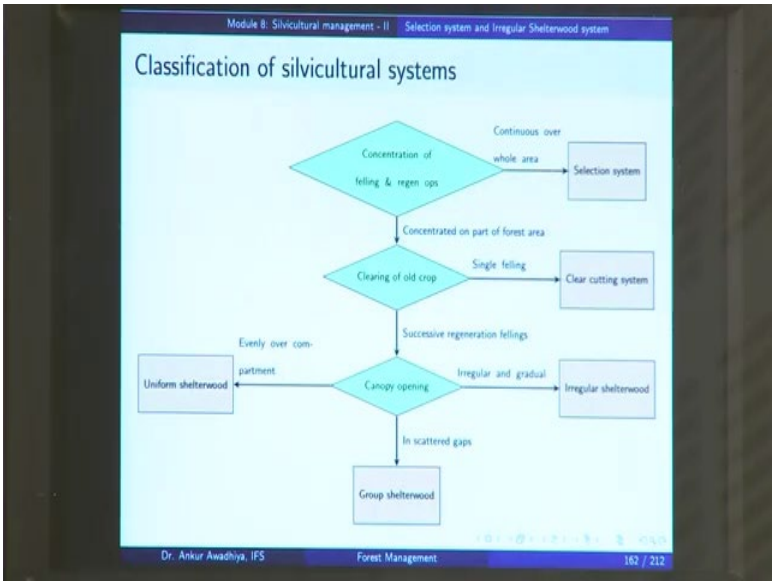
Forests and Their Management
Dr. Ankur Awadhiya
Department of Biotechnology
Indian Institute of Technology, Kanpur

Module – 08
Silvicultural Management - II
Lecture - 24
Selection System and Irregular Shelterwood System

[FL]. We move forward our discussion of the Silvicultural systems and today we will have a look at two different systems the Selection System and the Irregular Shelterwood System.

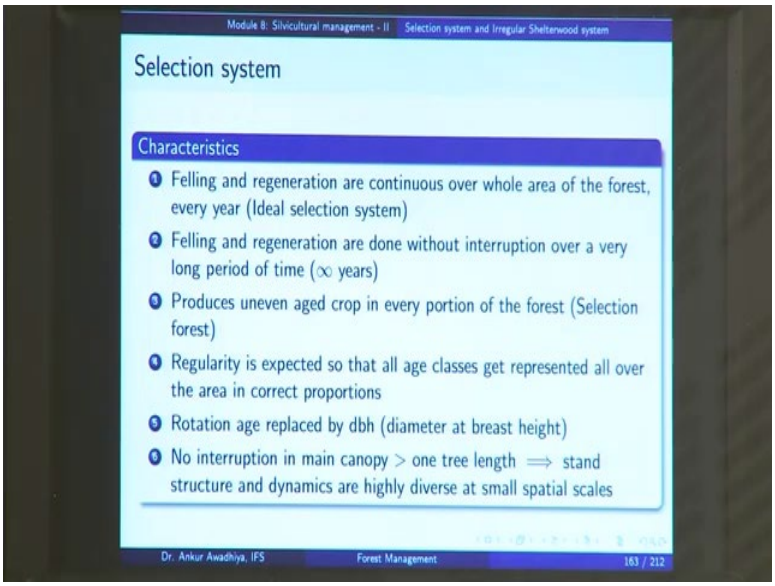
(Refer Slide Time: 00:29)



Now, as before we move on with our flowchart, and here you have the selection system. So, the first question that this flowchart asks is how is the concentration of felling and regeneration operations, and if felling and regeneration operations are continuous over the whole area, then you have the selection system.

So, this is the primary characteristic of a selection system that you are felling and regeneration operations are continuous over the whole area you are visiting all areas of the forest at all times.

(Refer Slide Time: 01:04)



So, the characteristics of the selection system are these, one: felling and regeneration are continuous over the whole area of the forest every year, which is an ideal selection system. So, you go to every area every year select for your trees to fell and regenerate.

Felling and regeneration are done without interruption over a very long period of time. So, there is no interruption; you are doing it every year, and you are doing it for an infinite period of time in a selection system.

It produces uneven aged crop in every portion of the forest, which is known as a selection forest. Now we had seen that in the case of the other silvicultural systems we were producing an even aged forest which means that in every stand the ages of the trees differ by less than 20 percent of the rotation age. But in the case of a selection system we are producing an uneven aged forest which means that most of the trees are having very different ages and the age difference between the trees is greater than 20 percent of the rotation age that you have selected. So, it produces an uneven aged crop in every portion of the forest.

So, we are not talking about the whole forest that, if the whole forest we are having trees with so much of a different ages, because that is possible even in the case of a clear felling system. But what we are emphasizing here is that in every portion of the forest you have an uneven aged stand. So, this is a selection forest.

Next, regularity is expected. So, that all age classes get represented all over the area in correct proportions. So, we have to be very regular if you do not work your forest for a few years then probably the characteristic of your selection system will be lost. So, this is one forest where you have to be very regular in your operations. So, that all the age classes get represented.

So, this is another characteristic of your selection forest you have all different age classes. It does not that you only have very young trees or very old trees or only matured trees, but in this case, you have all the age classes that are represented all over the area, and that too in correct proportions, which means that you are - you are creating a regular forest. So, all different age classes are represented in correct proportions.

Now the rotation age in this case is replaced by dbh or the diameter at the breast height. So, in the other silvicultural systems, we were talking about a rotation age. Now, rotation age as you remember is the age at which your trees are considered mature for felling.

So, you said that in the case of a teak plantation and your teak trees have arise in age of 90 years you are going to cut them. But then in the case of a selection forest, because you have trees of all different age classes and you are not able to very easily identify the age of different trees. So, in this case, your rotation age is replaced by diameter at breast height.

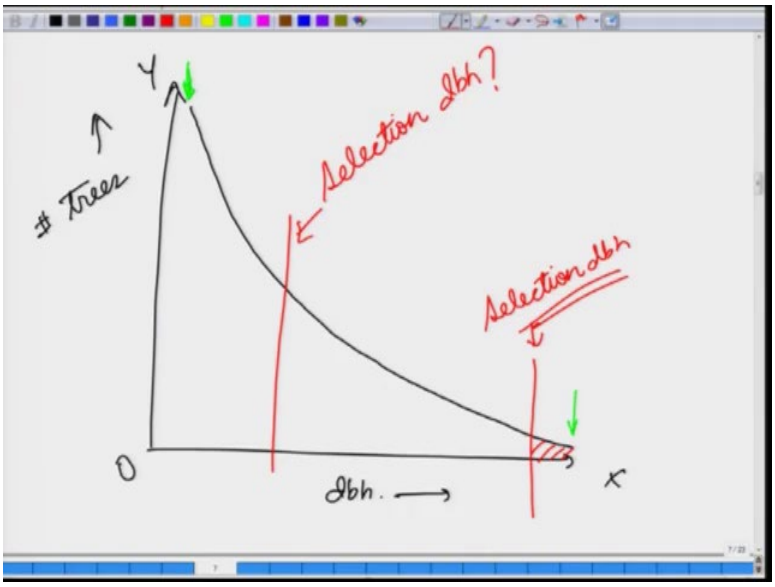
So, you have a cut off diameter at breast height, and you say that, if you have any tree that has a diameter that is greater than your selection dbh, then you are going to fell that tree. So, you do not have a rotation age you only have a selection dbh.

Next, no interruption in the main canopy because you are working all over the forest at all times, and you are removing only those trees that are above your selection girth or selection dbh.

So, there is no interruption in the main canopy that is greater than one tree length, which means that your canopy is continuously maintained all over the forest. There will be very small gaps that you create but other than that you have a nearly continuous canopy for all times in perpetuity in the case of a selection forest. So, this looks very similar to our natural forest at all times you have a canopy cover.

So, there is no interruption in the main canopy which is greater than one tree length, which means that the stand structure and dynamics are highly diverse at small spatial scales. So, even if you look at a very small area of a selection forest, you will find that the stand structure and dynamics are very diverse.

(Refer Slide Time: 06:02)



So, what we are saying is tha,t in the case of a selection forest, if you represent the number of trees on the y axis and the dbh on the x axis; so, in a classic selection forest or an ideal selection forest, you will have a curve like this. So, in the case of these young plants which have a low dbh, you will have a large number of trees which is showing you the regeneration. In the case of these trees, you are having a very large dbh which means that these trees are very old trees; very matured trees; they have grown to a very large extent and these are present in very few numbers.

And, what do you do in this ideal selection forest is that, you select a dbh; so, this is your selection dbh, and you remove the trees that are on the right side of the selection dbh. Now, here again, you do not remove all the trees that are above your selection dbh. So, we look at that in a later lecture. But what you do here is that, you remove some trees that are above your selection dbh, at all times.

