ENVIRONMENTAL GEOSCIENCES

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Lecture-46

Soil Classification

Welcome to the SWAYAM NPTEL course on Environmental Geosciences. We are discussing the module nine. In the module nine, we have to discuss about the process of soil formation, impact of soil erosion, physical and chemical properties of soils. Today we will discuss the lecture two, that is on soil classification. In this lecture, the important concepts will be covered like introduction to soil classification, purposes of soil classification, soil classification in India, soil degradation and erosion. Introduction to soil classification.

Classification is the grouping of objects in some orderly and logical manner. It is based on the properties of objects for the purpose of their identification and study. They are termed as differentiating characteristics as they differentiate and serve to separate one class from the others; for instance, soils are classified as sandy, loamy or clayey soils on the basis of their characteristics. For classifying the individuals of a large and widely varying population such as soils, it is useful to group individuals into classes and further into higher classes. This kind of grouping is called a multi-categoric or hierarchical system of classification.

The individual soils are grouped into classes of lower category, that is soil series, which are further grouped into classes of higher categories, that is soil orders. The lower categories are defined by a large number of differentiating characteristics and higher categories by a few differentiating characteristics. Within each class, there is a central core or nucleus to which the individual members are related in varying degrees. It is called the central concept or an idealized individual which typifies the class. Now what's the purpose of soil classification?

Like the flora and fauna, soils are classified in a systematic manner to remember their properties and understand their relationship. The purpose of classification is to organize knowledge leading to economy of thoughts, recognize properties of the objects, learn new

relationships and principles in the population as being classified, establish group or subdivisions of the objects under study in a useful manner for practical and applied purposes, say, predicting their behaviour, identifying their potential uses, estimating their productivity, and transferring agro-technology from research farms to cultivators' fields. Now, soil classifications in India. Soils in India are divided into eight categories by Indian Council of Agriculture Research, ICAR.

The All India Soil Survey Committee was founded by the Indian Council of Agriculture Research in nineteen sixty three and it categorized Indian soils into eight broad types. This is a highly reasonable classification of Indian soil and it has a lot of support also. ICAR divided the soils of India into the following groups. Alluvial soil, red soil, black soil, desert soil, laterite soil, mountain soil, alkaline and saline soil and peaty soil. Here also you can see the soil classification of India, the different, different type of soil, forest and mountain soil and alluvial soil, red and yellow soil, black soil, laterite soil, red soil.

So these are the India's major soil types. First is the alluvial soil. By far the largest and most important soil group in India is alluvial soils. It covers around fifteen lakh square kilometer or forty five point six percent of the country's total land area. These soils produce the majority of our agricultural wealth and provide for the majority of India's population.

Alluvium is made up of finer rock particles that are carried in suspension and eventually deposited in the river's bed and bank. Alluvial soils are those that are made up of alluvium. Alluvial soils remain rich in phosphoric acid, potash, organic matter that is humus. Now see the formation of alluvial soil. Although certain alluvial soil in coastal locations have been generated by sea waves,

Most alluvial soils are derived from sediments deposited by rivers, as in the Indo-Gangetic Plain. As a result, all of the parent material in these soils was moved. Crops that can be grown in alluvial soil include, despite being one of India's most important and productive soils, they lack nitrogen, phosphate and humus, limiting the growth of a wide range of crops such as rice, wheat, sugarcane, cotton, jute, potato, and vegetables. Alluvial Soil Distribution, the Satluj-Ganga and Brahmaputra floodplains, which run from Punjab to Assam, as well as the Narmada, Tapti, Mahanadi, Godavari, Krishna and Cauvery valleys and plains, account for approximately twenty three point four zero percent of India's total soil cover. The types of the alluvial soil, the Great Plain of India's alluvium, is split geologically between newer or younger Khadar and older Bhangar soils.

The Khadar soils are found in the valley's bottoms, lower part, which are inundated nearly every year.

The Bhangar, on the other hand, is located roughly thirty meters above the flood level on the highest level. It has a clayey texture and is often black in color. Beds of lime nodules known as kankar can be found in few meters beneath the surface of the bhangar. Alluvial fans with coarse. Frequently, pebbly soils can be found along the Shivalik foothills.

