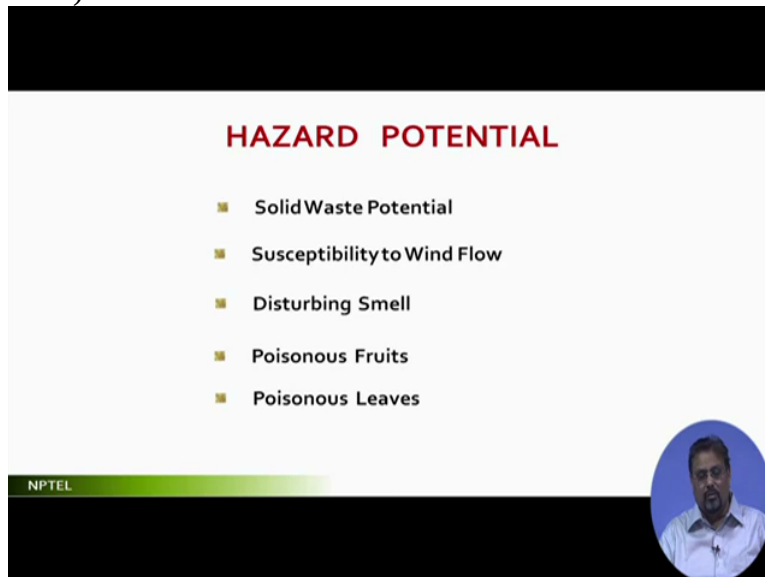


**Course on Landscape Architecture and Site Planning-Basic Fundamentals**  
**Professor Uttam Banerjee**  
**Department of Architecture and Regional Planning**  
**Indian Institute of Technology Kharagpur**  
**Module No 08**  
**Lecture 38: Planting Design (Contd.)**

Hello, good morning. Here we are about the discussing planting design where we have set a criteria that we need to use for our landscaping, that I'm discussing about.

(Refer Slide Time: 0:39)



When I am talking about the environmental criterion, you will see there is one more thing that we are very much concerned with, that is a hazard potential. See, the thing is in general plants, it gives us a good amount of oxygen but there are certain plants or trees which you know misleading. They may be good apparently but they have some kind of hazards associated with it. Not that every time we are very familiar with it, not that we are very knowledgeable about it.

So the thing is, I am just trying to give an idea that whenever you are thinking about the environmental criterion, also pay attention to the hazard potential of the plants. Most often you will find is it does not have the hazard potential but there are some. Here, what kind of hazards that you have? The trees which may have solid waste potential. In fact, in general all the trees will have solid waste potential. What is it for the waste potential?

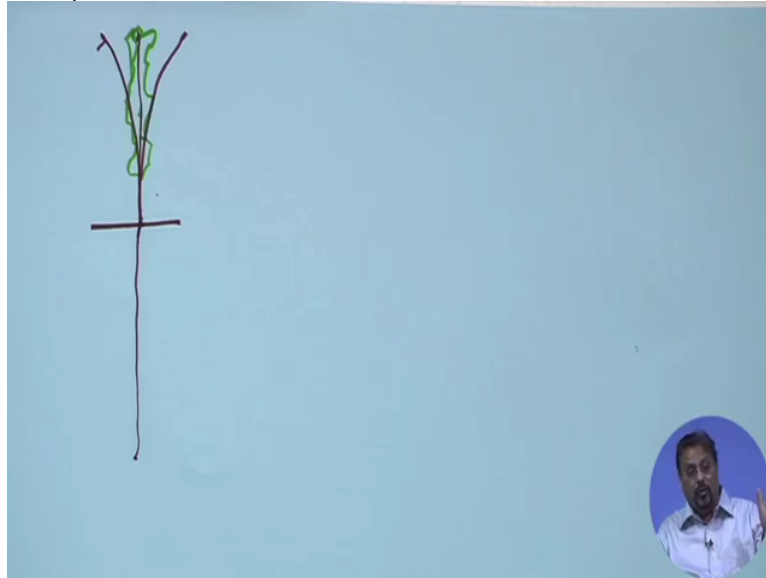
If a tree, for seasonal tree or seasonal plants, when it will die, it becomes a unusable mass, about degradable of course and that needs to be removed from the site. So it becomes now a solid waste mass. A plant or a group of plants which must have really enchanted us over the last 6 months by its own existence and flowering and fragrance, end of the 6 months, when it has lost its life, now it becomes a burden to us. So it becomes a solid waste.

