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FARMING PRACTISES AND SOIL MANAGEMENT STRATEGIES

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ABSTRACT

There is a growing population and a decreasing amount of land that can be cultivated. To fulfil the ever-increasing need for food, agricultural production must be balanced with population growth. Natural vegetation areas are being converted into farmland due to these changes, which have led to an increase in agriculture. When land resources are over-exploited over long periods of time, coupled with environmental variables, the soil's top fertile layer is lost. First wave of soil erosion occurred around the time of the first substantial change in land usage on the global scale. Soil erosion control is a critical component in achieving a balance between agricultural productivity and conservation. Soil erosion control and prevention demand an integrated soil erosion control system that incorporates engineering, agricultural cultivation technologies, law enforcement, biological approaches, and land planning and management strategies. Soil conservation structures and sophisticated soil loss models would be necessary for land management. Soil erosion dynamics and agricultural sustainability are examined through various soil management practises, which presents issues similar to those of predicting future climate or agricultural system changes. The focus of this chapter is on quantifying and understanding the impacts of agricultural land use and management on eroded soils.

Keywords: Agronomic soil management, Engineering soil management, Soil erosion, Water erosion, Wind erosion

I. Introduction

Along these lines, soil might be viewed as a combination of natural and inorganic material found on the world's surface that has shaped because of the connection of air specialists with organic action in the first material or the fundamental hard rock. Soil fills in as an actual substrate for the advancement of plants. Since the dirt gives supplements, water, air, and mooring, and on the grounds that it is viable with life on the planet, it very well may be alluded to as the Infinite Life Soul of the planet (SOIL). Of the many soil types, alluvial soils are the most critical and greatest gathering of soils in India, representing 45.6 percent of the nation's complete land region. For hydrological examination to be viable, explicit data on soil attributes should be given. Soil properties are significant in light of the fact that they impact how a watershed answers precipitation and snowmelt. The distinctions in soil geomorphological and hydrological processes that happen after some time and space are an intrinsic part of the different land use types (Meena, *et al.* 2020). The two cycles affect pedogenesis as well as the dispersion of water, dregs, and natural components in a dirt climate. Land use can affect the substance, physical, and natural parts of the dirt because of an assortment of human exercises, for example, soil culturing, cows

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stomping on, collecting, planting, manure application, over irrigation, and different exercises. A change or vanishing of a land use design, then again, could happen because of provincial varieties in soil characteristics, atmospheric conditions, populace thickness, financial conceivable outcomes, social practices, and financial factors. Land use altogether affects biological rebuilding and soil quality in naturally harmed spots, and it is a basic viewpoint in reestablishing environmental wellbeing. Contrasts in human action and vegetation altogether affect changes in natural properties, which thus help to support the design of the dirt.

Soil natural matter (SOM), soil supplements, and microbial biomass are completely impacted by the sorts of biomass and garbage. Whenever done suitably, plant rebuilding can improve supplements in the endlessly soil microorganisms in China's Loess and red-earth mountain districts (Hou, *et al.* 2020). Plant soil supplement aggregation and soil microbial populace and action are both helped when vegetation is reestablished. Plant advancement, litter breakdown, soil supplement development, and microbial action are completely impacted by environment and human administration. Besides, different researchers' perspectives on the dirt in general reach broadly. Soil, as per Russian researcher (Paustian, *et al.* 2019), is a characteristic body comprised of minerals and natural parts, with a specific beginning and one of a kind attributes. "Soil is a characteristic assemblage of minerals and natural fixings generally isolated into skylines, non-united variable profundity that separates among them and the first material hidden morphology, actual piece, compound and organic creation," says (Montanarella, & Panagos, 2021).

Earth's dirt profundity shifts from one spot to another and isn't predictable across the planet. In certain areas, it can arrive at many meters; in others, it may not exist by any means. Profoundly, the dirt profile might be much enhanced. The dirt profile is comprised of five principle skylines, each with an alternate thickness. Numerous layers can be found in a dirt profile, as portrayed by the chart in Figure 3. Disintegration of natural materials makes the natural matter layer (humus), which is just found in rich soil. Timberlands are the most well-known natural surroundings for this growth, while arable ground is quite often liberated from it. Bio-mantle movement is moved in the A skyline, ordinarily known as dirt (Lal, 2018). This layer is otherwise called the earth and incorporates mud, natural material, iron oxides, as well as other mineral layers. Enormous bits of immaculate stone make up the C skyline, ordinarily known as eolith. Similarly as with the bedrock, the R skyline is made out of a solitary, continuous layer.

