Forest Biometry
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Lecture – 11
Cross-section of a tree

In this week we shall be looking at how to measure the diameter of a tree. So, to begin with let us have a look at the cross section of the tree.

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So, as you can look at this slide here we are seeing a person who is marking a number of things on a stack of logs. Now these logs have all been painted with a material called giru which gives it a reddish color. And he is there in a timber depot and is marking what all these sections are all about.

So, it is very difficult to see from this picture what the cross section of a tree would be like, but because here everything is reddish in color, but let us have a look at how a cut tree looks like. So, this is a cut tree, which was cut in the forest and it has undergone stump dressing.

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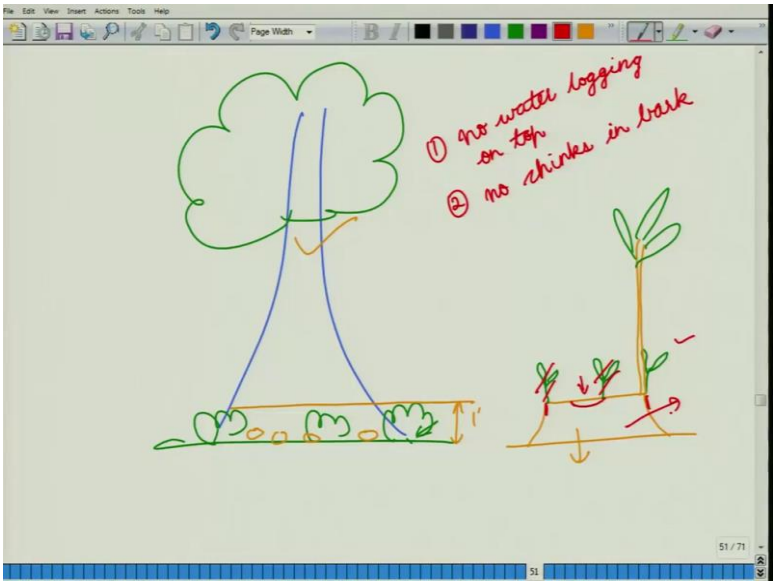

So, what do we mean by stump dressing? So, consider a tree. So, as we saw previously it is very difficult to cut a tree at the base, because we might be having some undergrowth here or we might be having some stones which might damage our instrument. So, we cut a tree at a certain height which is generally one feet.

So, once you have failed this log you get a stump, that looks like this. So, you have removed the top portion of the tree and you are left with a stump. Now there are a number of trees that are known as coppicing species. So, what do we mean by coppicing species. After this tree is cut it might undergo vegetative growth. So, it might result in us in the next rainy season, you might get some small stems rising we should give out leaves. And later on be a perform singling operations in which we remove all these leaving just one end, which would later on grow into a new tree. And would then slowly and steadily it would replace the original tree that was there.

Now to ensure that this portion does give out coppice, it is necessary to ascertain that we do not have any water logging on the top. Because if we had water logging here, then it might result in some fungal infestations and this whole stump might rot. At the same time we also need to ensure that there are no chinks in the bark. Now bark is as we shall see in a later slide it is the outer portion of a tree. So, if there are any chinks in the bark that might also result in some water logging or maybe some insect infestation, which might result in this stump not giving out any good coppice.

So now coming back to the slide. So, here we can see that the outermost portion of the tree is grayish in color. So, that is the bark, then right next to it is a yellowish colored section portion and after that we see a brownish colored section. So, no material has been applied to this stump it has only been dressed to ensure that there is no water logging and there are no chinks in the bark. But these are the original colors that you will observe on a teak stump. You can also see that in this image we can see a number of lines that are going through. So, let us now understand how this how do we depict these sections.