A fig tree which is going to shed its leaves, shed its flowers, shed its fruits, they abier solid waste potential. So this cannot be disregarding. But there are certain plants were the fruits are good but if they are plucked and taken away separately, it is good. But if it is not, it becomes menace. Let me give an example. You must have seen Jamun tree, Jambulana, Jamun trees you see, if you do not plug the jamun fruit from the tree, the tree is good. Big in size, believes, good shade tree, also fruiting.

If it shreds its fruits on the floor, the floor becomes a menace. The dark morphed colour, the dark violet colour I would say, you find splattered all through, becomes sticky floor. It becomes a real solid waste problem. The thing is, when you are using the plants, when you are assessing all its good characteristics, also try to see some negative characteristics which are there. Most often, the negative characteristics are least.

Okay. So solid waste potential that you have to check. Another is susceptibility to the wind flow. This is a hazard. You know what is susceptibility I am talking about is like this. The trees, I will just cite few examples. You must have seen the eucalyptus tree.

(Refer Slide Time: 3:50)



Eucalyptus tree if it is planted straight like this, has very you know scanty foliage in terms of let me say in terms of this, very scanty foliage. It is very useful for some reasons but it has to hazards. One is, it is too cylinder, so the cylinderish ratio matters. Here, okay to cylinder. And when it is too cylinder, during Winslow, it will be swaying. It will be swaying in this form. It will be bending like this depending on the wind forces. This might become hazardous.

Another is, another menace of this particular tree, the hazard psychology. It has a very deep tapped root and the deep tapped root as per the records, you know whatever we get to know from the records that this requires a good amount of water and because it is deep tapped root, it touches the water sources faster than other trees they were the root structure is such. And then it extracts very rapidly the water.

So what happens is when it extracts the water for its own survival, the rest of the trees now become deprived of the water content of that particular soil. Another hazard. It is because of which we say that if suppose certain area is what scarce and the ground water is scanty in quantity, then do not plant eucalyptus because they will be sucking out the entire water.

At the same time, the quantity of water that they are taking out, they will also transpire, no doubt about it but the thing is that perspiration is not going to add to so much of humidity of this to the surroundings that which will compensate we. It does not. But the point is, even if suppose it does

compensate, the entire water through transpiration, if it is compensating to the overground, the groundwater has been depleted.

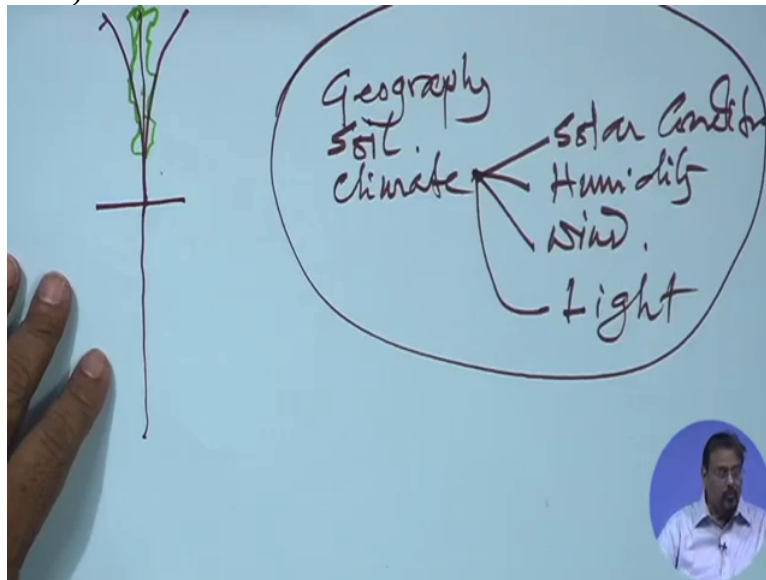
This has to be taken care of, okay? So (5:41) the wind flow is one, another is, you know I will I will talk about these trees more when, some of the trees more when I come to this particular point. Some trees are of disturbing smell. The flowers may be smelly, means bad smell or pungent smell. Bad means unwanted or uncomfortable smell, okay? Pungent smell. Some of the trees, they have the flowers.

