Soil Science and Technology
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Lecture - 06
Soil Taxonomy and Classification

Hello friends, welcome to this new session of Soil Science and Technology and in this section we will be starting a new topic that is Soil Classification and Taxonomy. And let us start this new topic and in this session we will be covering these following concepts.

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First of all we will be covering, why classification is needed and. Secondly, we will be discussing, what are the different developments of classification systems and then we will you know discussing different classes and will be finally, giving the description of individual classes.

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So, always it comes to our mind that, why we need a soil classification and taxonomy. Well, you know that classification always allows scientists to accurately identify individual soil wherever they are. And secondly, taxonomy provides basic understanding about the components of different soils which is necessary for effective decision making about conversation and sustainable use.

So, to get a holistic idea about the soil physico-chemical process you need to have a complete idea about its classification and in which group it belongs, what are their characteristics and how it differs from other soil groups. So, that is why we need soil classifications and taxonomy just like any other organism in the world.

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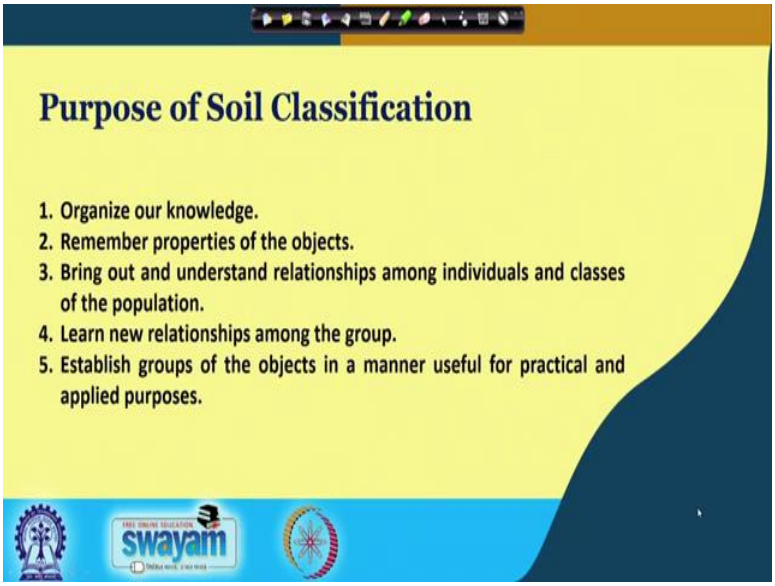

So, what are the purposes of soil classification? There are 5 major purposes of soil classifications. First of all to organize our knowledge, secondly to remember properties of the objects, thirdly to bring out and understand relations among individuals and classes of the populations, to learn new relationship among the groups and establish groups of the objects in a manner useful for practical and applied purposes. So, what I have told you in the previous slide, it reiterates the same; that means, you have to organize your knowledge of soil with the help of this soil classification system and it will help you to identify and remember the properties of soil.

And it will help you to understand: what is the relationship among these individual soils and what is the classes of the population. And it will help you to identify new relationships among the groups and finally, it will establish groups of the objects in a manner. So, it will give you some measurable; it will give you idea of a soil in terms of a soil some measurable properties that is most important.

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So, let us see the historical development of soil classification. So, earlier system of soil classification, there are couple of types; I mean 5 different types are mentioned here. First of all you know economic classifications, then physical classification, chemical classification, geological classification and physiographic classification. And this economic classification mainly you know, classified the soil based on tax purposes and other revenue purposes. At this physical classification, basically classified the soil based on soil texture and structure which have direct link to the soil productivity. So, it basically you know classified the soil based on soil texture which has direct relationship with soil fertility.

The chemical classification was based on the fact that soil can be divided into groups based on their chemical characteristics such as acid soils, sodic soils. So, the acidic soils are those soils which have pH of value of less than 7 whereas, sodic soils are those soils which are having a high concentration of sodium ions and both of them are problematic soil we will discuss them in detail later on. So, the chemical classification based on chemically dividing the soil into certain groups.