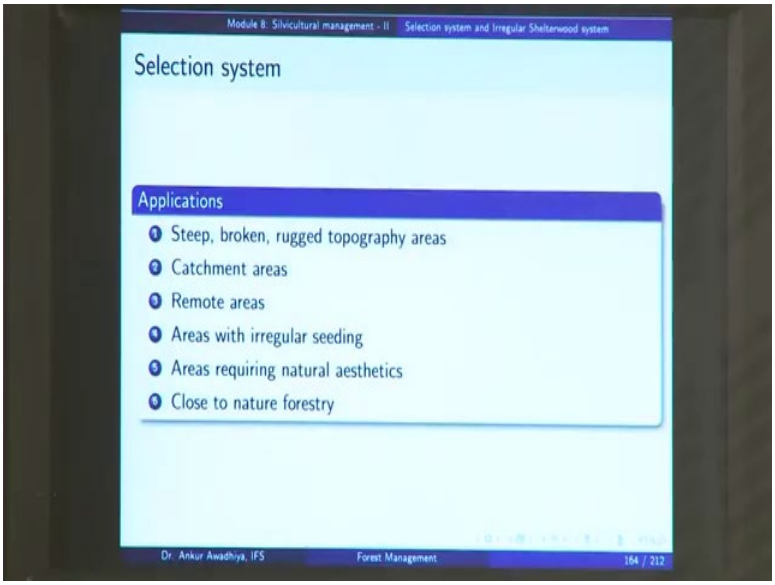
So, every year you will go to every part of the forest; you will measure the diameter of different trees, and for those trees that are above your selection dbh, they will be; they will be enumerated, and a few of those trees will be marked, and they will be felled. And,

why are you doing this felling? so that, these very old trees are removed from the system and the growing space that was a very old trees is now made available to the young crop.

So, essentially you are making that that physical space - the piece of land available to the young crop; you are making the light the sunlight available to the young crop; you are making water and nutrients available to the young crop. So, that is your purpose to do a selection forestry or to follow the selection system in forestry. So, these are their characteristics.

There is no interruption in the main canopy that is greater than one tree length and the stand structure and dynamics are highly diverse at the small spatial scales. So, what are the areas in which you will prefer to go for a selection forest?

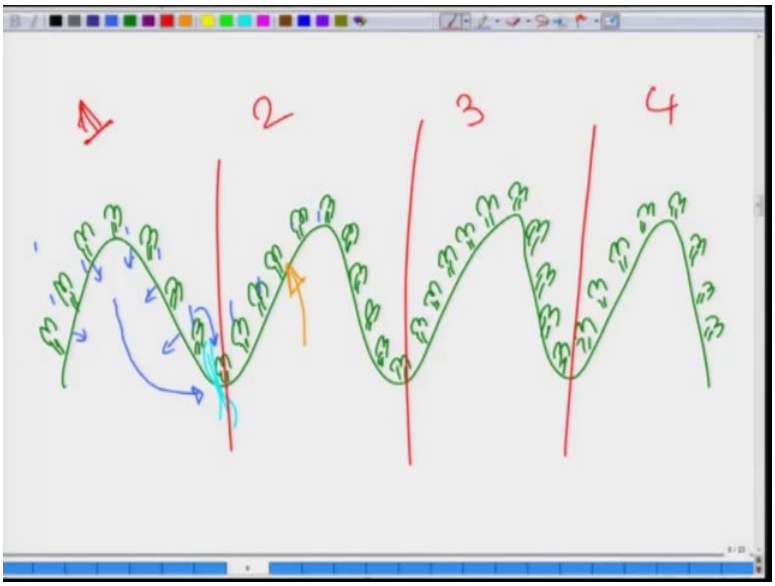
(Refer Slide Time: 08:27)



So, a selection forest is typically used in these areas. It is used in steep, broken and rugged topography areas. So, you have an area that is very steep, very broken or very rugged what it means is that you are having a number of hills in that area.

So, you have a rugged topography.

(Refer Slide Time: 08:51)



Now, if you consider an area with a large number of hills; so, there are two in two or three main characteristics. One is that when you have this tree cover on this land. So, these trees are also protecting the slopes, which means that if you remove these trees, then probably there will be a huge amount of soil erosion.

So, you go for a selection forest because, in the case of a selection forest, you are only removing certain trees from the forest and you are letting the other trees that remain here. So, they will stabilize the slopes also at the same time. In these forest, in a number of cases, you find that rivers originate in the hills, because these hills form a very important part of the water catchment areas.

So, if you remove these trees from this place, in say a clear felling system, what will happen is that, not only will you have soil erosion, but then this soil will also reach into the rivers. So, there will be a heavy silting there will be a very heavy deposition in the dams that come downstream.

So, you want to maintain your forests or manage your forests in a way that at all times you are having this canopy cover; at all times, you are having a binding of the soil; at the same time, trees also play a very important role in the groundwater recharge.

So, for instance, suppose you have a stream that is moving like this. Now, this is stream is not only getting water during the rainy season; this stream is wet or moist throughout

the year. And, why is that so? Because when you have a rainfall in and when you have the rainfall, this rain water is getting into the streams.

But because that the canopy of the trees is reducing the speed of the rains, you have a stream flow, and then you also have the roots and the undergrowth that is reducing the speed of water rate at all times.

So, what happens in that case is that, water is able to seep inside, and this water later on is made available to the stream. So, because you are having this forest in a rugged area; in a hilly area; so, this is also playing a very important role in the management of your water regime.

So, you want to maintain your forests so that your rivers are getting water throughout the year. Otherwise during the rainy season, there will be flood and in other times, they will be a drought. So, you want to maintain there the tree cover at all times, and which is why you go for a selection system.

Another issue with these sorts of forests is that it is very difficult to bring large size machines on top of these hills. So, if you wanted to go for say a clear felling system, you will probably want to take heavy machines cut all the trees put them into a truck, and take them away.

But in the case of the these hilly areas, it is difficult to take the machines. And so, it makes much more sense to go for a selection system, in place of a clear felling system. Because in the case of a selection system, you are only selecting a few trees at a time. And so, heavy machinery is neither required nor is it essential to bring these heavy machines in the case of selection forestry.

So, when big application is in those areas that have steep broken and rugged topography, areas that are catchment areas, areas that are remote areas. Because if there is a place that is in a remote location, then it is difficult to bring your machines for a large scale harvesting, as in the case of a clear felling system, and so in remote areas, you typically go for a selection system.

Then, selection system is also used in areas with irregular seeding, because in the case of other systems, you need to ensure the regeneration. Now, if you have a forest that is not

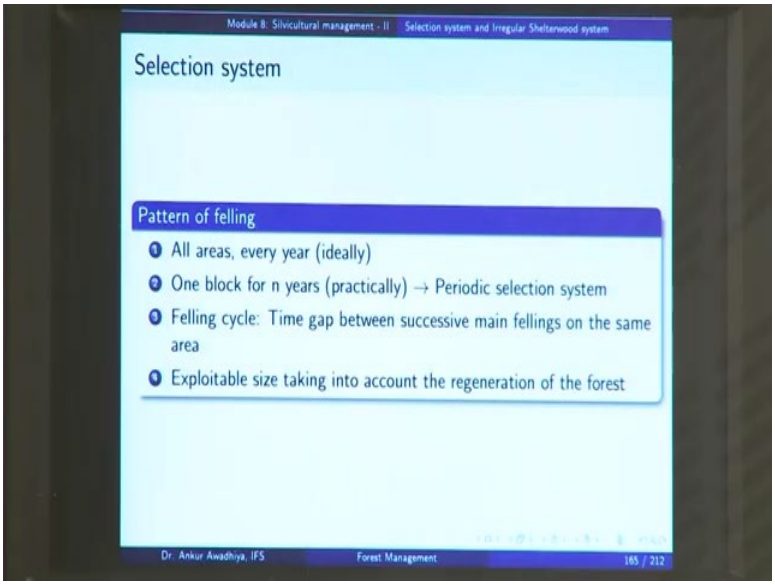
giving out seeds regularly; so, there is a big chance that if you harvest the logs your forests will not regenerate. And, if you have this doubt that whether you forest is going to regenerate or not, it is always better to go for a selection system, because in the case of a selection system probably 90 percent or more of the trees are always remaining in that forest. And so, there is a much better chance that whenever there is a seeding there will be a regeneration of the forest, you are never removing you are never denuding the forest cover.

Then, it is also used in areas that require natural aesthetics. For example, wildlife areas. Areas that have wildlife but you are managing them for timber. So, you want to maintain a canopy cover; you want to maintain the habitats, and the cover for the wildlife.

Now, in the case of a selection forest, you are only removing the very old trees; the very matured trees with larger dbh. And, even in a natural system, those trees would die off. So, what you are doing, in the case of a selection forest, is that you are maintaining the forest in a very natural state. So, it becomes very much useful for wildlife as well because their habitat is preserved.

Then, it is also used when you want to go for a close to nature forestry. So, you want to maintain a forest for aesthetically reasons in a natural state. So, because selection forest is the closest that you can have to a natural forest you go with a selection system.