But you know, the smell is pungent. But whether it is liked or disliked by people, there are difference of opinion. I have checked with my students. I have also asked people. Some people like it, some people do not like it. Some people feel it they are disturbed, disturbing, choking, some people say I like it very much. The point is these are okay, people who do not like it, if suppose there are more people of number responding saying that we do not like it, then naturally, that tree gets negated.

So you check the hazard potential of this. Some trees also bear poisonous fruits may be having a very good flower. The flower which you being used in the household but the fruit is highly poisonous. And since it is in the open, we really cannot educate everybody saying that the fruits are poisonous. So we have to take care of this. So I am not saying that which tree of what kind of negatives but it is our you know duty or diligence, we have to check any plant that we have shortlisted for use in the landscape, also try to find out its other hazard potential.

Solid waste potential is automatically intrinsic and it comes in the package. Susceptibility to the wind depends on the cylinderish ratio, disturbance smell is by the own intrinsic characteristic of the fragrance, flower or leaves or whatever, poisonous fruits is intrinsic to this. So it has to be checked. Some trees also has the poisonous leaves. Tree looks good, the leaves are poisonous. So what we have to check is, all those hazards.

(Refer Slide Time: 7:45)



### CULTURAL CRITERIA

- Climatological Tolerance
- City Tolerance
- Hardiness
- Resistance to Pests / Insects
- Soil Texture Tolerance / Sensitivity
  - Sand / Silt / Clay
- Soil Chemistry Tolerance / Sensitivity
  - Acidic / Alkaline / Saline
- Leafing Character
  - Deciduous
  - Evergreen
- Light Requirement
- Growth Rate

NPTEL

Then let us come to cultural criteria. I have already tried to say that what is the cultural criteria that we are referring to but let us see with respect to its attributes, what comes under the cultural criteria. Climatological tolerance is one. Here I would request you that okay, instead of criteria, right down criterion okay because criterion is singular. So when I am saying cultural criteria, basically I am trying to see the cultural criteria of multiple such kind of plants.

That is why, it is criteria but if you try to see, read this word as cultural criterion as a singular. Okay climatological tolerance, a plant, how it is tolerant climatologically in that particular

location. Then comes a city tolerance. Each city has a different kind of you know microclimate. It is contributed by its own you know intrinsic characteristics of topography, temperature conditions, the geography, the pollutions or the emissions whatever.

So it has some kind of, some you know its climatic characteristics. So how it is tolerant to that city, okay, the city tolerance. Hardiness, the trees which are you know whether it is hardy, means you take one particular cultural condition to cultural condition, how fast it is going to be succumbing to its negative or else how strong it is to resist or adopt to the next change climate. Then comes resistance to pests and insects.

Different kind of climates, you have different kinds of pests and insects. And the trees of different climates when it is taken to a climate, another cultural situation, weather the pests and insects which is intrinsic to the changed location, it is you know acceptable or adaptable, this has to be checked. Then, the soil texture tolerance and sensitivity. Basically what I discussed about the soil texture in the last lecture, basically the composition of, the proportion of sand, silt and clay.

Now here, the interesting thing is, the soil texture is going to be more effective or more usable or applicable in our tree's root structure. Different roots, root forms, root structure which I will discuss in detail in course of this discussion, you know different root structure would be you know adaptable to different kind of soil texture. In some cases, that maybe that okay, if the structure has more of sandy nature, it survives well.

The root grips well. But sometimes, it may be that okay if it is silt nature or silt in more in proportion, it holds good. So holding the roots holding capability is very much, you know directly proportional to the related to the the soil texture. So how much it is acceptable one that I think we have to check. Then soil chemistry. Soil chemistry tolerance or sensitivity means how much it is tolerant to the soil chemistry, acidic, alkaline or saline.

In many of the coastal areas where the soil chemistry is basically predominantly saline, so naturally it gives growth to extensive, some specific species like coconut and others. But you go to the other areas which is hot, arid, you try to plant coconut, coconut will not grow well because it requires a saline chemistry of the soil. So this has to be checked.