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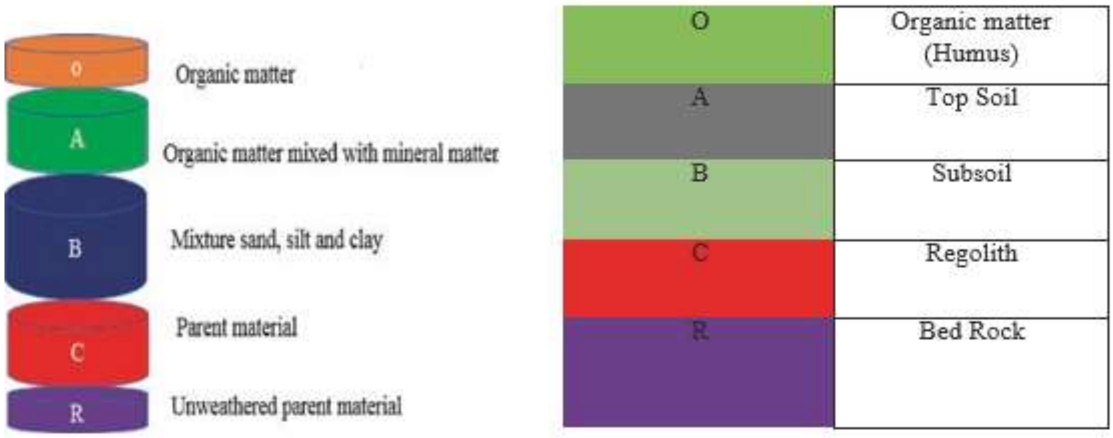


Fig. 3.1 Soil profile describing composition of the different layers of soil

Table 3.1 Soil composition volume basis

Soil component	Contribution (%)
Mineral matter	45
Organic matter	5
Soil water	20–30
Soil air	20–30

II. Factors Responsible for Soil Formation

There are several factors that contribute to the creation of soil. These include physical, chemical, biological, and human activities. As a complex natural process, soil formation is impacted by a slew of interrelated elements (Chalise, *et al.* 2019). These include topography, climate, organic matter, and time. It is easier to understand how soil and landscapes have grown and how climate change may affect them if soil formation is defined as a continual process, a mixed bag of explanations for soil creation have been offered.

