



SOIL GEOGRAPHY

V.B. Kale

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PREFACE

Soil Geography is the branch of Physical Geography. Soil scientist wishes to display the spatial distribution of the soils. Use of soil is done by human being right from the evolution of the Earth and which is continued. This book tries to discuss about the importance of soil.

In this book, Chapter 1 provides detailed description, introduction, nature and scope of Soil Geography. History of development of soil geography, approaches of study of soil geography, nature of soil geography, scope of soil geography are included in first chapter. Chapter 2 explains details about formation of soil, parent material, climate, biota, time and topography. Chapter 3 deals with components of soil, minerals, organic matter, air, water and micro organism. Chapter 4 focuses on characteristics of soil, physical characteristics of soil, density of soil, porosity of soil, soil structures, soil texture, soil colour, soil consistence and soil surface area. It also explains about chemical Characteristics of soil, soil PH and electrical conductivity.

Chapter 5 discusses about soil profile, characteristics of soil profile, soil horizons, O horizon, A horizon, B horizon, C horizon and R/D horizon. Types of soils are explained in Chapter 6th which includes alluvial soil, black soil, desert soil, laterite soil, mountainous soil and red soil. Chapter 7 covers erosion, quality and conservation of soil. erosion of soil, erosion by water, erosion by wind, erosion by ice, tillage erosion, artificial erosion (human-being induced), quality of soil and soil Loss, quality of agricultural soil in Nashik District and conservation of soil.

Chapter 8 deals with applications and research in soil geography. It covers soil resource inventory in watershed, soil-landscape Analysis: remote sensing approach, issues of the watershed management and soil erosion, deriving erosion model parameters using RS and GIS Future Research Needs. Last Chapter 9 includes soil testing and related aspects.

Many scholars and friends had a role, either direct or indirect, in completion of this book. Acknowledgements have made throughout the book as a mark of gratitude towards the scholars whose works I have cited in this book. I am thankful to the entire team of Himalaya Publishing House Pvt. Ltd. for this precise publication. My special thanks goes to Hon. Smt. Nilimatai Pawar, Secretary of MVP Samaj, Nashik, Maharashtra and Hon. Dr. V.B. Gaikwad, Principal, K.T.H.M. College, Nashik. My family is my greatest source of strength. My mother Yamuna and my spouse Smita supported me countinuously. There are some friends who supported me for each word.

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Author



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SOIL GEOGRAPHY: DEFINITION, NATURE AND SCOPE

Structure

- History of Development of Soil Geography
- Russian School of Pedology
- American School of Pedology
- Approaches of Study of Soil Geography
- Nature of Soil Geography
- Scope of Soil Geography

Rocks are the pages of history of the Earth. As we study the evolution and development of rocks we come to know the history of the Earth. Every soil type is the product of physical, chemical and biological weathering of various rocks. Soils are the medium by which human being can produce the food and sustain his life. Human beings are using the soils from the invention of agriculture systems. There are many evidences to prove the use of soils by human being. Study of soils include in Soil sciences. The study of Soil Geography is the part of Geography.

There are two main branches of Geography. These are Physical Geography and Human Geography. Physical Geography studies the Physical features and phenomena of the earth, while Human Geography studies the various aspects of human life. Thus, the interdisciplinary nature of Geography arose various sub branches of Geography. Soil Geography is the branch of Physical Geography. Physical Geography is the main branch of Geography which deals with the study of land features, climate, oceans, plants, animals and rocks. Soils are the product of rocks. Soil Geography is the science which deals with the study of characteristics and types of soils. Advance techniques and research have vital role in the development of Soil Geography.