(Refer Slide Time: 14:47)



So, how is the pattern of felling in a selection system? Ideally, in all areas, every year you should go and you should do the felling. So, every year you are visiting the whole of the forest and you are selecting those trees that are above your selection dbh, or above your selection girth. You are enumerating them, marking a few of them and removing them so that is the ideal case situation.

But then, as we just saw, we normally use selection forestry in those areas that have a rugged topography that have; that have hills that are remote areas. So, practically it is not possible to reach each and every side every year.

So, there is a practical modification that in place of visiting all the areas every year, you divide your forest into blocks, and you harvest one block for 'n' years, and you go to the next block.

So, what we are saying here is that, if you consider this forest; so, suppose you have divided this forest into 4 blocks; so, this is your block 1, block 2, block 3, block 4. Now, in the case of an ideal selection forest, you would say that we are going to visit each and every tree every year. But then, practically because it is difficult you might say that I am going to visit the 1st block in the 1st year, and in the 1st year I am only going to visit the 1st block, and at the end of this year I am not going to visit this block again. Now, I will move to the 2nd block for the 2nd year. Then in the 3rd year, I will go to the third block. In the 4th year, I will go to the 4th block, and then I will come back to the 1st block once again.

Now, this sort of a system makes for a periodic selection system, because for every period you are working on only one block. Now, this period is not necessarily 1 year, you can even say that for that to work your first block, you might require say 3 years.

So, you will say that I will visit the 1st block in years 1, 2 and 3. Then, in the years 4, 5 and 6, I will only visit block 2. In the year 7, 8 and 9, I will visit block 3; in years 10, 11 and 12, I will visit block 4. And then, in the years 13-14-15, I will again come back to the 1st block. So, this is a periodic selection system which is a modification of the idle selection system.

And in the case of the periodic selection system, we define a felling cycle. So, felling cycle is the time gap between successive main fellings on the same area. So, if you visit

an area this year, when is the next time that you are going to visit this area - that will be known as the felling cycle?

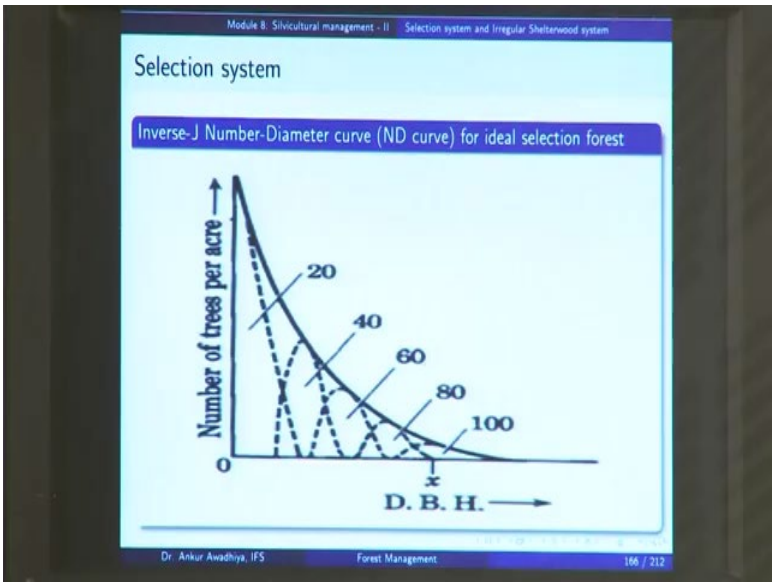
So, we also define the exploitable size taking into account the regeneration of the forest. So, we said here that this is our selection dbh. But, your exploitable size should also consider the regeneration capacity of the forest. So, suppose in place of taking this dbh you took say this dbh.

So, you took this as the selection dbh. What will happen then? In this case, you are not allowing enough number of matured trees; enough number of years to produce the seeds to regenerate the next generation. So, in this case, your forests will typically die off at a short period of time.

So, your selection dbh is not only determined by considering the size of the trees; the and the exploitable size and the economic considerations, but you also have to consider whether your forest will be able to regenerate adequately, if you are taking that selection dbh.

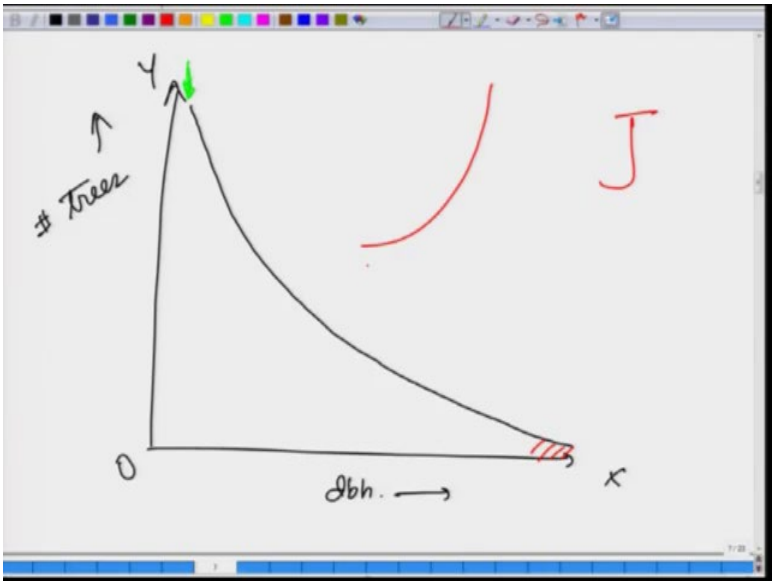
So, the exploitable size or the selection dbh is taken is determined taking into account the regeneration of the forest. So, if you have a less amount of regeneration, probably you will go for a higher dbh. If you have enough amount of regeneration, then probably you can reduce your dbh, and probably take out more trees from this forest.

(Refer Slide Time: 19:31)

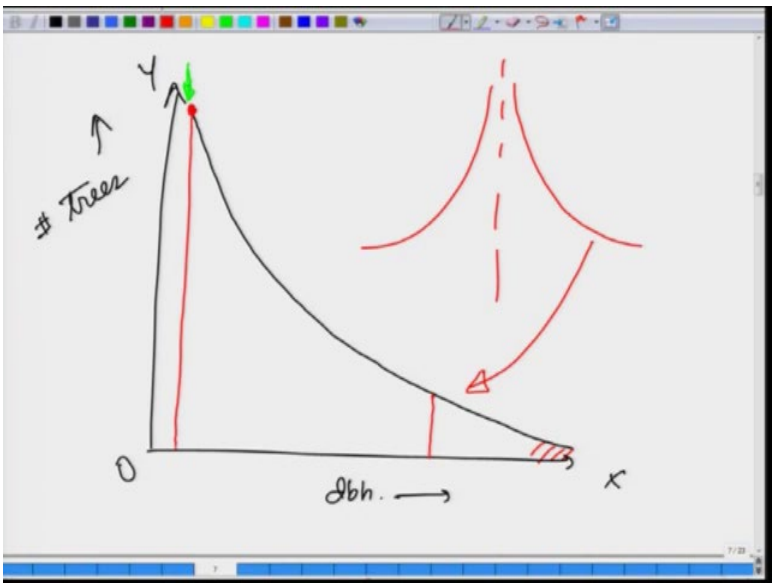


Now, a selection forest is characterized by this inverse J number diameter curve or the ND curve.

(Refer Slide Time: 19:49)



(Refer Slide Time: 20:01)



So, what we are saying here is that, if you look at the letter J it looks like this. So, this is the J, and so in this case, a J curve would look like this is an inverse J curve, which means that you are putting a mirror here and you are doing an inversion. So, this is the shape that we get in the case of a selection forest, and this is known as the ND curve. N

is the number of trees per acre or per hectare that you plot on the y axis, and D is the diameter of a these trees that you plot on the x axis, in the form of the dbh.

Now, this ND curve for an ideal selection forest; it is coming from a combination of a number of even age stands. So, what is happening here is that, if you consider an ND curve that looks like this, so here you have the number and here you have the dbh.

(Refer Slide Time: 20:41)

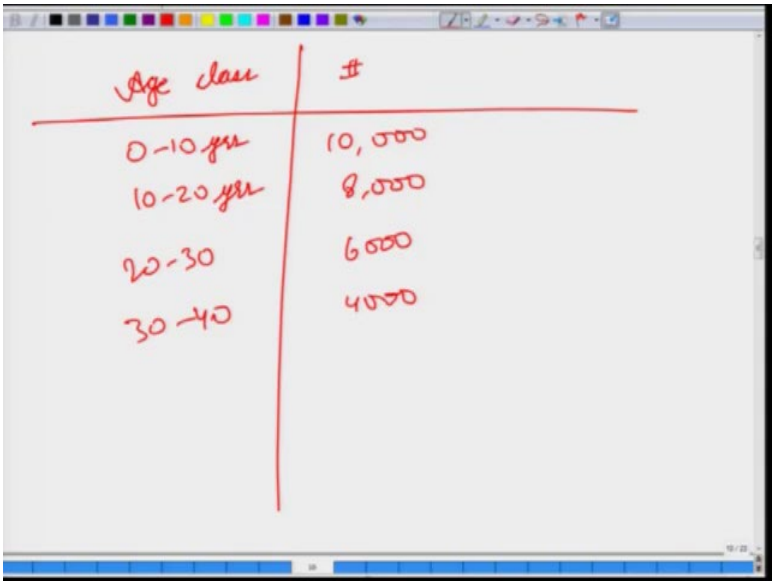
Now, if you consider a stand that is an even aged stand. So, how will the ND curve look like. So, the ND curve will look something like this because this is an even age forest. So, you will have all the trees or most of the trees that are having a single dbh, because that is corresponding to the age. So, you can even replace your dbh, and can say age. So, if you draw a number in age curve for an even age forest or an even age stand, it will look like this.