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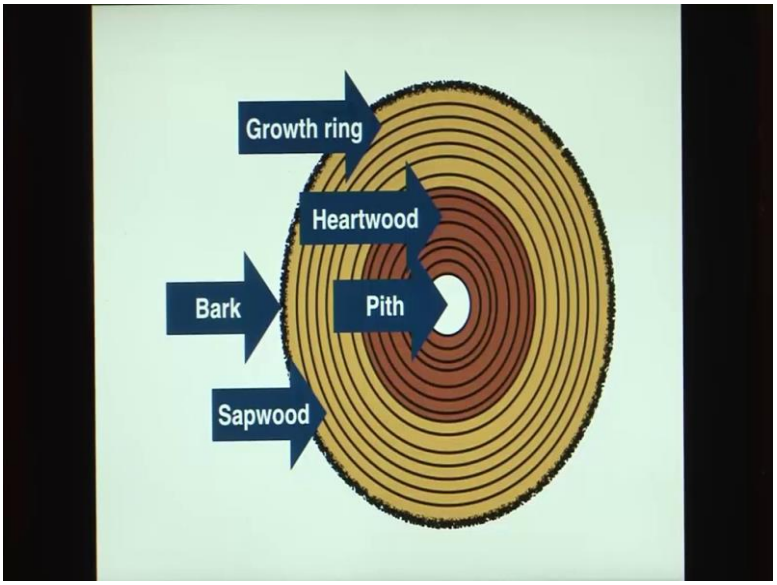

So, consider this as the stump as seen from the top, or consider this as the any cross section of a tree. Now what do we mean by a cross section?

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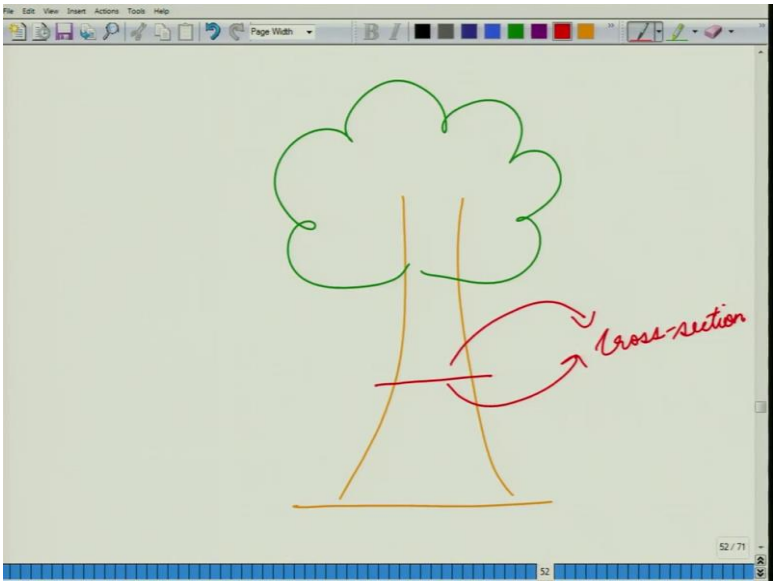

So, if you have a tree and if you made a section that is perpendicular to the tree and is parallel to the ground, and if you looked at this section from the top or maybe from the bottom. So, if you look at the upper log you are seeing it from the bottom and if you are looking at the stump that is left you are looking it from the top. So, what you will be seeing here is called the cross section. So, this slide as you can see. So, this is showing you the cross section of a bodhi tree.

Now if we wanted to see what are the portions in it. So, the outermost portion is called the bark. So, in our stump it is represented in this grayish color. So, it is the outermost section.