Leafing character. Leafing character is whether it is deciduous or evergreen. You know, this is intrinsic to a plant of course, but the thing is intrinsically, the evergreen tree is going to function well or deciduous tree is going to function well in a particular climate. So essentially when I am saying the cultural, I am talking about a geographical location, original root of its geographical location and the climate, corresponding climate and the soil.

So basically if you check, I would say for cultural conditions, if you have to check, you check the geography, the moment you check the geography, you also see the soil quality and also see the climate. So when you are going to check the climate, naturally, you are going to check the solar condition, you are going to check the humidity condition or precipitation condition and also you are going to check the wind condition and solar condition in terms of temperature as well as light.

So basically what will happen is, when you are checking the cultural condition, all these are going to be reviewed with respect to specific plants. The light requirement. I will discuss this in detail. Now the like requirement, whether this particular tree requires what amount of light fall for survival or sustenance, that you have to check. You also have to check the growth rate. You take one particular plant from one cultural situation to another cultural context, one cultural context to another cultural context, you will find that the growth will be varied.

It will be impeded or it could be faster. It all depends on the different climatic, different cultural condition. So growth rate is another. Now if I check with respect to this, let me go back to this slide once again for reference altogether. So you are checking with respect to the climatological tolerance. So if you see this, the geography, soil and climate, the climate with solar condition, humidity, wind and light, all together, you will find that humidity is basically going to give you the quantity of water okay? Sufficient water.

That means in the air, if the amount of water that is now contained within that underground under water, sorry under the ground. So when you check this, be very very cautious. It is because of this you will find when I said that when you are making the seed, best is to make (13:51) of cultural conditions. If you find that the plants are growing well in a particular locality or in a particular cultural condition and the other site where you are trying to plant a similar species over

there, and they also correspond to a similar climate or similar cultural condition, then you do not have to really worry.

You can always take these plants and grow there. But if you find no, they are diametrically opposite or they are you know, in fact if I say, you are taking a plant from a highly rain prone area to a hot, arid region or vice versa, hot, arid region tree or plant, now you are trying to plant in other cultural condition like say rain prone or hot humid areas or warm humid areas, you have to really crosscheck.

Okay once you do this, you will find that you are fairly you are making decisions which are very objective. It is not arbitrary, it is not because it looks good. It is not because it is functionally good or it is not because it is environmentally conducive. It is because you know that this particular tree will grow. You know when we see something like, say particular intrinsic characteristic of a plant which is culturally defined, we have to really pay more attention to this and understand more of this.

I can also tell you one thing that frankly speaking, we do not have sufficient amount of data or sufficient amount of references which gives us a very clear-cut you know idea about or classification of plants culturally but there are some hints. Some of the documents which are saying that okay, this tree is good for tropical, this tree is good for rainy, rain prone area, high humid area, this tree is good for hot area, this is for good for temporal climates.

There are some some you no indications but the thing is when you are practising, I think you have to do a little extra more work, or give more effort to find out what is there.



(Refer Slide Time: 15:52)



The next question is, operational criteria. Operational criteria what it is. Let us say I am comparing with visual, functional, environmental, cultural, I am just doing. What is that operational thing? Operational thing is very contextual to the location where you are working at that particular position. It can start with even like say whether we have a good camera for executioner, say executor, contractor who can make this garden or make this landscape created on the site the way I want.

It starts with that kind. That means operationally it is how it is going to work in terms of doing the work at site but here many issues, I have just listed one by one. The clients requirements, its operational. If the client does not want certain plants, you cannot give. It becomes very very sensitive. Availability in suitable size. You require a plant in a locality. Is it available? It may so happen that you have to select this plant and get it from somewhere else.

So the availability is important. Then maintenance requirement, some plants may require good, higher maintenance operations. You may, I would suggest that if some plants do require higher maintenance operations and you do not have much of funding for the maintenance, I would say do not select that particular plant. It is operational criteria that no no, I do not want it because who is going to pay for that and if I do not pay for this, if I do not go for maintenance, this particular tree is not going to survive.