Now, geological classification as I have already discussed in my previous lectures you know of soil formation that based on the location of the parent material, we divided the soil into you know sedentary soil and transported soil. So, geological classification was based on the location of parent materials mainly whereas, physiographic classification

was based on different you know physical land forms where soil occurs. So, physiographic some of the examples of the physio you know physiographic classes where you know mountain soils and so on so forth, plainland soil and so on so forth.

So, all this classification was you know all this each of this classification was based upon certain criteria. Now problem with certain criteria is, it is not holistic. So, based on the chemical characteristics you cannot divide all the soil of the world. So, you need to develop some kind of holistic classification system which can you know take into account all the soil properties. So, that is why people soil scientist started to think started to think about what are what could be the most appropriate way to classify the soil.

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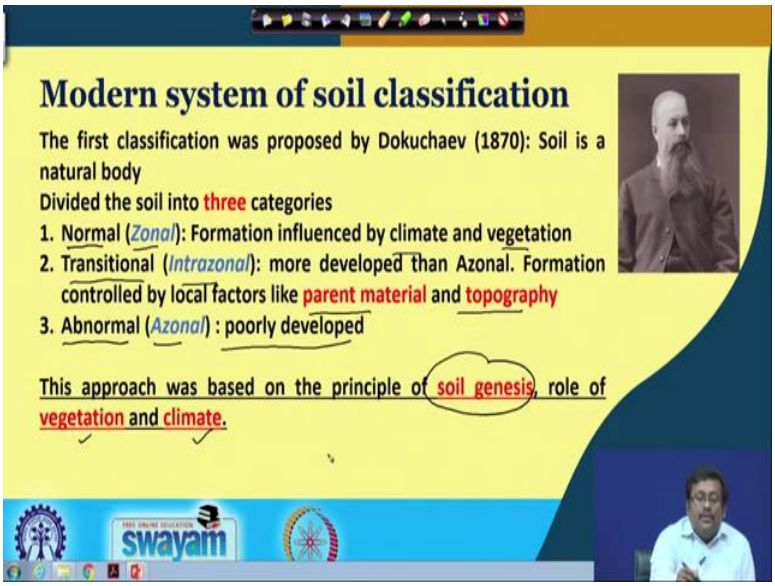

So, as far as the soil classification is concerned; the first classification modern in modern classification is given by a Russian scientist named Dokuchaev, year 1870 and he is considered as the father of soil pedology and he was the one who first considered soil as the natural body. Before that soil was considered as a weathered mantle of rocks. So, he is the first one who established the notion that soil can be considered as a natural body.

Now, as you know that soil is highly heterogeneous into the field and some soil contains some profile in some soils those profile may not be present in other soils. So, to compare the soils or to describe the soil, we need to have certain kind of you know certain kind of measurable entity. So, Dokuchaev first said that soil should be you know soil should be

considered as a natural body. So, he divided the soil into basic 3 categories; one is called normal, another is called transitional, another is called abnormal.

Now, normal soil sorry; so, the normal soil now we know this normal soil as Zonal soils. So, earlier he given the name normal soil. So, normal soil basically formed due to the influence of climate and vegetation. And transitional soils now they are known as Intrazonal soils, they are more developed than Azonal. So, before that we more discussed azonal soil. So, abnormal third category was abnormal soil. Now we now we termed this abnormal soil as azonal soils now, azonal soils are very poorly developed soils. So, you cannot see any well defined horizonation in those soils. So, this soil is called abnormal soil. So, transitional soils are more developed than azonal soils and formation of this as you know transitional soils are controlled by local factors like parent material and topography; as you know these are important factors of soil formation as we have already discussed Jenny's soil formation equation or formula.

So, Dokuchaev first divided these; so, you know Dokuchaev first divided soil into 3 categories and you see that the classification which is proposed by Dokuchaev was based on climate and vegetation. So, based on so, that is why it is called genetic system of soil classification and again this approach was based on principle of soil genesis. So, role on vegetation on climate was very much important and that is why this system is given by Dokuchaev was known as genetic system of soil classification.