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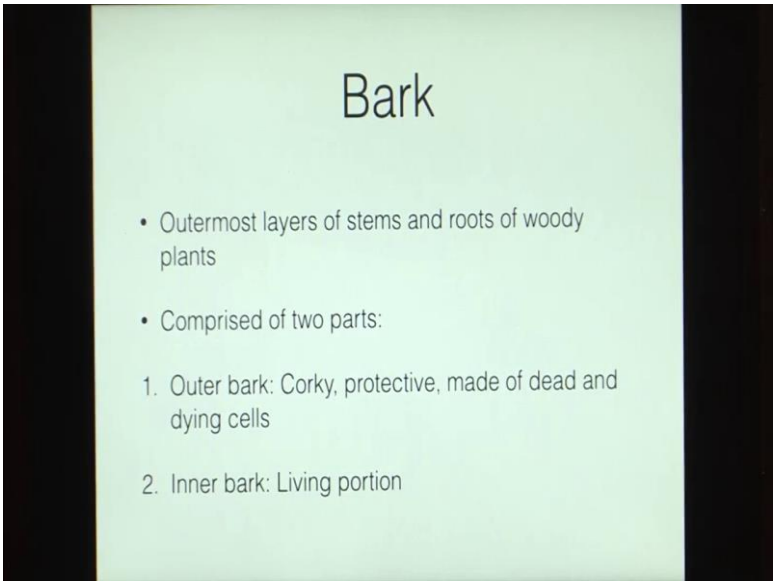

So, what is the bark consists of the outermost layers of stems and roots of woody plants. So, you only find it in woody plants certain all the plants. It is comprised of 2 parts, the outer bark that is the outermost portion of the bark is corki. So, it is used to make corks it has the same appearance it is protective. So, it protects your trees from infestations from birds from predators and so on. It is made out of dead and dying cells.

So, it is very similar to our hair or our nails it is made out of dead tissue and it is protective in nature. The second portion is called the inner bark. Inner bark is made out of living tissue. Right next to the bark as we can see in the slide is the sapwood. So, sapwood here is shown in yellowish brown colors, and if we looked at our stump as well it is the yellow colored portion of the stump.

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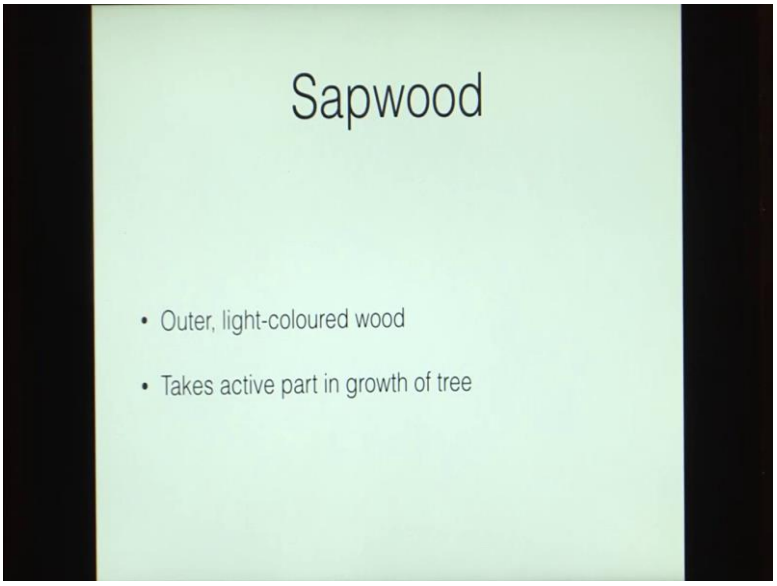

The so, the sapwood is the outer lighter colored wood it takes active part in the growth of the tree.

And what we have inside is called the heartwood. So, heartwood here is shown in brownish color as we see it on the stump as well.

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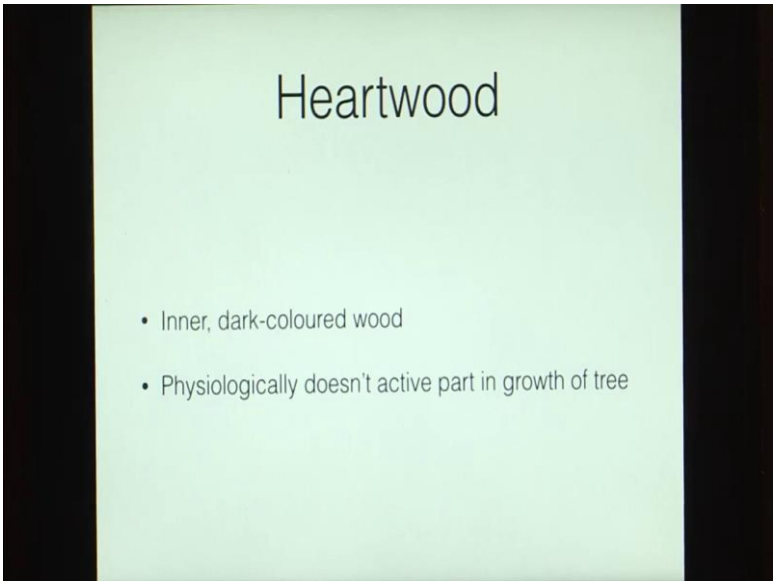