The location of Soil Geography in Geography

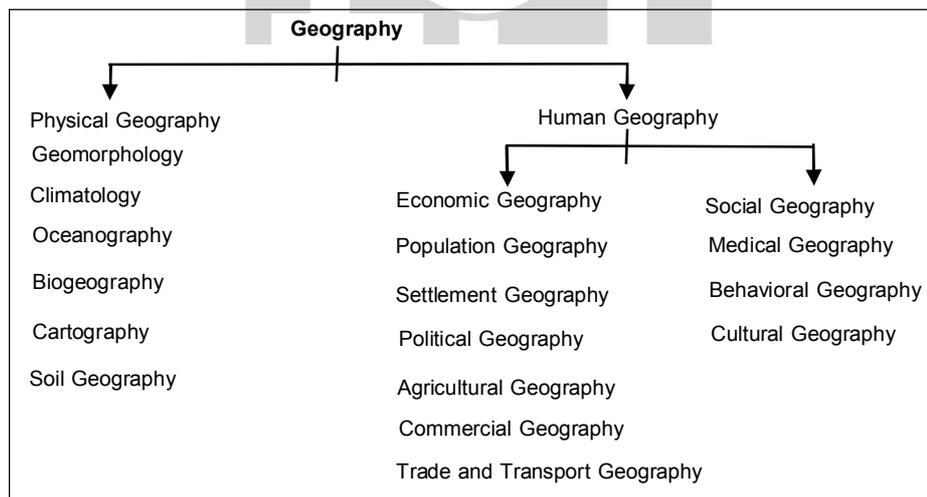


Fig. 1.1: Location of Soil Geography

Soil is a natural body developed due to pedogeni process which place during the end of the weathering of rocks. Changes and transformations occurred in the soil as it founds and these make soil a

dynamic body. Soils are scientifically studied by Pedologist and Edaphologist. Pedology (from Greek word Pedon, means soil or the earth.) Pedon is the three dimensional sampling unit of size about 1 to 10 m² used for examination and study of the soil in the field. Several continuous pedons with similar characteristics are grouped together in large area called a polypedon or individual soil.

Soil is not only related to rocks but it also related to climate, water and biotic factors. Soil changes as per the region. Geography is the dynamic branch, so Soil Geography also changes according the changes in Geography. It becomes necessary to know the meaning, nature and scope of Soil Geography.

There are two types of Soil Geography:

1. **General Soil Geography:** It studies the factors that influence the formation of soil and the general laws of geographic distribution of soils.
2. **Regional Soil Geography:** It studies the regionalization and description of soils in individual region.

Soil Geography compiles the comparative geographic method to study the distribution of soils with relation to factors affecting on soil formation.

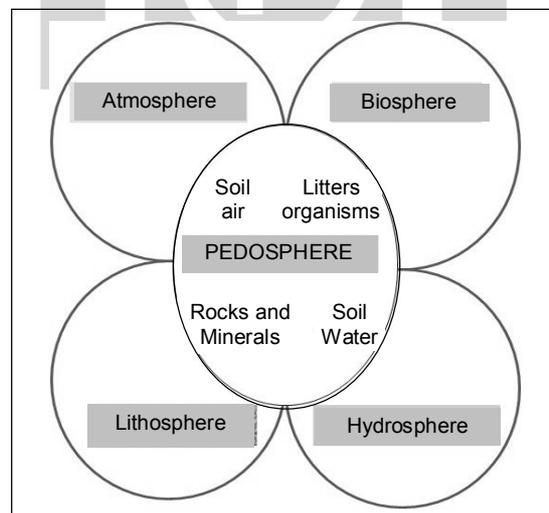


Fig. 1.2: Components of Soil Geography

Definitions

Soil Geography is an interdisciplinary science. The nature and scope of this branch is vital. So it is very complex to define the Soil

Geography. Many soil scientist and scholars have define Soil Geography as follows.

Soil Geography

Study of characteristics of soil and their distribution with geographic perspective is called Soil Geography.

A branch of soil sciences that studies pattern of distribution of soil on the surface of the earth.

V. V. Dokuchaev - It is the branch of Soil science, which deals with physical and biological properties of soil

History of Development of Soil Geography

Soil Geography developed and flourished in the end of 19th century. This developed due to response to demands of agricultural production and the requirement of classification and evaluation of soils. In the first phase, Soil Geography developed in European countries. V. V. Dokuchaev is the founder of School of Pedology. He wrote many books and articles on Soil Geography. He developed the horizontal and vertical zonality of the soil.

Soil Geography as an academic course is given in the Biology and Soil Geography departments of the largest universities in the country for specialists in soil sciences and soil scientists.

Soil commission was founded in 1888 by initiatives made by V. V. Dokuchaev. In 1913 this commission was recognized into V. V. Dokuchaev soil committee. The first sub department of soil Geography was founded in 1926 at Leningrad University by S. S. Neustrue.