Then transplantation limitations. Quite often, we think of getting a tree in the landscape in a full shape and form. That means mature form then comes the question of transplantation. I have to take the whole plant. I am not referring to the transportation means you take a sapling from the nursery and then plant it here. This is not transplantation. You are only taking that Sample and then immediately.

I am referring to the transplantation as a process in which the whole, fully grown tree I found somewhere, I purchase it and then lifting it up from there in its living condition and then I am going to plant it here. That is what is transplantation I am talking about. There may be limitations. Limitations in terms of expertise, limitation in terms of machineries, limitation in terms of cost, limitation in terms of the will of the client.

Naturally, if it is very costly, why the client would like to have a large tree there? Okay. Transplantation limitations and cost of transplantation if I am talking about, then transplantation limitation I am talking about the technical transplantation, logistics. They require different kinds of machineries, we require different kind of transportation equipments like vehicles. But the cost? Who is going to bear this cost? Is it worthy of this particular cost?

Then other operational thing like cattle proneness. Some plants, I mean most of the plants are highly, they are very cattle attracting and cattle proneness is a menace. It is a menace in our landscape. Large area landscape which you are developing, you do not expect that the entire square feet of this is going to be protected by some people. You created a green nature, at the same time you made a barbed wire all-around or a wall around and then you are putting a security guard at the point, you know this does not make a real landscape.

Landscape is something where your eye is going to flow through the nature. You have created, there is a domain, your eye is flowing through the nature and you are seeing the landscape as a part of the nature. Well in that case, now you have to think about protection of your plants and suppose you find that the other habitations that are around, and they have good amount of cattles and their cattles are let loose, let free and they are entering into your site for grazing purposes and they are attracting all these plants or trees which are highly cobated by the as a cattle fodder, then what you do?

It becomes a problem. It is because of which you remember just now I said, I had given an example that initial young tree has to be guarded by the tree regards. It is mainly to protect against the cattles. What I am talking about cattles, there are also vandals. I am thinking about the cattles but also there are vandals. Susceptibility to the wind flow is also a matter which comes in operational criteria.

It is highly susceptible. There are some things which will be breaking very easily in the winds. There may be sway, some trees which are swaying is one thing but there are, that came under the hazard. So many of these which will find a they come as a hazard here. So susceptibility I am talking about is fine but if suppose the wind flow ultimately for the branches to break and then ultimately fall on the floor, it may cause hazards, it may be fatal, it may be also a solid waste that has to be, that is generated because of the wind flow.

So this you have to consider. This is another thing in terms of operational criteria. There are multiple utilities. Plant for environmental purpose or functional purpose or visual purpose as a utility, whichever. Now let us take an example that one particular tree which is highly strongly used for environmental purpose and then it also has a functional purpose, 2 is satisfied, it also looks good, 3 is satisfied.

Culturally all right, for criterion satisfied but it is another utility. That utility which is a household, that negates all the effects because if suppose now it has multiple utilities in which the building utility or household utility is strong or maybe (21:40) strong, then it becomes a menace for us. So this you have to take into consideration. And when I was talking about the cattle, how about prone to vandalism?

From to vandalism, essentially see, the points which I said I mentioned about you know medicinal utility of a plant material which is highly susceptible to vandalism in terms of scraping out the skin, it is vandalism. Chopping down a sandalwood tree is vandalism, plucking fruits from a tree is vandalism unless authorised. Human vandalism is another very strong one. You can take care of the cattle is in vandalism, alright you do understand.

But how to protect your plants from this, the prone to human vandalism? (22:32) is the part we have to grow with and we have to take care of this. So this operational criteria that you have

to check and there is one more thing, there is experience factor. All said and done, it is suppose my suggestion is this, suppose you are planning a landscape for a particular location which you are not very familiar with. But I am sure when you are following the process of design, you are taking note of everything and now you are designing.

Let me also take it for granted that you are highly knowledgeable and you know everything about the plant materials, everything about that location, everything about the culture. All said and done, everything known. Still I would say, trust the experience factor. This experience factor from which what you have to do you know, you go to the local nursery, talk to them. The list of plants that you have selected, share with them, discuss with them, try to know from them that is it a right choice?