So, heartwood is the inner dark colored wood, and it physiologically does not actively take part in the growth of the tree.

So, it is physiologically not active in the growth of the tree. The next section would be the pith. So, pith is the soft or the innermost core that is found at the center of a log. It isn't you may be able to see it on a number of stems, but it is not usually seen in all the stems. It shape might be oval, it might be a round, it might be triangular or it might be square in shape. So, it is shape might vary.

Next we have the growth rings. So, growth rings are also known as the annual rings. So, here we are showing it as concentric circles. And in the case of our stump also we see it as concentric figures going all done. So, growth rings are also known as annual rings they are not found in all the species and they are formed because of changing growth speeds throughout the seasons. So, for instance in the rainy season you will be finding more growth. In the winter months the growth might be slow. It is the growth rings form are very important in branch of science known as dendrochronology.

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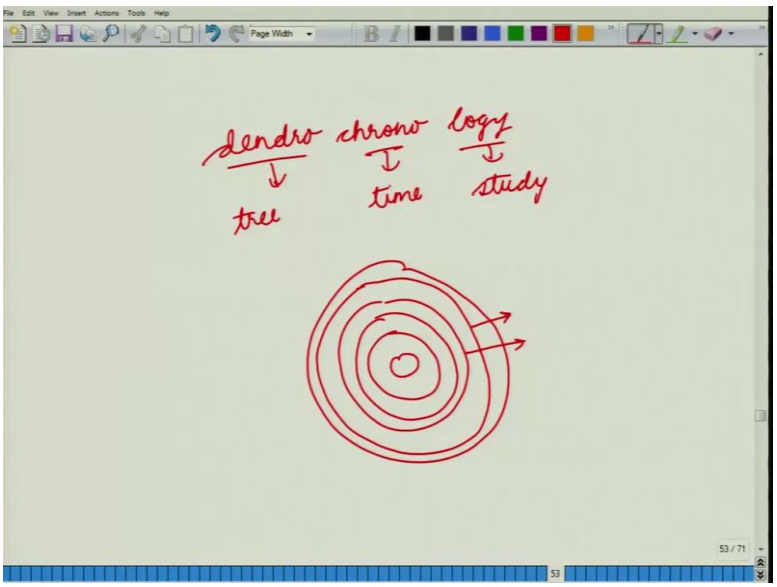

So, dendro means trees. So, looking at the word roots, it is dendro chrono logy. Dendro means tree, chrono means time and logy means study. So, we are trying to measure time using trees and we are trying to study those.

Now because the anual rings they have an anual character. So, if you have a section which has say 5 rings. So, this ring was formed in one year this ring was formed in another year. So, by just counting the number of rings that are there in the stump or in a log you can figure out for how many years this logger stump was living. So,

dendrochronology is the scientific study of dating feedings. So now, looking at the complete picture you will find you have bark as the outermost region followed by sapwood followed by heartwood followed by pith. And through the sapwood and the heartwood you will be having a number of growth rings. Next let us have a look at this stack of logs.

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So, this is how you stack logs in a forest after you have harvested the trees. So, this stacking is done as follows.