Various schools have contributed their role in the development of Soil Science. These are Russian school of pedology, European thought of pedology and American school of pedology. Among this Russian school of pedology have a significant role in the development of this branch.

The Russian School of Pedology

This school is probably the oldest school in the development of soil. V. V. Dokuchaev and Nikolai Sibirtzev contributed their work of evolving Russian soil philosophy. In the late nineteenth century

massive soil surveys carried out by these scholars in the whole Russia. V. V. Dokuchaev was a student of natural science. He completed geologic-geographic survey of European-Steppe lands. On the basis of this survey he wrote "Russian Chernozem" which means a fertile black soil rich in humus with a lime-rich layer beneath, typically occurring in the temperate grasslands of the Russian Steppe. It is proved that Chernozem soil contains vegetation and minerals.

He also conducted survey of physical environment including land and soil valuation survey. He was the follower of Geographer like Alexander Von Humboldt and Charles Darwin. He gives preference to the climate in soil formation. But at the same time he focused on the importance of plants and animal life in soil formation. He explained, unless and until plants and animals are not contributing their impact on soil formation, its distinctiveness will not found. He was the pioneer, leader and philosopher in the development of Russian school of pedology.

Russian pedology is based on soil classification which is based on the genetic framework.

They were able to do the horizons of the soil.

European Pedagogical Thought

P. E. Muller (Denmark) takes initiatives in the development of soil science. But there is no any school of pedology because individually researcher contributes their role in soil science. Denmark, Britain, France, Belgium, Spain, Portugal, Germany and Yugoslavia are the nations where soil research carried out in Europe in 19th century. They created soil map of Europe.

American School of Pedology

American and Russian ideas of soil are symmetry. Hilgard, Shaler and Whitney give their contribution and published the results of soil surveys. C. F. Marbut's contribution to pedology is of particular interest for geographer, because he himself was a geographer. N. S. Shaler published "Origin and nature of soils" in 1890. He has impact of Devisian ideas. Davis focused on dynamic character of natural phenomena. The first director of U. S. A. soil survey was Milton Whitney. According to texture and particles size they have created types of soil.

After II world war American penologists had taken the international leadership in soil nomenclature and classification. The U. S. Soil Survey Manual (1951) was major publication.

Approaches of Study of Soil Geography

Regional Approach

Geographer studies a very wide range of issues from spatial perspectives. Regional Geography is a certain approach to geographical study as compare to quantitative and critical geography. The ideographic study of spatial individuals (specific places, countries, continents) and the typological study of spatial types (coast, mountain and border) form the two pillars of regional geography. Regional soil geography is the branch of soil geography.

Region is a dynamic concept, which has been defined differently by different geographer. According to Vidal-De-La-Blashe, Region is the area of similar physical and cultural characteristics. While other says, the area which is differentiated from other areas according to specified criteria. There are various regions. i.e. mountainous region, Equatorial region, Tundra region, etc. In the approaches of soil geography regions are formed according to types of soils. Soils favorable to the particular crop form regions of crop. E.g. Black Cotton Soil. So central idea in the study of soil geography is region but it is less important the area and shape of the region. Region is the basic unit of the earth, so the collection of data can be done on local, national, global and universal level. It is most important characteristics of regional approach that researcher can analyse the data on any level.

V. V. Dokuchaev formulated the regions of the world according to soil. According to him physical properties of the soils are important. Chemical and biological properties are gain by soils from various factors.

Systematic Approach

We can't study soil separately. It is very important to do the study of physiography, climate, vegetation and work of denudative agents. Clear picture of the soil will seen in the study of all these factors. This is helpful for planning, causal relationship and comparative study of the region. Agricultural practices are depending on the types, nature and quality of the soil in particular region. So it is

an important aspect of soil study to do the study with planning and with logic. It requires knowledge of science, statistics, plants, animals and microbes.

In the systematic approach of study of soil geography loss of soil, degradation of soil, conservation of soil, health of soil and quality of soil are included. Regional approach and systematic approach are interrelated. Once the researcher has defined the region, he has to plan the action for his research work. After studying the various regions, comparison is possible by this approach. In the systematic approach, one factor is dependent on another, one step after another. There is a hierarchy of the steps.