Now, if you draw a number of even aged stands; so, suppose you have an even aged stand like this here; you have a stand like this; here you have a stand like this, and. so on. And when you join the tops of these curves, you are getting the selection curve; the inverse J curve for the selection forest, which means that what we are saying here is that suppose this is your this is one even age stand that corresponds to trees up to 20 years of age.

So, 0 to 20 years is coming here, then 20 to - then 20 to 40 years is coming here, 40 to 60 years has a curve like this, 60 to 80 years has a curve like this, and 80 to 100 years has a curve like this.

Now, if you are joining the tops of all of these curves, you get an ND curve. Now, why should you have the numbers that are decreasing as we increase the age. Now, that is because, in a natural forest, as well if you have trees that are moving from one age class to another age class, there will be some mortality.

(Refer Slide Time: 23:02)



So, for instance, let us consider that let us make this age class and you have the numbers. So, you suppose start with 10,000 trees you have 10,000 trees in the age class of 0 to 10 years. Now, if you look at the next age class of 10 to 20 years, will you be having these 10,000 trees or not?

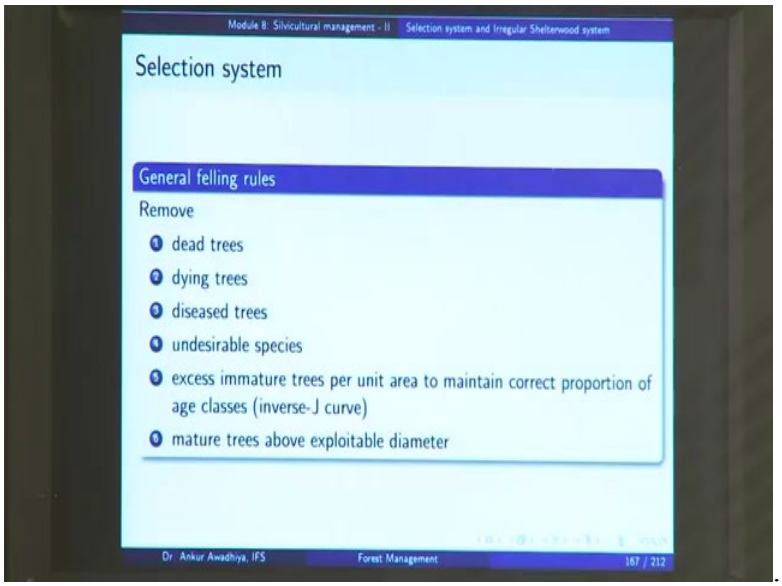
Well, as you as time progresses, there will be some plants that will die off, probably because of some diseases; probably they did not have enough water or enough nutrients; probably there was a frost; or probably there was an insect infestation; or probably some plants died off because herbivores came and grazed on them.

So, they ate up those plants. So, if we started with 10,000 plants in the next age class, they will probably be less number of plants. So, in place of 10,000, you probably have only 8000 plants in the next age class.

Now if you look at 20 to 30 years, this number will go down even further because at every stage you are having certain diseases; certain infestations; probably some forest fires or frost; because of which this number is again coming down to say 6000.

Then, you have 30 to 40 years and this number even comes down to 4000. So, this is what is expected in a natural system that as you move from one age class to another age class, the number of individuals will go down, and this is exactly what we are seeing in the case of a selection curve. The number of trees in a smaller age class with a smaller dbh is greater. But the number of trees at a larger dbh or a larger age class is reducing. So, we are trying to mimic a natural system in a selection forest.

(Refer Slide Time: 24:56)



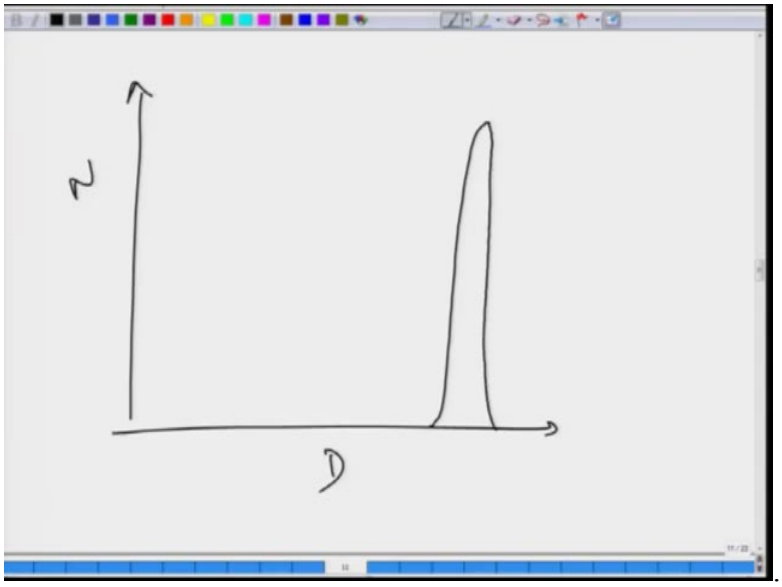
So, what are the general felling rules like? So, once you have selected your selection dbh or your selection girth, what are the trees that you will fell in this forest every year, or when if you are taking a periodic selection system in every block? So, you first of all you remove the dead trees - the dead, dying and diseased trees have the highest preference if you have to remove trees from the forest.

Now, why is that so, to understand that we will have to go back to why do we why do we want to manage this forest. Now, remember that one aim of or one silvicultural objective of managing a forest, in the selection system, is that you should be able to harvest and get your timber out of this forest till perpetuity.

Now, you want a forest that maintains its condition for infinite number of years. Now, if you consider a forest in which most of the trees are very old or most of the trees are say diseased trees; what will happen to that forest? Will you be able to maintain that forest for a very long period of time?

The answer is NO. Because, in the case of very old or very diseased individuals, there is a very good chance that there will be a huge amount of mortality. So, suppose you have an ND curve.

(Refer Slide Time: 26:22)



So, you have this ND curve, and suppose you have - you are maintaining your forest as an even age stand, and you have all the trees at a very high diameter. So, all of your trees in this stand of very old trees. Now, you have a single disease or you have a single infestation, and the whole of the stand will be wiped off.

So, to make to manage your stand in a healthy condition, you would want that you have less number of very old trees. Most of your trees should be there in a young age or in a mature age. And, at the same time, you should be having an adequate amount of regeneration; you should be having plenty of young plants, so that, if anything happens, these plants are there to cover up the space; to cover up the growing space.

So, you remove the dead, dying and diseased trees in the highest preference. So, the most preference is that all these dead, dying and diseased trees are removed. So, that you no

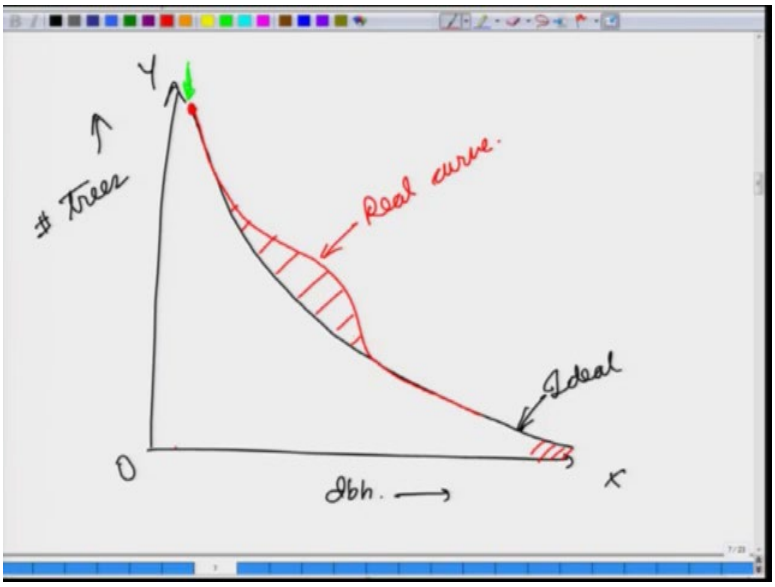
longer have any disease or any pests or any insects that are there in the system. So, that you are trying to maintain the health of the system.

So, after these dead, dying and diseased trees, next is the number of next is the preference of the undesirable species. So, suppose you are maintaining a forest and there is one species that is an invasive species, or probably you have a species that does not have any economic value.