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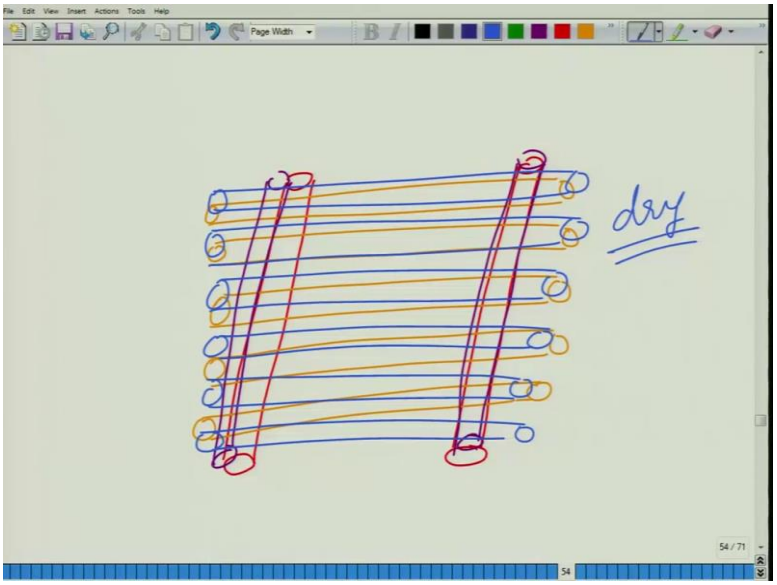

So, you take one log. So, you take 2 logs you keep those at the bottom. So, they act as stands. So, in the next layer you will be arranging your logs like this. So now, you have put a layer of logs on top of these 2 logs. Then you take another 2 logs when you keep those like this, parallel to your original logs and then you repeat the process. So, you take another line of logs you keep it like this. So, the whole stack would be a whole plane of logs that I kept like this. And this process is repeated again and again.

Now why do we make such an arrangement, because if we looked at the picture on the slide. So, if you look at the bottom most layers. So, it consists of only 2 logs. So, there are only 2 logs that are having a contact with the ground. So, suppose your ground were wet suppose it had termites, they would only be able to infest the bottom 2 logs and not all the logs that are there in your stack. Then you have a layer of logs kept on top of it followed by again 2 spacer logs. Now these spacer logs are important because they help in the seasoning of the wood, because tree is a living entity. So, when you cut a tree it has a lot of moisture inside if you kept all those logs together in the form of one big huge lump. So, in that case the trees at the center would not be able to lose out their moisture. So, any moisture that remains there would be would make your stack of logs a very good food for insects or me before fungi. So, we want to dry these logs.

So, if you want to dry your logs you want to keep them a space by spacer logs.

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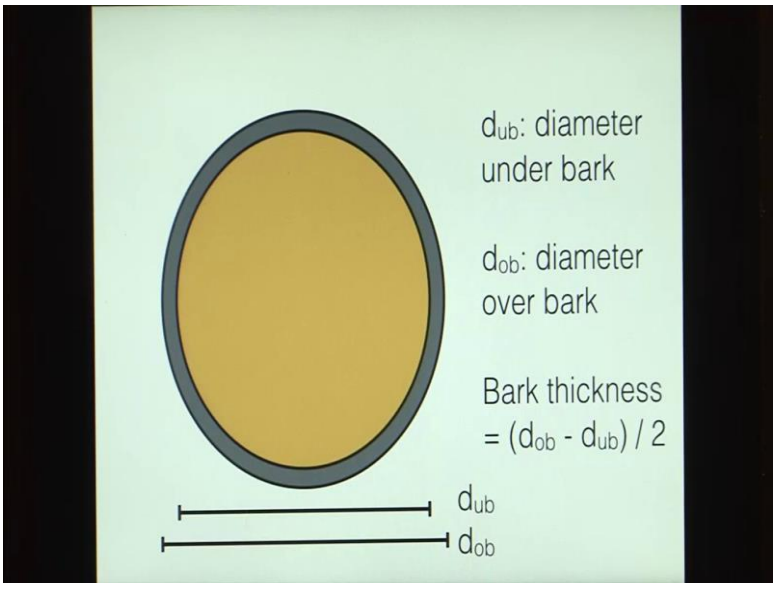

So, as we saw in the original figure you have a tree.