Nature of Soil Geography

As it is a branch of Physical Geography and as it is a science, the nature of soil geography is dynamic. Soil Geography was descriptive subject in the period of 18th century. In the late 19th century it gets its position and separate identity as a branch of knowledge. Various crops, distribution of crops, types of crops, yield and quality of production enhances the study of soil geography. A change in environment and agriculture brings the changes in the study of soil geography. Soil Geography experiences the drastic changes in its nature. Descriptive nature of Soil Geography changed and become analytical and scientific.

According to V. V. Dokuchaev, in soil geography, location of soils, their characteristics, nature and patterns are checked and studied. Soil geography studies problems of soil, their scope, need and seriousness of their quality. E.g. In one region there is a production of grapes, where is the same soil there farmers can produce grapes and if it is not possible to yield the same crop in that soil, researcher can analyses why it is not so? He find out causal relationship of the same. Where is that same soil found? From this he can get idea of soil pattern.

Modern geography is become so powerful and scientific. Researcher of soil geographer also studies crop yielding decision, area for specific crop, its economics, etc. Soil Geography relate with many branches. Geomorphology, Climatology, Bio-Geography, Zoo-Geography, Chemistry, Agriculture and Economics are related to Soil Geography. In the research of Soil Geography researcher need to study of Statistics and Computer science.

In the explanation of nature of Soil Geography V. V. Dokuchaev explained that it is the study of soil in various regions. It also studies formation, characteristics and changes in the soils. Changes in physical, chemical and biological characteristics of soils are occurred due to which causes are also studied in this branch. So the nature of this branch is completely dynamic.

Scope of Soil Geography

Scope of the Soil Geography is vast. In the period of development of Soil Geography its scope is only limited to distribution, type and characteristics of soils. But, after 19th century scope of soil geography has been increased. Productions of crops become a crucial issue nowadays. Farmers are facing the problem of decreasing yields, various crop diseases, soil degradation and soil salinity.

In earlier days there was a limited scope to soil Geography. But in the modern period of science and technology scope of soil Geography has been widen. Biologists, environmentalists and geographers are widely collecting the information of soil. Research has been carried out in the field of soil science. Every nation is engaged in agriculture, so it is the requirement of every nation to get information and knowledge of soil. By using statistical techniques measurement of agricultural efficiency, cost benefit ratio means input-output ratio, nutrition, malnutrition, starvation, hunger, health, food security these problems can be solved. Population of various countries, availability of food to sustain that population is comparatively studied by geographers.

In the 20th century, arable land, conservation of land becomes essential. Irrigation, use of fertilizers, use of technology, changing pattern of crops, pollution affects on agriculture. Due to regional imbalance it is very important to increase the agricultural production. Organic farming, sustainable farming and use of biotechnology increased the facets of soil geography. Soil Geography has challenges of soil pollution, soil degradation, soil contamination and soil conservation. Soil fertility, soil salinity (saltation), water logging, residues in crops and fruits, nutrient losses, diseases on crops erosion and soil loss are some of the burning issues. Soil is eroded by natural and artificial causes. Floods, stormy winds, cyclones are the natural causes while deforestation, over use of water, use of pesticides, insecticides and fertilizers are artificial causes. Soil is the only medium

by which human being can meet the need of food for increasing population. So it is an integral part of the study for human being.

Various institutes engaged in the study of soil and related problems. World Soil Information (WIS) and his partners involved in various externally funded and co-funded projects. The aim of this institute is to collect, analyse, dissemination of quality assessed soil information. The Indian Institute of Soil Science at Bhopal in Madhya Pradesh is an ideal institute in India. The awareness and information of soil increasing day by day. Farmers, scientists, biologists and environmentalists are now engaged the spreading of knowledge of soil. It is become an essential to become a soil friendly nowadays. So the world soil information society has decided to celebrate the World Soil Day on 5th December per year. But more than this it is important to become aware of problems related to soil. New surveys and techniques will bring detailed information of worldwide soil. So it is important to find out precise formula of universal soil loss and it is only possible when government and research institute will take initiatives for the establishment of soil testing labs and infrastructure.

