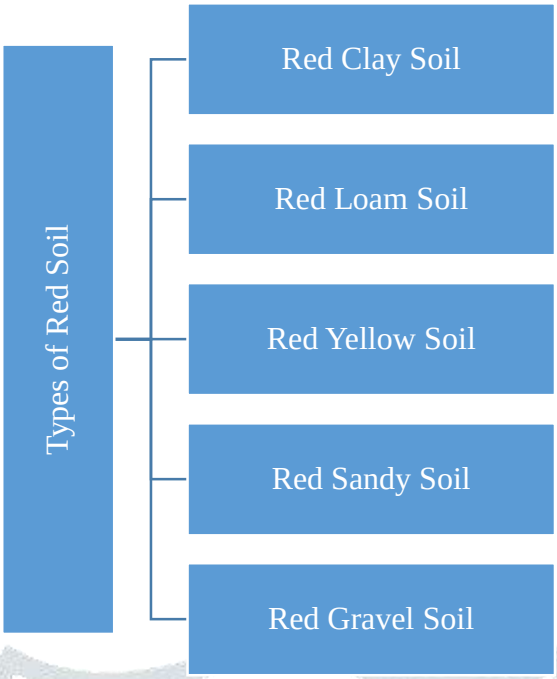

Figure 3: Illustrates the classification of the red soil.

3.4. Laterite soil:

The name "laterite" is derived from the Latin word "later," which meaning "brick." When temperatures are high and there is a lot of rain, with wet and dry intervals in between, they develop. Soil leaching (nutrients carried away by water) is encouraged by heavy rains, resulting in the loss of lime and silica and the development of a soil rich in iron oxides and aluminium compounds. Due to the lack of clay and the presence of red sandstone gravel, laterite soils are reddish-brown in colour. In the states of Karnataka, Kerala, Assam, Maharashtra, Orissa, Madhya Pradesh, and Tamil Nadu, they may be found predominantly on the peaks of the Western and Eastern Ghats, as well as the Satpuras and Vindhyas. Laterite soils are rich in bauxite or ferric oxides. There is a scarcity of lime, magnesia, potash, and nitrogen. Laterite and lateritic soils are both good building materials. Laterite soils are often utilised as bricks in home construction [8].

2.1.1. Saline soil & alkaline soil:

They're also known as Usara soils. Saline soils are sterile and incapable of supporting vegetative development because they contain greater levels of salt, potassium, and magnesium. They have increased salt levels due to the dry environment and poor drainage. Arid and semi-arid temperatures, as well as damp and marshy settings, are suitable habitats for them. The soil texture ranges from sandy to loamy. Gujarat, Punjab, Haryana, Rajasthan, Uttar Pradesh, and Maharashtra have saline, arid, and semi-arid soils. These soils are infertile and uncultivable, with a texture ranging from sandy to loamy sand, a nitrogen deficiency, and a high perviousness, resulting in low water retention capacity.

2.1.2. Peaty soil:

They live in regions where there is a lot of rain and high humidity, as well as areas where there is a lot of vegetation. As a result, a significant amount of dead organic matter builds up in these areas, giving the soil a high humus and organic content. The biological matter content of these soils might be as high as forty to fifty percent. These soils are mostly found in Orissa, Kerala, and parts of Bihar, Uttar Pradesh, and West Bengal, such as Kottayam. This soil's chemical characteristics indicate that it is low in phosphate and potassium. Most peaty soils are inundated during the rainy season, but after the rains cease, they are converted to paddy farming. These soils are often heavy and black in color. They are also alkaline in a number of places [9].

2.1.3.. Forest soil:

As the name implies, forest soil is created in the forest where enough precipitation is available. Soil structure and texture differ depending on the alpine settings in which they are formed. They're loamy and silty on the valley sides, but coarse-grained on the upper slopes. The Himalayan snow-bound zones are depleted, acidic, and deficient in humus. Heterogeneous soil is another name for this type of soil. Forest soils have an exceptionally high humus content. Potash, phosphate, and lime are all insufficient. They require a lot of fertilisers in order to produce large harvests. In the peninsular woodland region, they're good for tea, coffee,

spice, and tropical fruit crops. Wheat, maize, barley, and temperate fruits are grown in the Himalayan Forest area [10].