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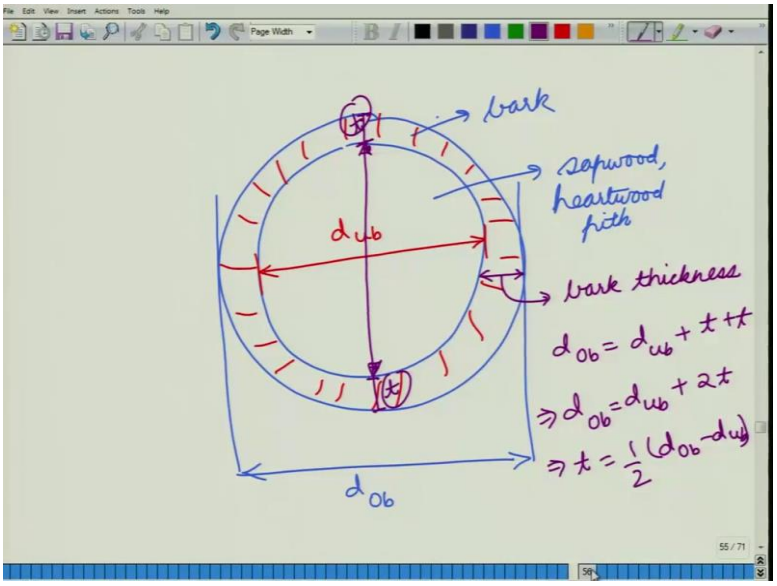

So, if this is a log you have the outer park and the inner sapwood, heartwood and the pith. Now bark being the dead layer it very easily gets separated from your logs and the sapwood heartwood and pith are the structural portions that we use commercially. So, if you wanted to measure the diameter of your logs you could be measuring 2 diameters. One is your diameter over bark. So, diameter over bark is this complete diameters from one end to the other. You could also be measuring the diameter under bark.

So, in this case you could remove all the bark. So, you could remove all these bark portions and whatever remains that consists of the sapwood heartwood and pith if you measure that diameter it will give you the under bark diameter. From these 2 we can also figure out the thickness of the bark. So, this is the bark thickness. Now if we looked at any section it would be having your bark thickness let us call it t. So, you have t at both the ends and then you have the under bark diameter from here to here. Will you tell you and this total becomes the over bark diameter. So, d over bark is equal to d under bark plus a thickness here, plus a thickness here.

So, you have diameter over bark is equal to diameter under bark plus twice the thickness of bark. So, the bark thickness t is given by half of diameter over bark minus diameter under bark.

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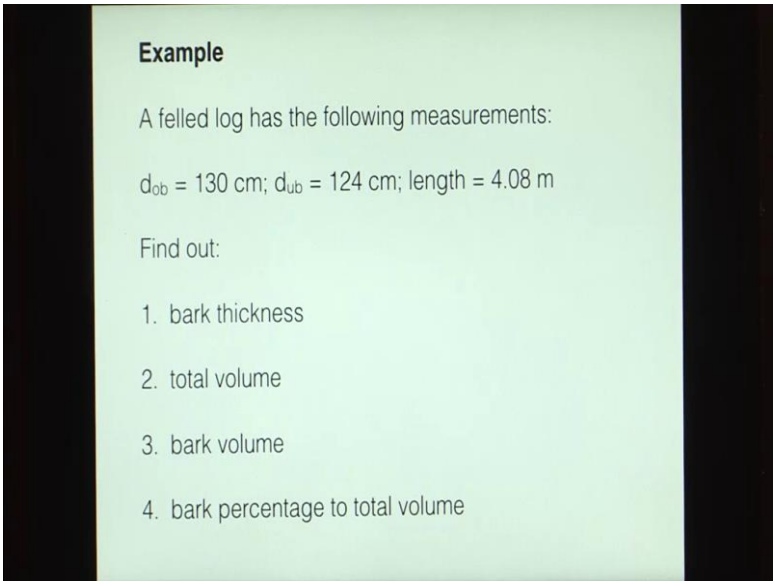

So, let us look at a few calculations. As you can see on your slide there is an example is given a felled log has the following measurements. The diameter over bark is given diameter under bark is given, the length of the log is given we need to find out the bark thickness the total volume the bark volume and the bark percentage to total volume. Now why is it important to know the bark volume, because in the case of a few tree says cinchona tree the bark has it is own medicinal values. So, the bark contains a chemical known as quvnine that is an anti malarial drug.