This area is known as Bhabar. A long, thin band of swampy lowland with silty soil runs south of the Bhabar. It is known as Tarai and covers fifty six thousands six hundred square kilometers. The soils of the Tarai are high in nitrogen and organic matter, but low in phosphate. These soils are typically covered by long grasses and woodlands, but in reclaimed conditions, they are excellent for a variety of crops such as wheat, rice, sugarcane, jute and soybean. Next type of soil is the red soil.

Red soils are often reddish to brownish in color, resulting from weathering of the granites, gneisses, and crystalline rocks, and range in quality from poor, thin, light-colored upland soil to fertile, deep-colored lowlands and valley soils. Here you can see red soil is rich in iron, potassium, and potash. Distribution wise, red soils are found in sections of Tamil Nadu, Southern Karnataka, Southeast Maharashtra, parts of Madhya Pradesh, Goa, Kerala, Odisha, Bihar, West Bengal, Uttar Pradesh, Eastern Rajasthan, Assam, Manipur, Tripura, Meghalaya and Nagaland accounting for twenty nine point zero eight percent of India's total soil cover. Ragi, groundnuts, millets, tobacco and potassium are all grown well in these type of soils. These soils are having some important features.

You can see that these soils are high in iron, have a little amount of humus and are somewhat acidic and having low phosphorus, nitrogen and organic content. Due to ferric oxide coatings on soil particles, the color changes from red to yellow. The texture of this soil varies greatly, ranging from loam to clayey loam. Because they are deficient in nitrogen, phosphorus, and humus, soil depth varies from shallow to deep in nature. Now, third category of soil is the black or regur soil.

The black soil gets its name from the black coloration of the basalt rock that forms under semi-arid conditions. Because it is most suited for cotton production, it is also known as regur, that is from the Telugu word reguda or black cotton soil, which remains rich in lime, iron, magnesium and alumina Al_2O_3. The formation of black soil. Several ideas have been proposed to explain the origin of this category of soils, but most pedologists believe they were generated by the solidification of lava dispersed across broad areas

during volcanic activity in the Deccan Plateau during the Triassic period. The Deccan and Rajmahal traps, as well as ferruginous gneisses and schists found in Tamil Nadu, are responsible for the majority of black soils.

The former is appropriately deep, while the latter is mostly shallow. The genesis of black cotton soils is attributed in some regions of Gujarat and Tamil Nadu to historic lagoons where rivers deposited sediments transported down from the interior of the peninsula, covered in lava. Black soil distribution in India. In India, black soil is primarily found in the Deccan Trap region of Maharashtra, Madhya Pradesh, section of Andhra Pradesh, northern Karnataka, Gujarat, Tamil Nadu and Rajasthan. Black soils are found in high temperature, low rainfall areas across the globe.

As a result, it belongs to the peninsula's dry and hot soil category. The most typical places for these soils are Maharashtra, Madhya Pradesh, parts of Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu. Important features of the black soils are the black dirt has a high water retention capacity. Working on such soil is nearly difficult in such conditions because the plough gets trapped in the muck. It swells dramatically and becomes sticky when wet during the rainy season.

During the hot-dry season, however, the moisture evaporates, the soil shrinks, and broad deep cracks, frequently ten to fifteen centimeter wide and up to a meter deep, appear. This allows the soil to be oxygenated to a suitable depth and the soil is extremely fertile. Next category of the soil is the desert soil. Arid and desert soil can be found in India's semi-arid and arid regions such as western Rajasthan, southern Haryana and southwestern Punjab. These are the lands between the Indus River and the Aravali Hills encompassing approximately twenty nine million hectares.

The features of the desert soil, they range in hue from sandy to loamy, pale brown to yellowish brown. The structure is less to sub-angular blocky in structure, low in nutrient and water holding capacity, resulting in moisture deficiency, causing the pH of the soil to range from seven point two to nine point two under generally high salt content but not in dangerous proportions. Because they are low in nitrogen, humus and phosphates and nitrates, these soils contain soluble salts with concentrations slightly below hazardous levels, making them unsuitable for most crops except a handful that can be cultivated with irrigation. Next type of the soil is the lateritic soil. Laterite is a type of rock found only in tropical regions like India, where the climate is alternately wet and dry. Heavy

rainfall and high temperatures cause soil to become rich in iron and aluminum oxides, entirely depleting the soils of silica.