4. DISCUSSION

4.1. Major Problems of Soil in India:

Soil deterioration is India's most serious concern. Soil lateralization, alkalization, and salinization, as well as soil erosion, are all processes that cause soil quality to deteriorate. Natural processes and human activities can contribute to soil deterioration. Soil erosion is caused by poor farming practices, overgrazing, deforestation, shifting cultivation, rivers, and top soil removal for industrial purposes.

4.1.1. Soil Erosion:

The process of eroding the soil coverings is known as soil corrosion. Soil formation and erosional processes driven by flowing water and wind occur at the same time. However, in general, these two processes are in balance. The pace at which small particles are removed from the surface is same to that of the soil layer. This equilibrium can be disrupted by natural or human factors, resulting in a higher rate of soil loss. Human activities are also to responsible for a major part of soil erosion. As the human population grows, so does the demand for land. Forest and other natural vegetation are removed for human settlement, gardening, grazing animals, and a variety of other purposes. Running water erosion is more common in places with heavy rainfall and steep slopes. Plate erosion and gully erosion are the most hazardous types of water erosion in many parts of India. Sheet erosion occurs on high soil after heavy rain, and soil loss is difficult. It is, however, detrimental because the finer, more fertile top soil is lost. Soil erosion is a significant concern in Indian agriculture, and it can also be seen in other places. Eroded materials are transported down the river, reducing its capacity and causing flooding and damage to farming communities on a regular basis. Soil erosion is caused by a variety of factors, including deforestation. Plants prevent soil erosion by keeping their root locks in place. Soil deterioration costs Indian countries millions of tons of soil and nutrients each year, reducing local productivity. As a result, rapid action is required for soil recovery and protection.

4.1.2. Soil Conservation:

If people cause soil erosion and exhaustion, it stands to reason that they may also be prevented. Nature has its own set of laws for achieving and maintaining balance. Humans have plenty of resources with which to develop their economy. Soil conservation refers to the use of various strategies and procedures to keep soils healthy. Soil conservationists strive to preserve soil rich and productive while also preventing erosion and degradation from disturbing nature's natural balance. Soil conservation is a strategy for conserving soil fertility, avoiding erosion, and restoring soil conditions that have been harmed.

5. CONCLUSION

Finally, India has a wide variety of soil types, ranging from extremely productive alluvial soils to saline and alkaline soils that are unproductive. The formation of various soil types is influenced by parent rocks, topography, climatic conditions, relief features, and natural vegetation. Fertile alluvial soils cover the most acreage in India's various soil types. Soil is a mixture of rock debris and organic compounds that forms on the ground's surface. All important components in soil development, including parent material, climate, plants, and other forms of life, as well as time, are referred to as relief. The preservation of soils against corrosion is critical for future prospects since human existence is entirely dependent on food. These foods grow and develop in the soil, which is the outermost section of the earth's crust.

The management of this soil is a crucial component for the excellent quality of food as well as boosting the food output of crops. In India, several types of soils may be found, and these soils are categorized based on their color and formation. Agriculture is entirely dependent on the land and its state. Agricultural productivity grows when soil quality is excellent, and farmers' income rises along with it, as does the economy. Soil is constantly produced, although it takes time owing to the weathering of rocks, which is a biological, chemical, or physical process. Soil formation is aided by the buildup of material created by wind, gravity, and water motions; these processes can take tens of thousands of years to complete. In the farming industry, soil is crucial. The earth's surface has been coated in soil like a blanket. As a consequence, it establishes a systematic link between the rocks within and the humans that dwell on the planet. It serves as a pathway for plants and animals to survive. Soil is made from rocks.

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