So, if you wanted to manage a forest stand to get quvnine you would want to know how much amount of bark volume is there per tree or say in the whole stand. So, which is why we need to know the bark volume. We also need to know the bark percentage to total volume, because say if you wanted to felled your trees you might be losing some volume as part of the bark.

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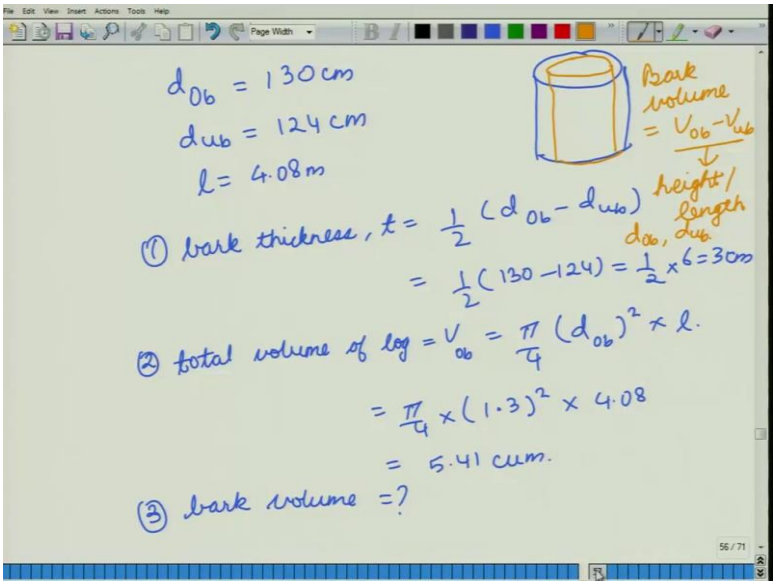

So, you want to figure out how much is the bark percentage to the to the total volume of your log. So, coming back to the example you have diameter over bark is 130 centimeters. Diameter under bark is equal to 124 centimeters. Length is 4.08 meters.

So, the first thing is bark thickness. So, bark thickness t is given by half of diameter over bark minus diameter under bark. So, you will have half of 130 minus 124 is half of 6 is 3 centimeters. So, we know that the bark thickness is 3 centimeters. Now the total volume of the log is the over bark volume is pi by 4 d ob square into the length. So, in this case it is pi by 4 into diameter over bark is 1.3 meters into the length that is 4.08 meters.

So, this becomes 5.41 cubic meters. Now if you wanted to calculate the bark volume if see this is your total volume, and this is your under bark volume, you can calculate the bark volume is equal to the volume over bark minus the volume under bark. So, in both these cases we would be using the same height of the log or the length of the log, but we would be using diameter over bark. In the case of vob and diameter under bark in the case of vub. So, let us now calculate the volume under bark it is pi by 4 d under bark square into the length.