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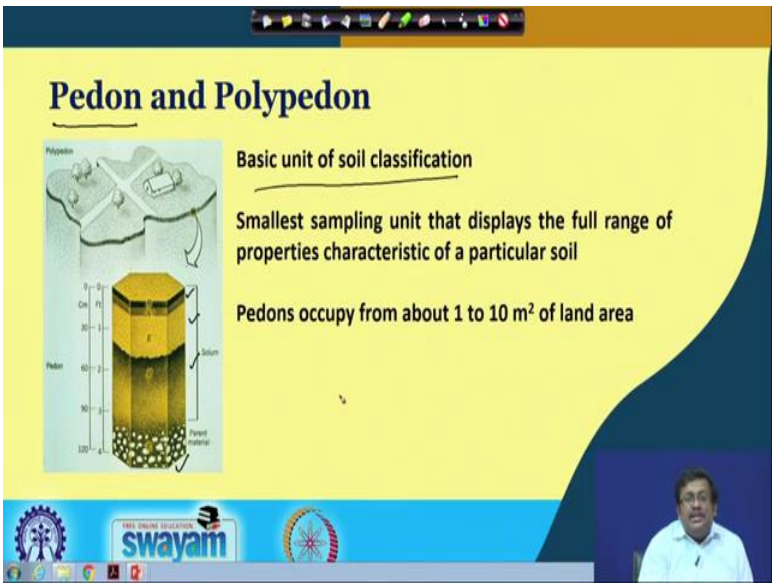

So, before we go to the next classification system, its needs to you know we need we need to discuss some of important terms. So, one of this term is called Pedon. Now as I was already told you that soil is a natural body and in the landscape one soil differs from other soil in a you know in a because soil is very much heterogeneous. So, we need some basic unit of soil classification or we need some smallest sampling unit based on that we can differentiate one soil at a particular point to other soil at a you know to another soil from other point. So, then this term pedon came.

So, pedon is basically basic unit of soil classification and it is a smallest sampling unit that displays the full range of properties of which are characteristics of a particular soil and; obviously, one pedon can be describe by this imaginary three dimensional you know three dimensional structure. And as you can see all this individual horizon are present here which you have already discussed in the last class. So, remember that pedon is a three-dimensional entity and it is the small sampling unit that displays the full range of properties, characteristic of a particular soil and generally a pedon occupies from you know generally varies from 1 to 10 square meter of land area.

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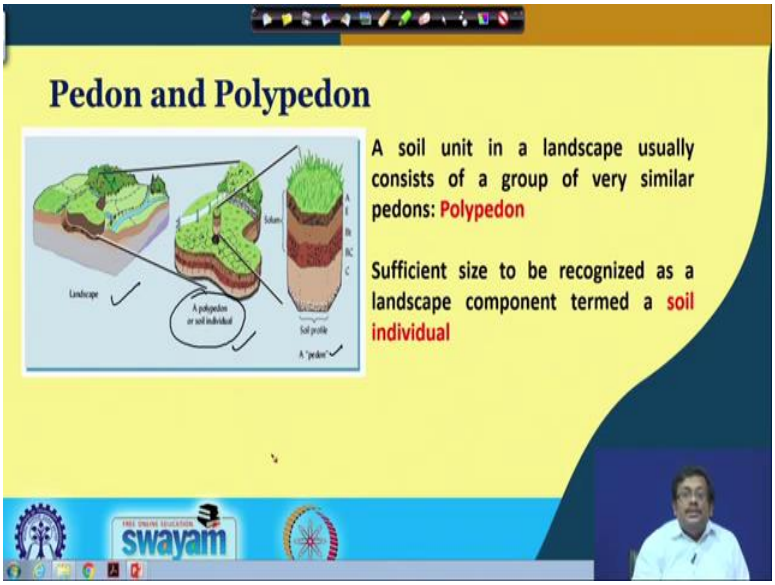

So, now let us discuss another important term called Polypedon. So, a soil unit in a polypedon is basically a soil unit in the landscape which is usually consists of a group of various similar pedons. So, pedon is singular term where as whether there are several pedons occurs you know in a very close proximity collectively we call them polypedon.