Laterites, which have a compact to vesicular structure and cover four point three zero percent of India's soil cover, are the leftovers of such oxides. Distribution of the lateral soil, you can see that they can be found in the states of Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Assam and Tamil Nadu, mostly on the summits of the Western and Eastern Ghats as well as the Vindhyas and Satpuras. Important features of this type of soil is that they are low in calcium and magnesium as well as being well drained and porous. They can be used to grow rice as well as plantation crops such as cashew, rubber, tea and coffee. They are acidic in higher elevations and inefficient at keeping moisture while on the plains they are generally thick loam to clayey.

Next is the mountain soil. Mountain soils are the soils that are found all along the slopes of the mountains and hills. They are discovered as a result of the breakdown of organic waste in the forest. Climates, vegetation, and terrain all contribute to the creation of the soil profile. Hence, the properties of these soils vary from region to region.

Important features of the mountain soils are that they are having a dark brown color, a clay silt to loamy texture and are slightly acidic to moderately acidic due to their high humus content. They are ideal for growing plantation crops such as tea, coffee, spices and tropical forests since they are the most fertile soil. They are primarily found in Jammu and Kashmir, Himachal Pradesh, Manipur, Western Ghats of Karnataka, Kerala and Tamil Nadu, encompassing a total area of two point eight five lakh square kilometers in India. Next is the Alkaline and Saline soils. Saline, arid and semi-arid soils can be found in Rajasthan, Punjab, Uttar Pradesh, Haryana, Gujarat and Maharashtra.

These soils are infertile and uncultivable ranging in texture from sandy to loamy sand with a nitrogen shortage and a high perviousness resulting in low water retention capacity. Important features of this type of soils are they are projected to cover seven million hectares in India with fifty percent in the Indo-Gothic alluvial plain, thirty percent in black cotton soils and the remaining twenty percent in the desert and coastal regions. Soils that are moderately to severely acidic in character with abundant organic matter but little phosphorus are classified as saline and alkaline type. And the next is the peaty soils these soils form in hot, humid conditions as a result of large accumulation of organic matter. They are black, heavy and highly acidic with a high concentration of soluble salts.

These soils are mostly found in Orissa, West Bengal's, Sundarbans, parts of Bihar, Uttar Pradesh and Kerala's Kottayam and Alleppey districts.

Important Features of this soil are that they are dark, almost black in hue, and there is a lot of organic debris in them. Fine texture with moderate ferrous and aluminum sulfates build up, resulting in a pH below three point five or four, making it extremely acidic. This is related to the organic matter decomposition in anaerobic environments. Now, The soil degradation or erosion, the most serious challenge facing in India's soil is soil degradation.

Laterization, alkalization and salinization of this soil as well as soil erosion are examples of causes that lead to a reduction in the soil quality. Natural factors and human activity both contribute to the degradation of the soil. Soil erosion is caused by torrential rainfall, moving rivers, glaciers, wind and other natural forces resulting in the soil being unusable for cultivation. Deforestation, overgrazing, shifting cultivation, poor cultivation methods, rivers and the removal of topsoil for industrial purposes are the main cause of soil erosion. Now let us summarize the lecture two which we have discussed about the soil classification.

We have discussed first about the introduction to soil classification. We have seen that the upper part of the earth crust is known as soil. Weathering of rock under the effect of climate, vegetation, relief and parent rock causes it to develop. India is a huge country with a diverse range of geology, relief, climate and vegetation. As a result, India has a wide range of soil types that are existing from one another.

Secondly, we have discussed about the purposes of soil classification. We have seen that soil classification is very important because it recognizes the property of the objects, learn new relationship and principles in population being classified, establish groups or subdivision of the objects under study in a manner useful for practical and applied purposes in predicting their behavior, identifying their potential uses, etc. And lastly, we have discussed about the soil classification of India. We have seen that ICAR divided the soils of India into the eight different groups. That is, first the alluvial soil, second the red soil, third the black soil, fourth the desert soil, fifth the laterite soil, sixth the mountain soil, seventh the alkaline and saline soil, and lastly the peaty soil.

Thank you very much to all.