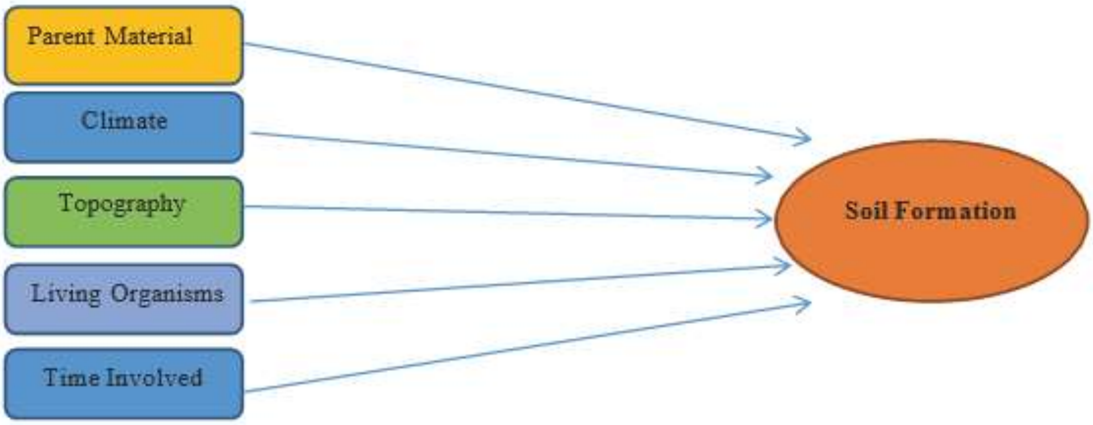
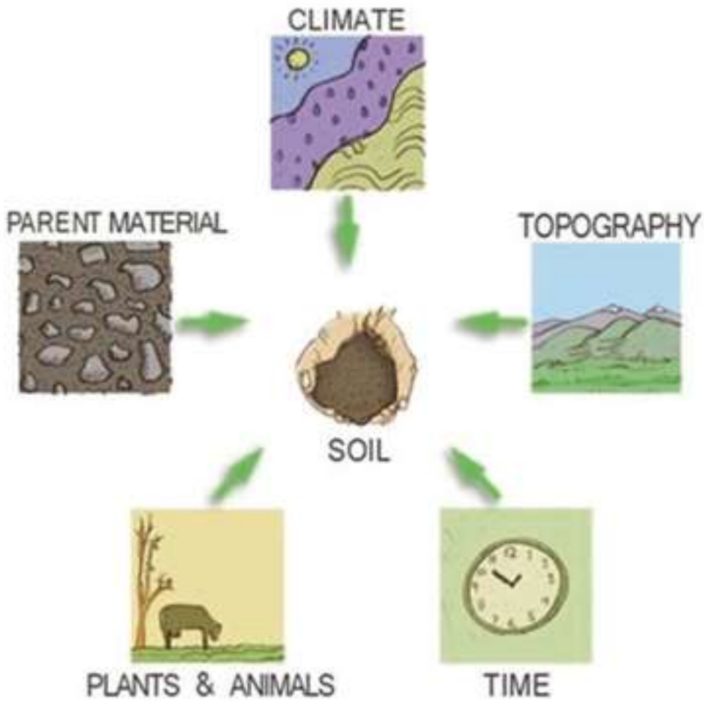


Fig. 3.2 Different determining components of soil formation

Fig. 3.3 Factors of soil formation



However, this rise is not linear nor homogeneous. The bedrock's weathering and eroding processes are two of the most important factors in determining the depth of the soil. Erosion carries the separated materials, lowering the depth of the soil, while disruption slowly disintegrates rocks to generate elements that constitute the floor (Amelung, *et al.* 2020). For a given site, the specifics of soil erosion define whether or not the ground depth is lowered; as long as the land flow divergence is positive, there is a net movement of earth away from a point. Net transport outside the site reduces depth if land production on the site is greater than net transport. Due to the fact that sediment movement is heavily influenced by relief, increased erosion rates in high-relief places lead to decreased topsoil thickness. Soil development is influenced by relief in a number of ways:

- In other words, as the inclination angle increases, so does the erosion risk since it affects the soil profile thickness?
- Soil development is influenced by changes in the climate.

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- In addition, it affects runoff, percolation, and mass flow.
- Microclimate conditions can be created by altering the visual look of a space.

A soil's parent material has a significant impact on its qualities, especially in the early phases of its formation. Color, weave, structure, mineral content, and permeability/drainage are just a few of the ways the original material may affect the soil.

There is a wide range of parent material in India, which may be broken down into the following categories:

- Rocks that are both crystalline and metamorphic
- Vindhyan and the Cuddypah rock outcrops
- Rocks from Gondwana
- basalts of the Deccan
- extra-continental India's tertiary and mesozoic sedimentary rocks
- Rocks that are recent