Now remember that polypedon is also known as soil individual. So, polypedon is sufficient size to be recognize as a landscape component. So, as you can see here a poly you know this is a landscape and from this landscape we can take out individual section which is basically a polypedon or soil individual which is basically a you know collection of individual pedons. And, from that we can we can magnify or we can segregate individual pedons; it is a three dimensional body. So, a polypedon or soil individual is a same kind of thing. However, a polypedon is basically the you know collection of similar pedons.

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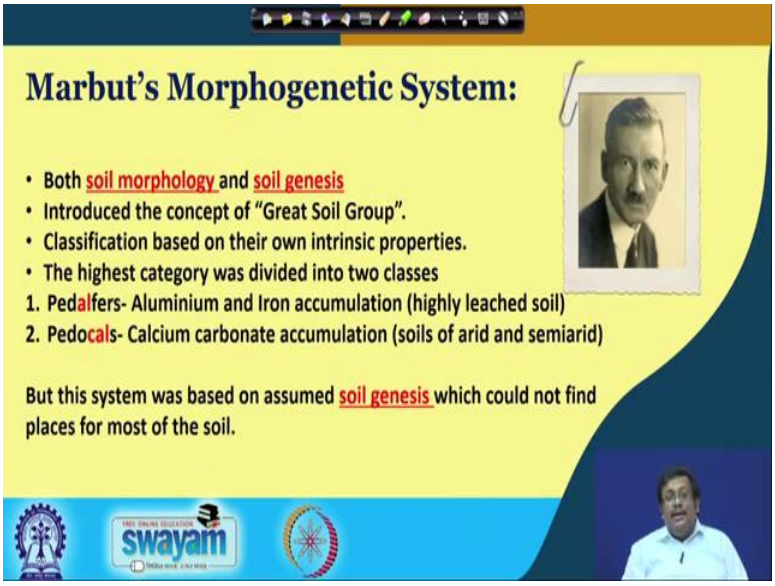

So, Dokuchaev gave the genetic system and classification which was the first classification system, but there were a couple of problem. First of all, it was in Russian language and people were skeptic about this type of genetic classification.

So, it was first this scientist called Marbut in United States; so USDA, United State Department of Agriculture who gave who adopted the you know the proposed system of Dokuchaev and he gave a system called Morphogenetic system. And this system is based on both soil morphology and soil genesis. So, that is why it is called morphogenetic system and he introduced first to who introduce the concept of great soil groups and he gave the classification based on their own intrinsic property as I told you it is a morphogenetic system. Now morphology is basically showing their own intrinsic property. So, these were considered as important aspects for classifying the soil.

And remember that the high highest category was divided into two classes he gave the name pedalfers and pedocals. Now pedalfers are basically aluminum and iron accumulation. Those soils which are highly leached soil due to high weathering and you will see aluminum and iron accumulation is there. So, he divided he gave the name pedalfers for those soils. Another class he gave which is called pedocals which is basically you know soils of arid and semi arid region and they show you know the calcium carbonate accumulation. So, this is called Marbut's Morphogenetic system, but this system was based on assumption of soil genesis which could not find place for most of the soil. So, that is that was the major drawback for Marbut's morphogenetic system.

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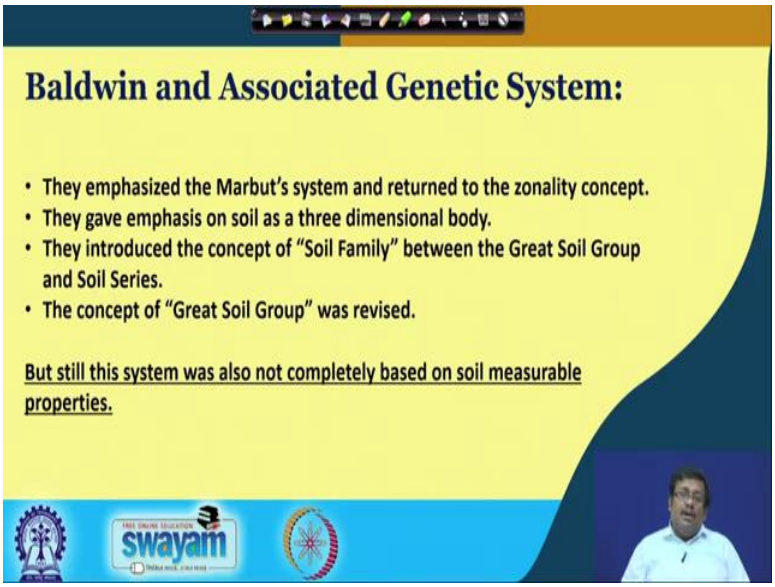