If there is any other conventioner, if there is any other botany expert, horticulture expert, talk to them or even if you find that there is a construction and maintenance department in terms of landscape and there are people working years after years in the same city, talk to them. Take note of their experience and pay value to their experience. Experience factor cannot be really just by quantification.

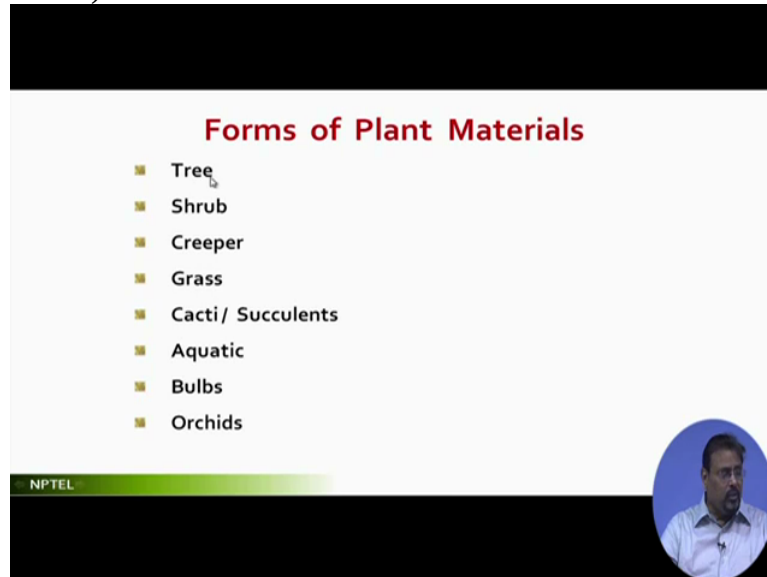
Experience factor is essentially, it comes through seeing things over the years and when you take that experience factor and add it to your operational criterion, you will find that you will be doing things in a much better way. An example of experience factor, let me tell you, a landscape site that you have been given, you have studied. In your site analysis, you did not find that there is any kind of you know, termites in the site.

You have not seen, fine. Go and talk to the local people, talk to the paedologists, talk to the plant scientist, local or even horticulturalist. They will tell you that this particular locality is in generally infested with termites. Maybe there is a site that you are studying now in which there is no termite visible because there is no such you know, no attraction for the termites. The moment you start do plantations, then naturally termites will come in and they will spoil your trees and vegetations.

Take that experience factor in your analysis. When you do that, you find that automatically the entire design is going to be very very proper. Now let me give you a very brief idea. I do not

want to go into the details of this now because I am reserving this is for my 2<sup>nd</sup> part of the, 2<sup>nd</sup> episode of my lecture in which our lots of discussions are supposed to be within this but still I will tell you one thing.

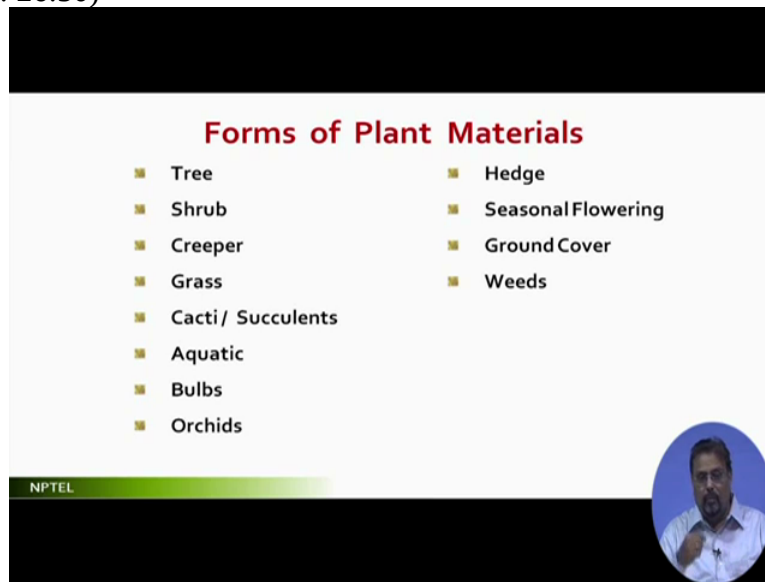
(Refer Slide Time: 25:39)



If suppose you have thought about various criteria based on which you have made your selection, when you are making your selection, selection of what? Plant materials. When I am saying plant materials, plant materials of which kinds? So it comes in different forms and when you are using these plants in your landscape, different forms will give different kind of appearances, different it will occupy different kind of spaces and volumes and also it will behave differently with respect to different climates.