Soil formation is a complex process that is heavily influenced by the weather. A soil's mineral makeup and organic matter concentration are influenced by weather conditions, such as temperature and precipitation. Organic matter decay and microbial activity increase rapidly in soils with high temperatures, while low temperatures cause leaching by decreasing evaporation and encouraging organic matter deposition (Babin, *et al.* 2019). This slows down decomposition and erosion effectiveness, as well as the volume of water that filters through soils and the microorganisms that live there. Low temperatures also cause leaching. The soil ecosystem is made up of plants and fauna, as well as microbes. In temperate locations, earthworms are the most essential fauna for the formation of soil, with the assistance of smaller arthropods and larger digging mammals, such as rabbits, moles, and squirrels. Between 0.20 and 0.50 is where the dryness index (the yearly total precipitation divided by potential evapo-transpiration), is a subtype of semiarid environments. The past usage of the earth has deteriorated semiarid soils, leaving them with low levels of soil organic carbon (SOC) and poor structural quality. Soil erosion, salinity, and human activity are the primary risks to semiarid soils. Groundwater quality and atmospheric greenhouse gas (GHG) emissions are all impacted by these processes, which include deterioration of soil structure and a consequent loss of storage. A biophysical process directed by cultural, social, and political elements is called desertification. It is hastened by the harsh weather conditions brought on by climate change events, as well as the resulting soil erosion and salinization processes (Johnson, 2018). As a result, people move away from less fertile places and settle in more productive ones, putting increasing strain on natural resources (Meena, *et al.* 2020). These soils may be sensitive yet their importance for agriculture and human food security makes them a "hot point" in the world. Semiarid ecosystems have been shown to contribute the most to the inter-annual variability of the terrestrial CO2 sink with 57 percent (0.04 P C year1), whereas the global one is 0.07 Pg C year1. This highlights their potential as a C sink, as well as their importance for the global cycle of C and their role as climate regulators (Ahlstrom et al. 2015). At the moment, the semiarid soils are a major contributor to the global warming gases we're emitting. Due to climate change, water and semi-arid temperature-sensitive ecosystems are particularly vulnerable to drought and interannual precipitation variability.

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III. Soil Sustainability for Future Generation

Sustainability is the capacity to fulfil our own needs without sacrificing the potential of future generations to meet their own needs.. Maintaining soil sustainability requires controlling soil erosion. A decrease in agricultural output is inevitable if the soil declines. For sustainable farming, a healthy soil is a need. Wendell Berry believes that sustainable farming does neither harm the environment or the human population. Sustainable agriculture relies heavily on healthy soil. Crops that grow in good soil are less vulnerable to disease because of the presence of water and nutrients. In order to maintain long-term production and stability, soil must be safeguarded. All of the criteria covered in this chapter go into the protection strategies (Montanarella, & Panagos, 2021). The use of biological fertilisers rather than the use of chemical fertilisers is essential for the long-term sustainability of soil. Biochar should be utilised because it improves soil fertility and extends the productive life of crops. Organic farming must be practical, as it produces healthy soils by feeding the microbial inhabitants that release, process, and transmit nutrients into the environment. A healthy soil rich in micronutrients may be utilised for decades without depletion in organic farming. In summary, soil sustainability is vital to achieving sustainable agriculture, and may be done by suitable soil conservation strategies, improved seed types, and better cultivation practises (Schlesinger, & Amundson, 2019). Organic farming can also be a viable option for increasing agricultural yields in a sustainable manner. It's not just the usage of legume crops, crop rotation, and the use of vermicompost that may have a significant influence on our already overburdened agriculture industry.

IV. Conclusions and Future Perspective

This study has surely generated a significant quantity of knowledge and an outstanding grasp of many fundamental soil qualities and processes that influence and affect numerous land management decisions. A reductionist approach does not provide answers to complex questions, such as how weather patterns, landscapes, and cultivation systems interact, or which soil and crop management strategies should be regulated to provide food, fibres, and fuel for more than nine billion people, in the absence of a more comprehensive approach. Results in the field are typically heavily impacted by the weather and geographical conditions (espe- cially those affecting soil moisture content). The spatial inference model of a research can incorporate temporal variance by using a probability surface that describes the occurrence of crucial environmental components in a field investigation (Paustian, *et al.* 2019). Using these domains, it is possible to discover regions of commonality where the survey findings may be useful. Using innovative search methodologies and visualisation procedures, users may specify inference domains relevant to their study or production environment. These strategies may also be used to lead future research, extend study results to end users, and assist producers in managing risks. Societies tend to overlook or rely on nature's solutions as a last choice when confronted with modern difficulties, which is a shame. There are several environmental issues facing the world/humanity now (Johnson, 2018). It is possible to overcome and address most of these difficulties if researchers give more attention to the study and understanding nature and the positive laws of nature.

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