So, Marbut's morphogenetics system was later device by Baldwin, Kilogens, Horbs three scientists later. So, they also modified this genetic system and morphogenetic system. So, they emphasized the Marbut's system and returned back to the zonality concept. Now zonality concept you remember given by the by Dokuchaev in the genetic and soil classification. So, Baldwin and the associate move back to this zonality concept and they emphasized on soil as three dimensional body and they introduce the concept of soil family between great soil group and soil series. We will we will discuss this game later on and the concept of great soil group was further revised. So, this soil family soil series and we know great soil group, we will discuss this later on when we will discuss we will be discussing the soil classification and soil taxonomy.

Now, but still this system was also not completely based on soil major able property. So, all this system starting from Dockuchaev's genetic system, then Marbut's morphogenetic system and then Baldwin and associates' genetic system all these system they did not highly rely on measurable soil properties. So, that was the major drawback of all these systems.

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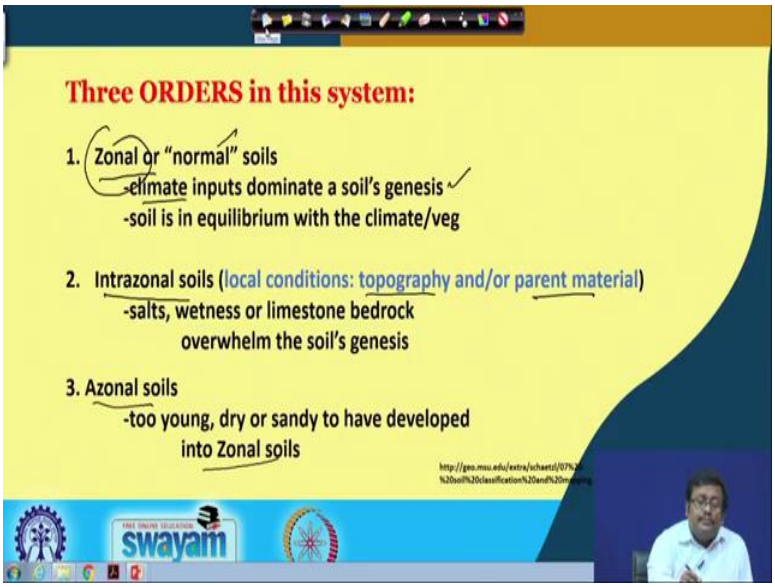

And so, the Baldwin and other associates, they are classified the soil into three categories. One is zonal or normal soil and normal soil it was the name given by Dockuchaev, then intrazonal soils and azonal soils. Now, zonal soils basically the soils were you can see the in the dominance of climate for soil genesis. So, it is an important and soil in the you know equilibrium with the climate and vegetation. So, these soils are called zonal soils or normal soils. Now, azonal soils are too young dry and sandy to have develop into zonal soils.

So, these are basically similar to the earlier abnormal soils given by Dockuchaev and finally, intrazonal soils which are you know we which intermediate between zonal soils and azonal soils. So, these soils shows the impact of local conditions like topography and parent material and you know. In these soils salts wetness and limestone bedrocks all these overwhelms the soil genesis. So, these are three major classes given by Baldwin and the associates.