So, you will remove those species because you do not want these species to propagate it in your forest, because they will not provide you any benefits and they will in fact they might lead to some harm as well.

Next, you remove excess immature trees per unit area to maintain the correct proportion of age classes. Now, what we are saying here is that, if you look at your ideal ND curve, suppose you have a situation in which there is a bump say here or let us say that in place of your normal curve, it comes to be something like this.

(Refer Slide Time: 28:36)



So, here you were having an ideal curve and this is your real curve. Now, if you have a situation like this, the next preference would be these trees you want to remove these many trees that are not completely mature. But these are a deviation to your ideal curves, so, you are going to remove these trees as well when you are doing the harvesting.

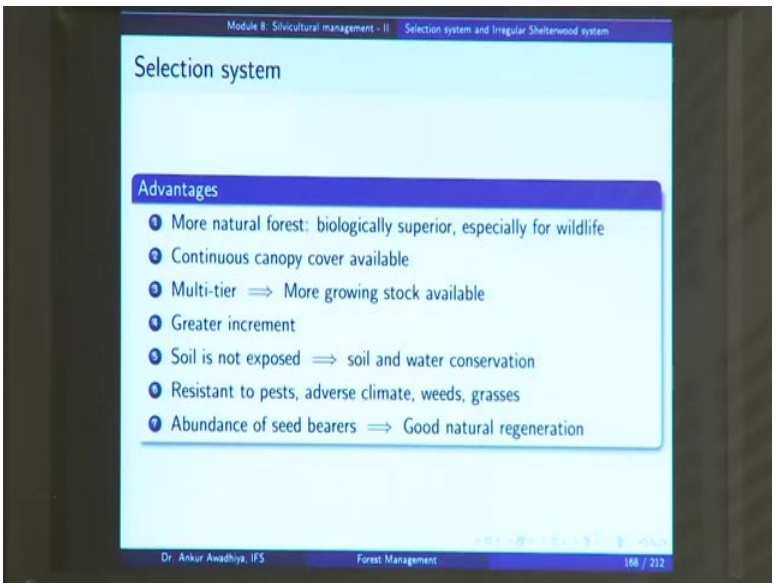
So, the fifth number is excess immature trees per unit area to maintain the correct proportion of age classes, and then finally, after you have removed all these trees the next preference is that of the mature trees above the exploitable diameter.

So, what you are doing in an ideal selection forest is that, every year you are visiting every part of the forest and if there is any dead, dying, diseased tree, because you are visiting your forest every year. So, if you find any tree that is dead, dying or diseased, you remove that tree. Then, you remove those trees that are not useful to you or that are say invasive species; so, you remove those trees as well.

Then, if you find that there is certain deviation from your ideal ND curve and ideal inverse J curve of a selection forest, and you maintain your trees in such a manner that you remove the excess trees, if there is any excess.

And then finally, you remove some of the matured trees that are above your selection dbh, so that you are making the growing space available for the next generation. So, this is these are the general felling rules in the selection forest.

(Refer Slide Time: 30:28)



So, what are the advantages if you do such kind of a management?

The first is that it is a natural forest; it looks natural; it behaves like a natural forest. Because, even in the case of a natural forest, you will be having a large number of young

plants and then as you move up in the age classes the number of individuals die, and in the case of a selection forest, you are trying to mimic that condition.

So, this is a natural forest as natural as you can maintain and manage and so, this is biologically superior, and especially for wildlife, because all these trees of different age classes; they have their own utility. In the case of an ideal selection forest, you have a large number of young trees which can be used as food by the herbivores.

You have a small number of very old trees which will be having hollows, and they can be used as a nesting areas or as breeding areas, by say birds or small mammals or even reptiles. So, you are mean you are a having trees of different age classes and all of these will be having certain biological values for different species of flora as well as fauna.

So, it is a natural forest which is biologically superior especially for wildlife. Then, you have a continuous canopy cover that is available. So, if you want to use this area for say recreation, you will always find a very good canopy cover and you will not have a very harsh sunshine inside it. So, this canopy cover is there for recreational purposes. It is also there to prevent the desiccation of the soil.

So, if you have a break in the canopy, then your sunshine is going to remove the moisture from the soil. But here because you have a continuous canopy, your soil is protected. At the same time, the raindrops are not able to say to fall to the ground with a huge impact; so, the amount of erosion is reduced because of a continuous canopy.

Then, in most cases, you have a multi-tire forest which makes more growing stock available. So, this is especially true, if you want to manage a forest for say, carbon sequestration. Now, in the case of a selection forest, because you are having trees of different age classes and you are maintaining them in the natural state, then probably you will also be having a very good under canopy. And, you will also be having a very good ground cover.

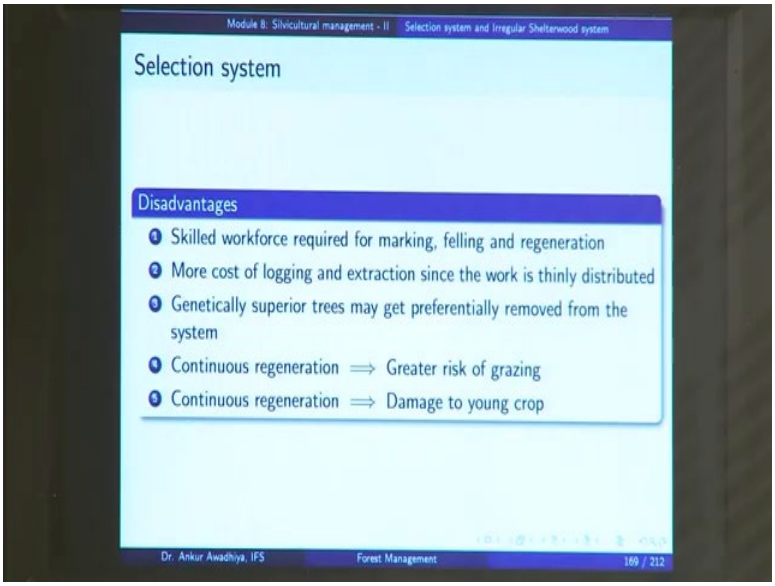
And, in that case, you have more growing stock that becomes available. At the same time, even if you consider a single species, because you are having trees at different heights, you have some young trees that are of a less height; you have some old trees that are of a greater height. So, all different tires in a vertical structural arrangement of a forest are there and so more growing stock becomes available.

There is a greater increment that is put up by the plants; the soil is not exposed; so, there is soil and water conservation. It is resistant to pests, adverse climate, weeds and grasses. Why so?

Because you have a continuous canopy; so, the microclimate remains more or less the same, so then it acts as a buffer against short term changes in the weather or even long-term changes in the climate, because you are not exposing the soil. So, there is less chance of infestation by weeds or grasses and it is also resistant to pests, because you do not have a situation in which you have very old trees which have reduced immunity and so, they become very highly susceptible to the pests. So, we have a number of mature trees a number of young trees and so, this is resistant to the impact of pests.

Then, there is an abundance of seed bearers which ensures a very good natural regeneration.

(Refer Slide Time: 34:33)



However, you also have certain disadvantages. You require a skilled workforce for marking, felling and regeneration operations because your workforce needs to be trained on measurement of these trees on the enumeration of these trees.

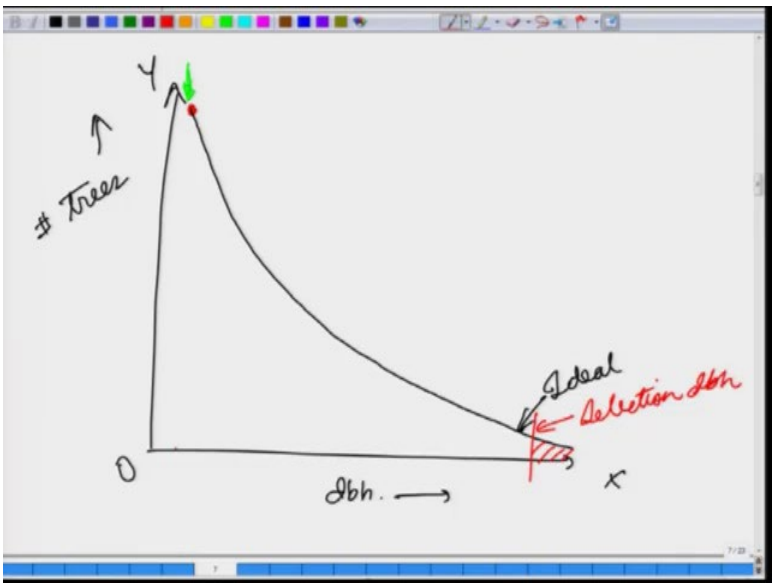
So, they need to maintain a data about at what location, what species of trees are available, what is the diameter of that tree, what is the height of that tree, what is the GPS coordinate of that tree. So, if you require such sorts of information to maintain your

forest in an ideal selection state, then you will have to impart training to the workforce; so, more amount of skill is required.