It is because of which is just to have a brief idea about these forms of plants materials is essential. After we discuss about this plant material, then I go into the individual items of characteristics of plant materials to conclude my whole discussion for today. There are different kind of forms - tree, shrub, creeper, grass, factor your succulents, aquatic, bulbs, orchids. Essentially what happens is, this how would you know what is what?

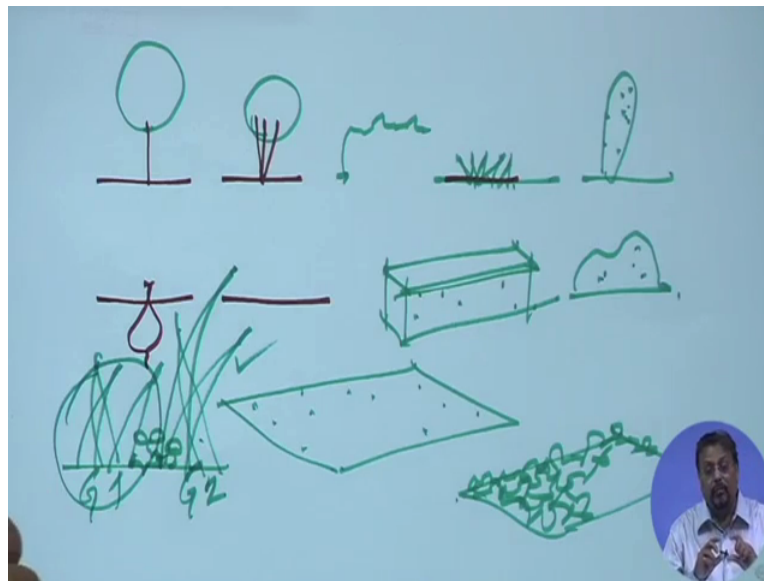

(Refer Slide Time: 26:50)



**Forms of Plant Materials**

- Tree
- Shrub
- Creeper
- Grass
- Cacti/ Succulents
- Aquatic
- Bulbs
- Orchids
- Hedge
- Seasonal Flowering
- Ground Cover
- Weeds

NPTEL



Most often, the trees are of single trunk oriented. So if suppose you have any vege, any plant that you see like this which has a single trunk, you can classify this as a tree. Shrubs are generally multi-trunk. If we see such plant, you should say it is a shrub. Height is varying for different plants, different heights for different plants. Shrubs are generally not very tall. Since they are not very tall, it is very easy to identify or say differentiate between a tree and a shrub.

Shrub may go up to the height of 10 to 15 feet, that is 3 to 5 metre approx, roughly. Tree, generally you will find it will be ranging from 10 upwards to whatever height. Shrub, you will

find that they do not have much wider spread. Maybe, at the most 3 meter. But the tree can go up to any meter. We have example in Calcutta botanical garden. I think more than 200-year-old Banyan tree which is several feet about, say 200 feet spread, widespread okay, 60 meter. So this is how when you are looking at it, you must know the form of this. So tree and the shrub. And the creepers are those kind of plants which generally have soft skins and they generally require supports. Whether it is grills, whether it is trailies or some other trees but they do require, so they have a prostrating nature, they will flow in you know? It is something like so when I like to draw a creeper, it is it is something like which will be supported okay?

Grass is essentially a different kind of, different form of plant which is growing from the soil. It has its own root structure but it does not go to a larger height. Different kinds of grasses. So in my next series of discussion where I will talk about these forms of plant material, I will discuss in detail about all these, all the different kinds of trees, different kinds of shrubs and all. I am just to introducing you to this that when you find that small small spike like thing which is spiking out as leaf blades from the ground is the grass.

Cacti and succulents are you know the kind of plants which are thorny in nature. They generally have, they do not have generally whether to call this as stem or the leaf, is a question. But we do see, the cacti and succulents which are fleshy material, mostly we say fleshy stem, it may have flowers and all that and they hold water within itself. In fact all these trees will be holding the water but the quantity of water that is being held is very very little. But the characters, it holds a good amount of water for its own survival. Okay?