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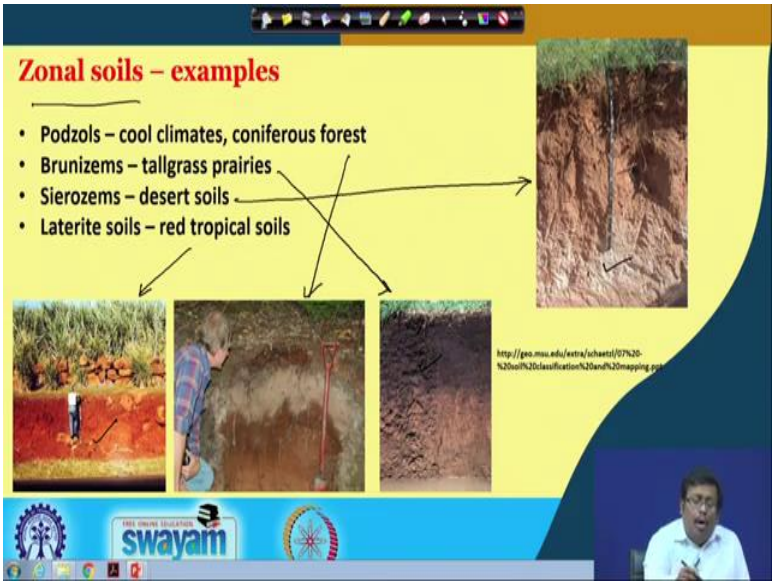

And let me show you a couple of examples of these soils. So, as you can see here these are some examples of zonal soils or normal soils. So, these are examples of Podzol which develops in the cool climate and in coniferous forest and this is Sierozem which is desert region soil or desert soils. This is lateritic soil which occurs in red and you know these are basically red tropical soils and this is called Brunizems which are Tallgrass prairie soils.

So, all these soils represent the zonal soils are normal soils which shows the which shows the influenced of climate for their soil genesis. For example, Podzols shows the importance of their cool climate and laterite shows the importance of warm and humid climate and these desert soils or Sierozems shows the impact of this hot and arid climate and these Brunizems they show the impacts of vegetation. So, all these are showing the impact of soil you know climate and vegetation.

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Now, let us see some examples of intrazonal soil. These are some intrazonal soil examples are Rendzinas which are shallow to limestone bedrocks. You can see these are two examples here and Gley soils are wet soils. Gleying is the property of wet soil and finally, peat soil which is an organic soil.

So, these intrazonal soils are dominated by the local categories you can see here the Rendzinas are dominated by limestone which is the local property and the Gley soils are dominated by wetness which is another local property and peat soil is dominated by high organic matter which is also a local property. So, these are the examples of intrazonal soils.

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Finally, let us see the azonal soils or abnormal soils. So, these are too young soils to be developed into a true zonal soils. For examples, as we can see dry sandy soil as we can see here and shallow to bedrock soils and alluvial soil. All these are young parent material as you can see. So, you all these soils you will not see this are shallow to bedrock soils and this is dry sandy soils.

So, these soils will not see a proper you know soil horizonation or in other words soil horizons are not easily visible. So, there is no properly developed master horizons so, that is why they are called young soils or poorly developed soils. So, these are examples of azonal soils.

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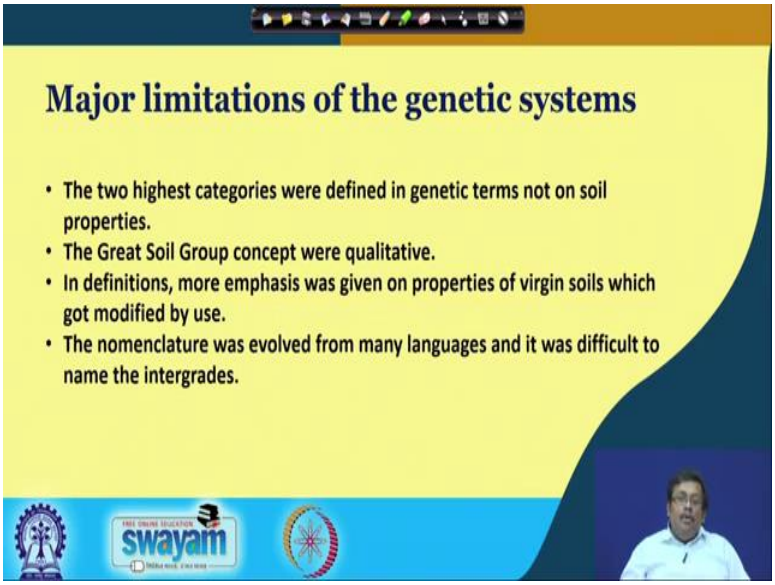

So, what are the major limitations of the genetic system? So, the major limitations were the two highest categories were defined in genetic terms not on soil properties. And the great soil concept was qualitative, again this not quantitative. In definition more emphasis was given to properties of virgin soil which got modified by the use and the nomenclature revolved for the many languages and it was very much difficult to name the intergrades.