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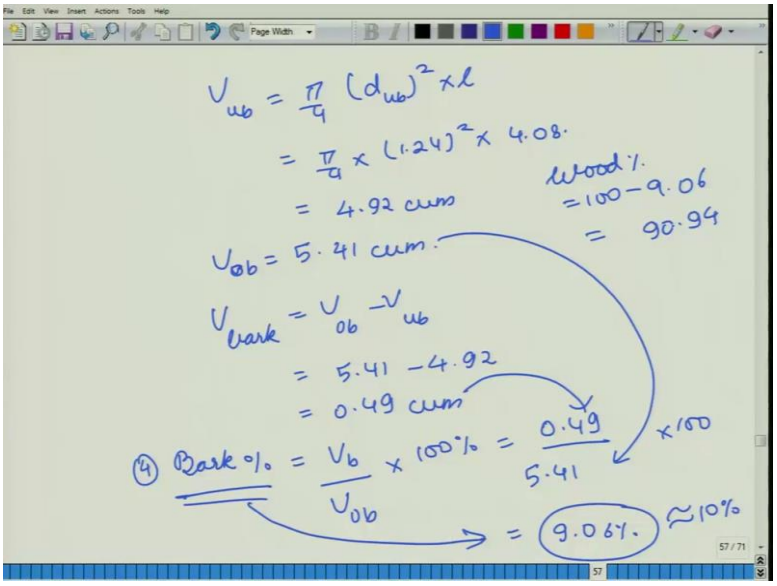

So, it is pi by 4 into 1.24 meters square into 4.08 meters. So, this comes to 4.92 cubic meter. Section b found out the volume over bark is 5.41, 5.41 cubic meter. So, the volume of bark is a volume over bark minus the volume under bark is 5.41 minus 4.92 is 0.49 cubic meter. Now the next thing that we want to calculate is the bark percentage. So, the bath percentage is the volume of the bark divided by the volume of the whole log which is the over bark volume into one 100 percent. So, it comes to 0.49 from here divided by volume under bark that is 5.41 in to 100.

. So, it comes to 9.06 percent. So, what we can say from this value is that nearly 10 percent of the volume of your free is comprised of the bark. Suppose we were using the volume table.

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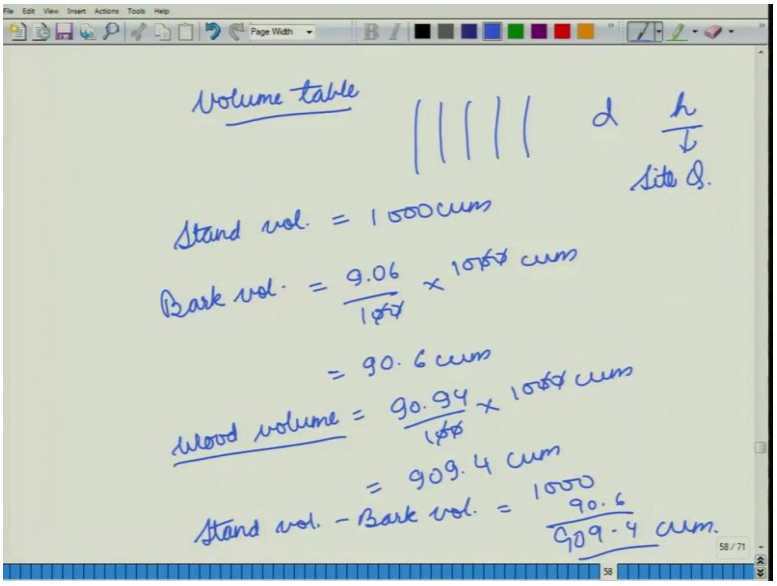

Now, a volume table gives you the volume of a stand in terms of it is the number of trees that is the standard density the diameter and the height or the side the height is also calculated from the sight quality. So, if we knew that a stand volume was suppose 1000 cubic meter. From this example we calculated that the bark percent was 9.06 percent. So, how much would be the bark value? It would be 9.06 percent of 1000 cubic meters is 90.6 cubic meters. And what would be the wood volume? So, if you have a 9.06 percent as the bath percent we would be having wood percent is 100 minus 9.06 is equal to 90.94 percent.

So, in this case we would be having 90.94 percent into 1000 cubic meters is 909.4 cubic meters. We could also calculate the wood volume by taking the total stand volume minus bark volume, 1000 minus 90.6 is 909.4 cubic meters. So, today we learnt about the sections of a wood. How does your log look from inside, what is the bark how do we calculate the bark volume what is the importance of the bark how we calculate a bark volume as a percentage of the total stand volume and so on.

Thank you for your attention.