There is a greater cost of logging and extraction, since the work is thinly distributed. You are not concentrating your operations in any area; you are doing the operations over the whole of the forest, which makes it which makes it much more costlier as compared to say a clear felling system, where the work is concentrated in an area.

Now genetically, superior trees may get preferentially removed from the system. Why so? Because, if we consider the ideal selection forest; now, in this case, we have decided that this is our selection dbh. .

(Refer Slide Time: 35:57)



Now, consider a tree that is genetically superior, which means that in place of reaching the selection dbh at an age of say 90 years, which is the average age for reaching that selection dbh. It is so much the genetically superior that it reaches that that diameter in say 50 years.

But what happens in the case of a selection forest? We would have wanted that tree to remain in the forest produce seeds, so that in the next generation also we have these genetically superior characteristics. So, in the next generation as well, your trees should be able to reach the selection dbh in a shorter period of time, which would make your operations much more economically attractive.

But, in the case of a selection forest, because you selected trees that have reached that that diameter, we are you are not considering the age of that tree. So, what happens is that you fell that tree.

So, before it gets a time to produce sufficient number of seeds that should be having the superior genetic qualities, the trees is - the tree is felled. So, there is a chance that the genetically superior trees may get preferentially removed from the system. Then also, because you have a continuous regeneration throughout the forest, so at all times, you are having the young crop that is there in every portion of the forest.

Now, if you have more and more of young crops - they is a - there is a greater risk of grazing, because you will not be able to protect each and every portion of the forest. And because you are having the young crop everywhere, there is a greater risk of grazing.

At the same time, because you are doing the felling operations in different areas where you are having the young crop; so, there is a greater chance of damage to the young crop. When you fell a log, when you drag a log, when you take machines inside there is a greater chance that your regeneration gets adversely affected.

So, this is a selection system. The main points are that, you maintain your forest in a natural state you remove the olden the older individuals; you try to maintain the ideal inverse J curve, and you are doing this either for your esthetical reasons, or you are doing it if you want to use your forest for wildlife purposes, or if it is in an area that is very far off it is in a very rugged terrain; so that you are not able to carry your instruments again and again. Or, if or if the area is such that it is prone to soil erosion or it is a water catchment area; so, in those areas, you try to go for a selection system.

The kind of a forest is an uneven aged forest, but this is a regular forest, because in the case of different age classes there is a proportional amount of a growing the space or proportional amount of land that is being occupied by these different age classes.

But what do you do if you have an area that has an irregular forest? So, in the case of an irregular forest, different age classes will not be occupying the proportional areas of land. So, in those cases you go for an irregular shelterwood system.

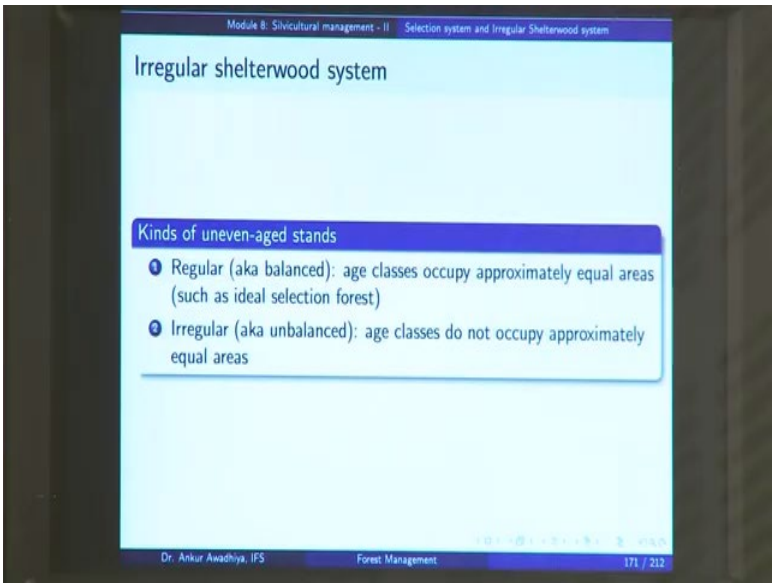
So, here we have the irregular shelterwod system in the flowchart. So, how do we reach an irregular shelterwood system? The first question is concentration of felling and regeneration operations, and in the case of irregular shelterwood system, they are concentrated on part of the forest.

So, you are not doing it in the whole area as in the selection system; you are concentrating; you are concentrating it on part of a forest.

The clearing of the old crop happens in successive regeneration fellings, as in the case of other shelterwood systems. And, the canopy opening is done in an irregular and gradual manner, and in that case, you have an irregular shelterwood system.

So, this is a shelterwood system in which you are maintaining a shelter of the old crop, and you are - you are doing your operations in such a manner that you maintain the irregular characteristic of the forest.

(Refer Slide Time: 40:16)

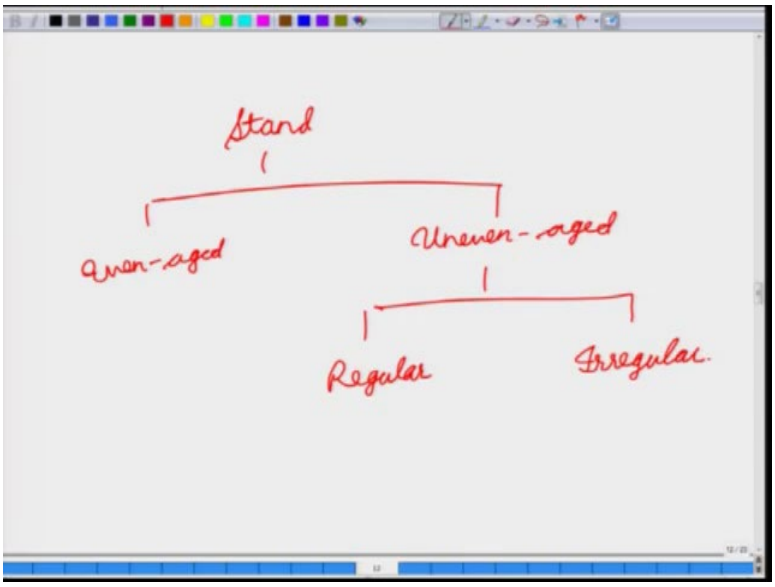


So, now, we look at a irregular shelterwood system in more detail. So, the kinds we have two kinds of uneven aged stands. So, we first of all we talked about even aged versus uneven aged. In the case of an even aged stand, the trees or the crop have very similar ages. The differences is - the difference in their ages is less than 20 percent of the rotation age. In the case of an uneven aged forest, you have plants that have very

different ages, and generally the differences in their ages is greater than 20 percent of the rotation age.

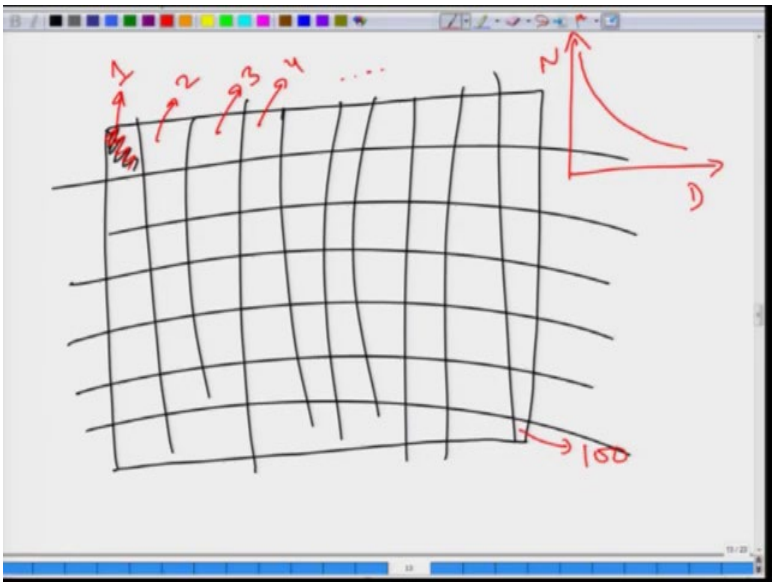
Now, in the case of these uneven aged forest, you have two different categories. So, what we are saying is that, in the case of any stand, you can have an even aged stand or an uneven aged stand. And, in the case of an uneven aged stand, you can either have a regular uneven aged stand or an irregular uneven aged stand.

(Refer Slide Time: 41:04)



Now, in the case of a regular or balanced uneven aged stand, the age classes occupy approximately equal areas such as in the case of an ideal selection forest.

(Refer Slide Time: 41:39)



So, for instance, if you have a forest and let us divide it into a number of small portions of equal areas; suppose, we divided into say hundred equal areas. And, in each of these areas, you raise an even aged crop.