So, these are some inherent problems or drawback of genetic and that is why there was a pressing need for development of a more scientific and more you know comprehensive system of soil classification.

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And this was given in the year 1975 by United State Development Department of Agriculture in collaboration with National Co-operative Soil Survey under the leadership of G.D. Smith and this is called soil taxonomy. And this is the most widely used soil classification system nowadays, which is followed in almost 50 countries. So, this soil taxonomy again given by United States Department of Agriculture and this called a comprehensive system of soil classification. Because it has got several properties; first of all it is system based on the measured or observed soil property.

Earlier the properties were qualitative in nature; however, now this soil taxonomy is based on measurable soil property. It is based on the surface and sub surface of the diagnostic horizons and it considers the moisture and temperature regime of the soil. It considers color, texture, structure; it consider you know it considers organic matters clay, iron, aluminum oxide, silicate, clays, salts, pH base saturation soil depth. So, it is a holistic system which considers all the important soil properties for distributing soil into some homogeneous groups.

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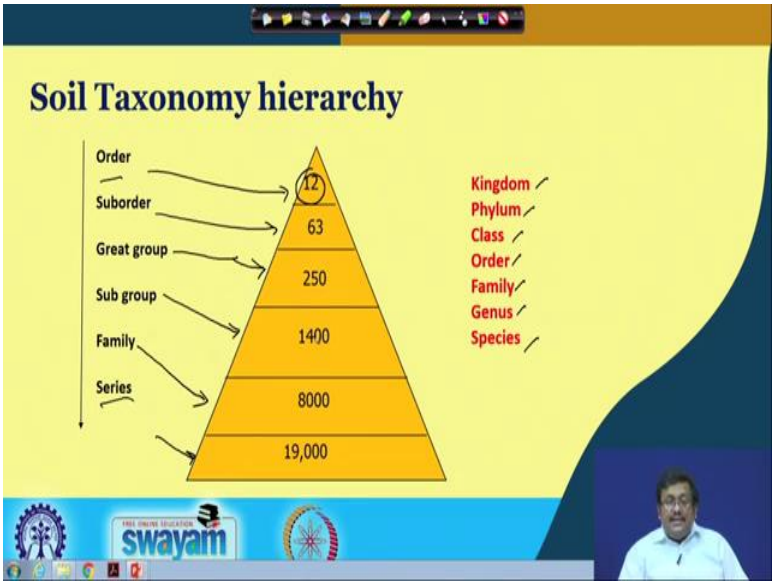

So, if you see a soil taxonomy it is a kind of it is a hierarchical system of soil classification and we will see there are 6 different levels; at the bottom we call it soil series. At the bottom we call it soil series followed by soil family, followed by sub group, followed by great group, then suborder and order. So, the lowest category is soil series and highest category is soil order and as you can see there are 12 soil orders which you can see in soil we will discuss them later on one by one.

So, similarly just like any organism can be you know classified based on their kingdom, phylum, class, order, family, genus and species. Any soil can be classified based on these classes, based on these levels. And, as you can see there are 19,000 series and 18,000 family, 1,400 subgroups, 250 great group suborder and 63 suborder and 12 orders.

So, any soil can be differentiated into or any soil can be grouped into using this hierarchical system of soil taxonomy. So, let us wrap up here and from in the next session we will be discussing different properties which this soil taxonomy considers for classifying the soils. What are the epipedons, what are the endopedons and what is the soil moisture regime, what is the soil temperature regimes and then what are different soil orders and what are their properties. So, we will be discussing them in the next section.

Thank you.