Aquatic plants are those which which have the root structure built grows well in the water, in the moist conditions, not, it does not require soil but there are some plants which are semi-aquatic nature, that means root will be growing better in the moist soil, okay?

Bulbs are the ones where the root structure is of a bulbous nature. So basically it is like onion shape kind you know, the bulbous nature. And orchids is one special kind of plants which which has its own intrinsic characteristic something to do with original cultural condition. There are different kinds of species. But the point is, when I am using this, there are some more terms you will be hearing.

That terminology when I am, you will be hearing, I have just listed over here. It is hedge, season flower, look at the screen, hedge seasonal flowering, groundcover, weeds. Now they are not plants by itself. There are, these are a different kind of you know, appearance of the plants in its own self. Let me explain. It is very hard to explain this. If suppose a plant a series of trees one after another and make a wall, it can be called a hedge. Generally we call this as a hedgerow.

If we plant a series of shrubs one after another, it makes a hedge. You remember that in your European landscapes, we saw lots of such hedges of this kind of profile or maybe sometimes even this kind of profile in Japanese landscapes, this kind of profiles in our European landscapes. This is called hedge. So hedge is basically a series of plants, same plants placed one after another.

I am saying same plants but I can tell you, if suppose you have multiple such plants, then also it should be called hedge. Hedge is just one profile of vegetation in combination. Seasonal flowering, it may be shrubs, it maybe even trees, it may be creepers but the thing is it is basically seasonally will be flowering. So we call seasonal flowers. Seasonal flowers means in a particular season, these will be flowering.

We take this kind of a tree. Basically they are shrubs, there may be creepers okay. Groundcover is also another form, another form of vegetation. Let us say, let me take the example of most common ground cover that is called grass. So whenever we have a surface which is covered with grass, it is groundcover. Basically, the vegetation covering the ground. Hedge is a vertical element. The groundcovers are generally horizontal elements.

Of the same thing, if suppose on this side, if you have small small small height shrubs planted all over like this, that is also groundcover. So groundcover basically is the vegetation that is covering the ground. You know if suppose you look at the entire landscape site from above, you have a series of trees that you are seeing covering a large area. That is also a groundcover. But the only thing is we do not pay much heed to that because we are always, in the landscape we are experiencing this at the base level, at the ground level.

That is why we do not, we never see the landscape from the top but if suppose I would have seen the landscape from the top, say top of 25 storeyed building, and then I am trying to see the whole



landscape from the top, then a series of trees placed and covering a ground is a groundcover for me. Okay?

And weeds is a very peculiar thing. Weeds is a negative aspect you know to us. Hedge, season flower, groundcover, all positive elements to us, positive forms but weed is always a negative form of plants. Interestingly weed is also another type of plant. Weed can be a tree, a tree can be called a weed or any fills creepers, grass, cactus, succulents, you know aquatic, bulbs, orchids, all can be called weeds only if it is negative to another plants.

That is what is a weed. Weed is then in that case what happens is you know how would you identify weeds? Quite often if you see a lawn, in that if I am just trying to draw a little bigger sketch here, you will find that these are all you know grass leaf blades and then maybe there are small small small you know plantations. They are also being grown automatically. Nobody plants it. But these are the plants which have survived over, in presence of the grass and taking away much amount of water and not allowing that water to be taken by these grasses to that extent that could have been released.

Now this particular vegetation becomes a weed. If suppose you plant here, one kind of grass and then there is another kind of grass that you plant suppose, another kind of grass and slightly higher size then I would tell you, if this is grass 1 and this is grass 2 and the grass 2 is your objective and the grass 1 becomes a weed if it is now negating the effects of this then the grass 1 also will become a weed. That is why weed is if I summarily say, is that form of plant which becomes counter-productive or contrasting or negative to the other plants.

So these are different kinds of forms of plants that we do use in our landscape and we will have a greater, detailed discussion on this. Okay, so far different criterion and different forms which we are discussing, now in the next series of discussion, I will go into the individual characteristics of plant materials okay? Enjoy. Thank you.