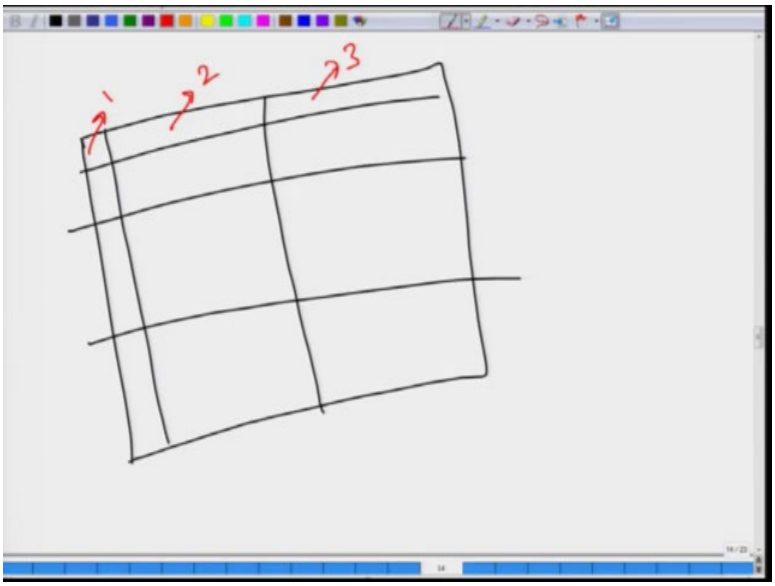
So, here you have an even aged crop of 1 year, here you have 2 years, here you have 3 years, here you have 4 years and so on, till this one that has an even aged crop of 100 years of age.

So, everywhere you are doing a clear felling and you have raised your crops such that in every area, and all of these areas are equal areas; you have an even aged crop of that particular age class.

So, if you draw the curves the ND curves, you will; So, here you have the ND curve, if you draw it for such a forest, it will be an ideal selection forest. And, this is a regular uneven aged forest, because here you have different age classes. So, like this is the age class of one of 0 to 1 year; so, different age classes are occupying approximately equal areas of the land. So, this is in the case of a selection forest.

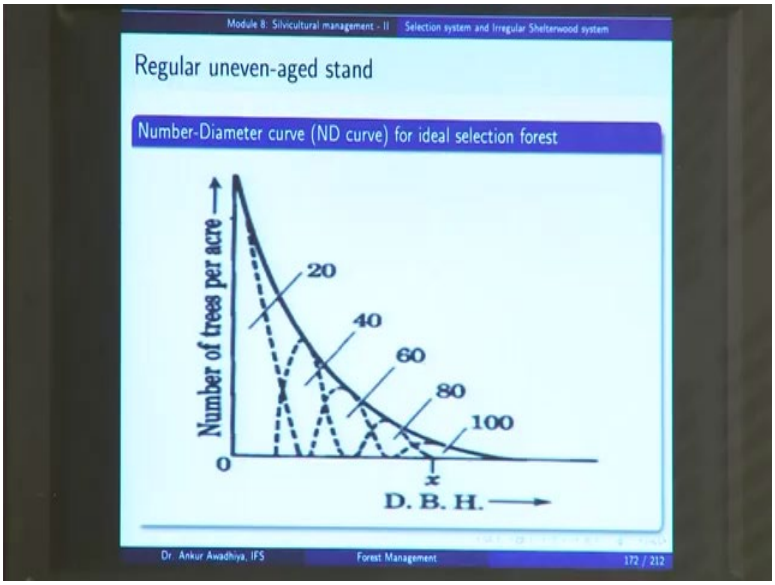
In the case of an irregular forest or an unbalanced forest, the age classes do not occupy approximately equal areas. So, suppose you have your area and you divide in such a manner that you have so this is your 0 to 1 year, this is your 1 to 2 year, this is 2 to 3 year and so on.

(Refer Slide Time: 43:15)



So, different age classes are not occupying equal areas. So, in this case we will call it an irregular forest.

(Refer Slide Time: 43:38)



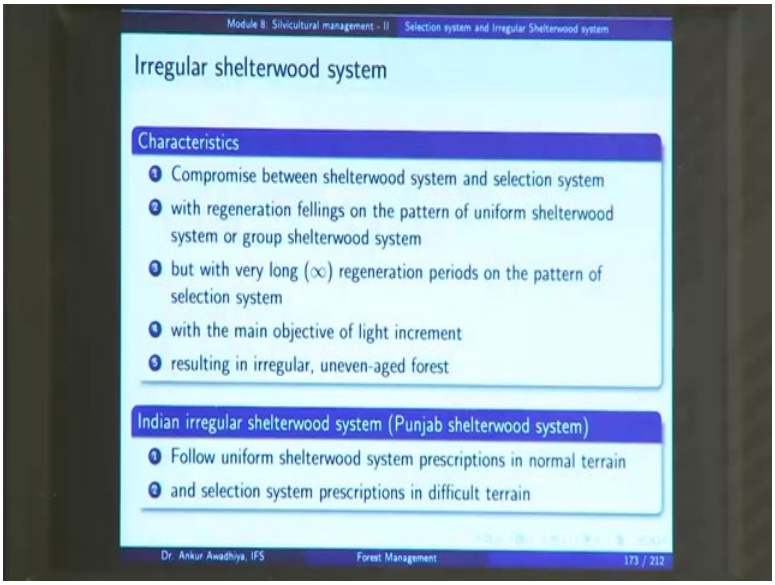
So, this is how a regular uneven aged stand looks like. So, it looks like an inverse J curve if there are any deviations. So, in the case of a selection forest, if there was any deviation, we perform such harvesting operations that it went back to the regular uneven aged forest.

(Refer Slide Time: 44:03)

So, what we said there was that, this is our ideal curve and suppose your curve started to look like this; so, in that case, you would fell of these trees and bring it back to a regular uneven aged stand. But in the case of an of the irregular shelterwood system, you will not do that; you will let your forest show this irregular nature. And, you will manage it in such a way that this irregular curve is just preserved, but it is also propagated for perpetuity.

So, how do you do that.

(Refer Slide Time: 44:42)



So, first of all let us have a look at the characteristics of this system; this is a compromise between a shelterwood system and a selection system. So, in the case of a selection system. we were having a regular uneven aged stand. In the case of a shelterwood system, we were having an even aged stand.

Now, to create an irregular forest, you make a compromise between the selection system and the shelterwood system. So, you have characteristics of both these systems together.

So, this is a compromise between shelterwood and selection system with regeneration fellings, on the pattern of uniform shelterwood system or group shelterwood system. So, what you are doing here is that you are; you are doing your regeneration fellings either in the form of a uniform shelterwood system or in the form of a group shelterwood system.

But unlike in the case of a of a uniform shelterwood system or a group shelterwood system, in which you are doing your operations in a very short period of time, here you do the regeneration over a very long period of time; in infinite number of years on the pattern of the selection system, because as you remember, in the case of a selection system, we were visiting each area of the forest every year till infinite number of years for the regeneration.

So, this characteristic of the selection system is added to the shelterwood system to get the irregular shelterwood system.

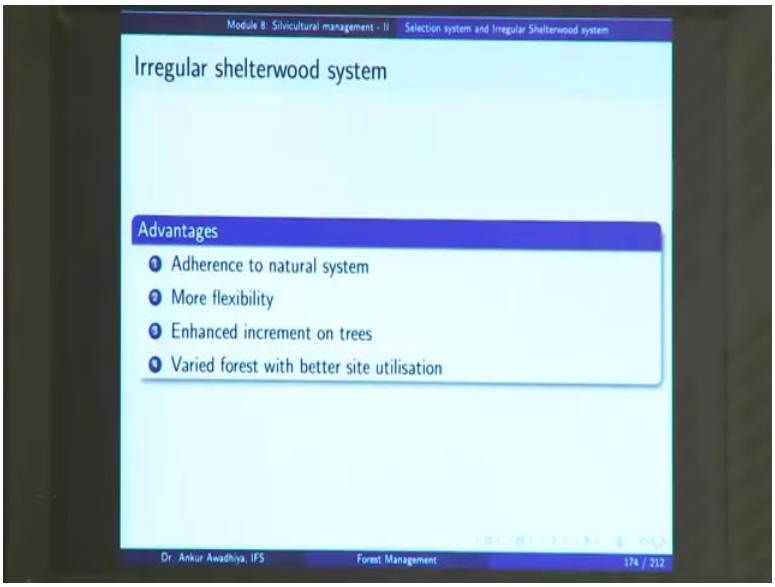
Now, the main objective is that of light increment as in the case of your shelterwood system, and because you add both these characteristics, you get an uneven aged forest and which is irregular in nature. So, you are doing selection system in certain areas, and you are following the shelterwood system in certain other areas.

So, a good example is the Indian irregular shelterwood system, also known as the Punjab shelterwood system. And, what do you do here, if you have a terrain that is difficult; if you have a rugged terrain; if you have a hilly area, you go for a for a selection system - plain and simple. But if you have a normal terrain, you go with a uniform shelterwood system.

So, this is a combination of a selection system as well as shelterwood system. So, you will get a curve; this you will get an ND curve that is showing both an uneven aged

forest, because of a certain areas that are that you have you are managing with selection system. But it will also be irregular, because there are also certain areas in which you are going with a shelterwood system.

(Refer Slide Time: 47:28)



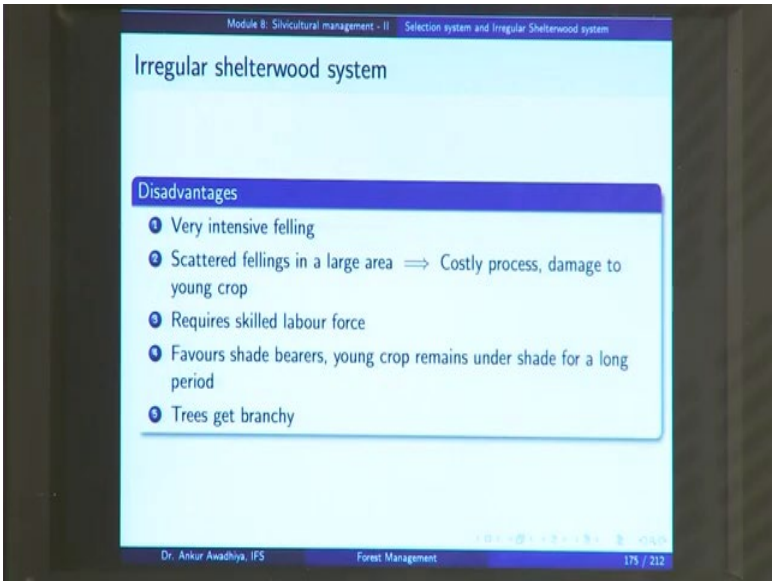
So, what are the carriage - what are the advantages? why would you want to go with such a complexity or such a bizarre system? This is because you get certain advantages. There is an adherence to the natural system because you have characteristics of a selection forest.

So, in this case, at all times, you are having a canopy cover unlike in a shelterwood system, in which at certain times, you are removing the canopy cover. So, here the canopy is more or less maintained. But you have much more flexibility because in the case of a selection forest. It was difficult to work the area, because you had to visit the areas again and again. So, in those areas where it is possible to go with a shelterwood system, you go over the shelterwood system.

So, there is more flexibility; there is an enhanced increment on trees, because you are using the selection system, but at the same time, you have a varied forest with better side utilization. The forest now is varied because, in certain areas, you have an even aged forest; in those areas where you are using a shelterwood system. In those areas where you are using a selection system, you are having an uneven aged forest and so,

combining both of these together is giving you a varied nature of the forest, and there is a better site utilization.

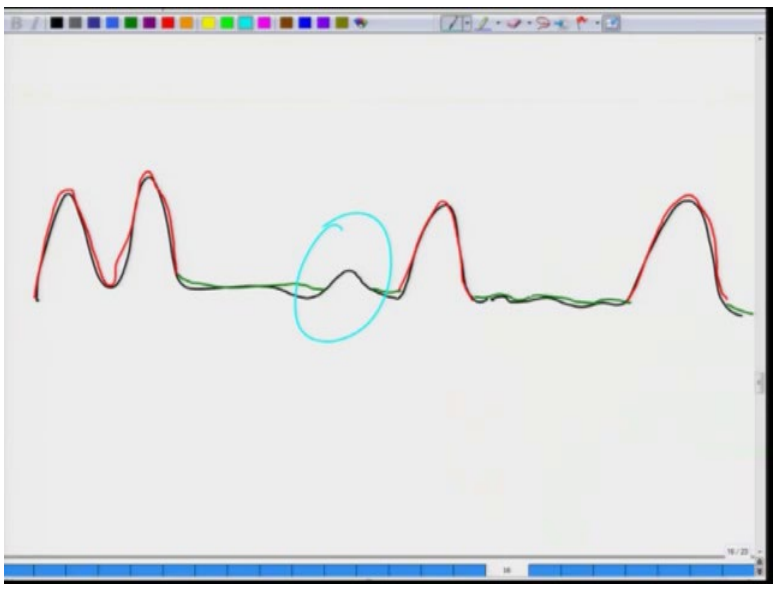
(Refer Slide Time: 48:49)



However, there are also certain disadvantages.

The first disadvantage is that- it becomes a very confusing system. It is difficult to train your labour force, because now your labour force does not only have to be skilled enough to go to different areas; take GPS coordinates; take the diameter; take the height ratings, but also they have to use different prescriptions in different areas.

(Refer Slide Time: 49:19)



So, suppose your for your terrain look like this. So, you have these hilly areas; then you have this plain areas, or let us show it like this. So, you have this hilly area, then you have this plain area, then small hills, then again, a plane, then again hills.

So, what this irregular shelterwood system say is that, in these areas, you will do you will go for a selection system, whereas in these areas, you will go for a shelterwood system.

The confusion would be in areas like this, if you have a; if you have a small bump do you go with a selection system or do you go with a shelterwood system, and you have to train your labour in such a manner that they are able to take these decisions they are able to understand and appreciate this system. So, it becomes confusing and it becomes difficult to skill your labour force.

At the same time, there is a disadvantage that there can be very intensive felling in certain areas. So, suppose you had said that, in the case of your rugged topography, you will go with a selection system.

So, that there is a less intense felling, but your labour decided or your labour was under the impression that this is an area to be maintained under shelterwood system. So, they went there and they cut a number of trees to create an even aged forest. So, in that case, your objectives of management will very easily be lost because there will be a very intensive felling in your area which you did not want.

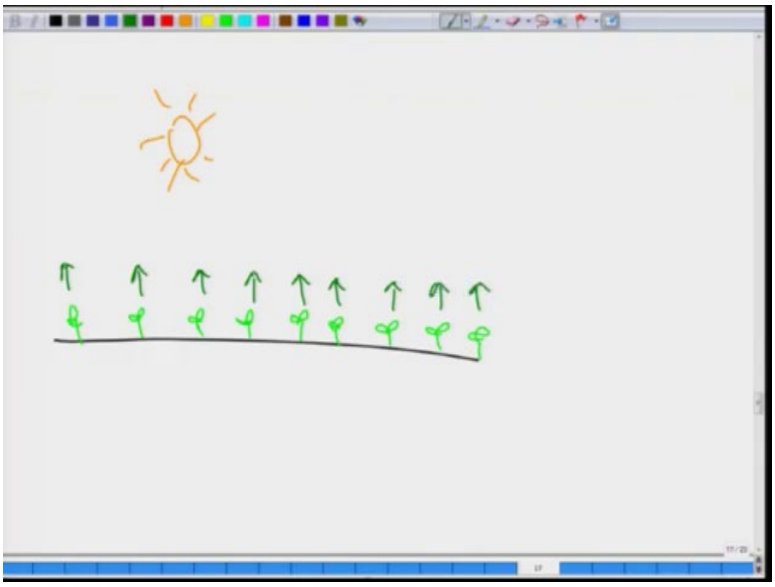
Then, there is this disadvantage of having scattered fellings in a large area. So, this makes it a costly process because you have to visit different areas every year, and at the same time there is huge amount of damage to the young crop. We looked at this one it requires skilled labour force.

Then, another disadvantage is that, it favours the shade bearers. So, you cannot use it for the light demanders and the young crop remains under the shade for a long period of time. So, unlike in the case of a shelterwood system where you are giving periodic light increments; where things were under your control. In the case of an irregular shelterwood system, this is basically a mix and match of the shelterwood and the selection system.

So, what happens is that, even though you are favouring your plants that are shade bearers or shade loving plants, but you are not able to give them a periodic light increment, so that they would be able to put up more amount of increment.

Then, another disadvantage is that the trees get a branchy in this situation. Because things are so confusing; so, I have said that in a number of cases that trees get branchy. Now, this is unlike in the case of an even aged forest, such as a clear felling forest.

(Refer Slide Time: 52:16)



So, in the case of a clear felling forest what was happening is that you are raising these young plants and they were close together, and they were competing against each other. So, in that case, all these plants wanted to have more and more of the sun. So, that was forcing all of these plants to grow up.

So, most of the increment was done in the vertical direction and hardly any increment was being done in the sideways direction. So, they were hardly any branches; all these trees wanted to just go up and up.

But in the case of this irregular shelterwood system, because you are providing shade; and because there would be certain locations where you will be getting sunlight certain other locations where you will not be getting sunlight. So, in such a situation, there is a big chance that your trees become branchy, and if you have a branchy tree, then the economic value is less.

So, in the case of an irregular shelterwood system, you go with a combination of a shelterwood system and the selection system. Typically, a very good example would be the Indian irregular shelterwood system. In which case, in the case of rugged areas, you go with a selection system. In the case of plain areas, you go with a shelterwood system. You are mixing both of these and so, you get a characteristic of both these silvicultural systems.

So, you have an uneven aged forest, as in the case of a selection system; but because there is also a mix of your even aged forest that come from the shelterwood system. So, the character of the crop becomes irregular and it is maintained as an irregular forest. So, this is also another variant of a silvicultural system. So, that is all for today.

Thank you for your attention [FL].