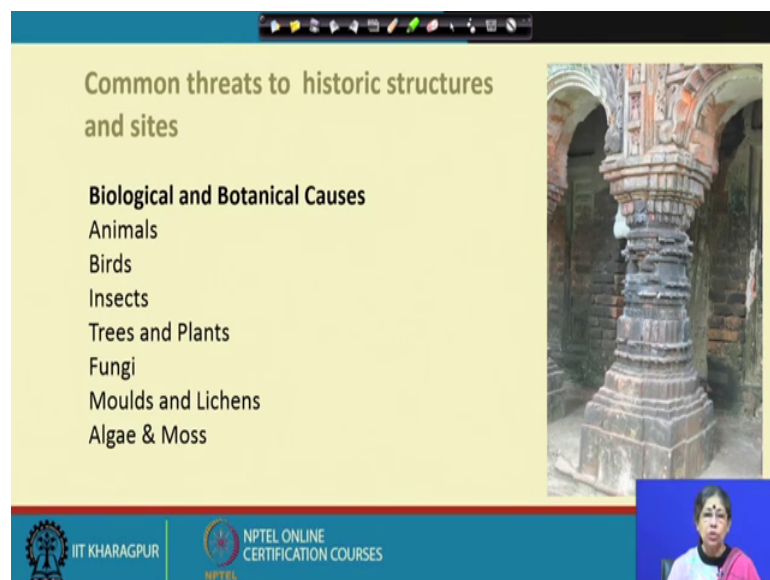


Architectural Conservation and Historic Preservation
Prof. Sanghamitra Basu
Department of Architecture and Regional Planning
Indian Institute of Technology, Kharagpur

Lecture – 23
Causes of Decay in Cultural Property (Contd.)

We are continuing with the Causes of Decay of Cultural Property. In our last lecture, we have talked about the natural causes and today, we will continue with that, but some other aspects.

(Refer Slide Time: 00:28)



This biological and botanical cause; if you can see this is a beautiful structure a small temple near Vishnupur in West Bengal. It is the terracotta temple all the carvings and other things are more or less intact, but it looks very dark and there are several reasons for that which apparently is not only cleaning, but there are far more other causes which are contributing to this look of this temple. So, these are mainly comes under the biological and botanical causes which and we ascribe to the animals, birds, insects, trees and plants, fungi, moulds and lichens.


So, this is something's under and also the algae and moss and there are various types of there are various categories of them we will broadly take a look of these many major aspects and which cause and maybe some of the remedial measures or preventive measures just to have an idea that what are these major causes of biological and botanical

factors which deteriorated called damage to the historical structure. Let us first talk about the animals.

(Refer Slide Time: 01:57)

Biological and Botanical Causes Animals

- Animals contribute to ground salt in the soil by urinating and defecating.
- Animals cause abrasion to the building fabric and deposit grease.
- Monkeys can be destructive, removing tiles etc..



www.dailymail.com - 1809075

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

Animals contribute I mean as you know it is very difficult to control there are different types of birds, animals and other things which comes to the historic structures especially when they are not in use. So, animals contribute to the ground salt in soil by urinating and defecating and these are very difficult because until and unless there is a proper drainage system not a proper cleaning we will cause damage to the fabric. an animal's cause also abrasion to building fabric and deposit crease. these are sometimes it is not only very different to look at or damaging to look at ugly sides, but these are also causing problems to the actual fabric of the historical structures.

Another site which we conference very often is the monkeys and they cause a lot of problem to the tourists and other and they are also sometimes given food and that also because of that they come and settle or try to come near the historic sites and they can be very destructive right removing not only the different things from the tourists and the people, but they also sometimes just talk to you because they take the some of the tiles and other things which can be removed.

(Refer Slide Time: 03:30)

Biological and Botanical Causes Animals

- Congregating birds (such as feral pigeons) can cause problems when surfaces become covered with droppings and nest litter (combustible material)
- Faeces contain acids damaging to historic fabric, glass and metal like aluminum
- Faeces block rainwater gutters and down pipes

toxic and corrosive droppings of pigeons in historic structures

The slide includes two photographs: one showing a close-up of pigeon droppings on a stone surface, and another showing pigeons nesting on a wooden beam. The footer features the IIT Kharagpur and NPTEL Online Certification Courses logos.

We will talk to the animals and these we also know that it is not only that we have to keep a balance between the animal protection laws and the laws for the historic preservation and the cause of historic preservations we have to be very careful and they may be sometimes a part of their natural habitat or ecosystem. One has to be very careful about when talking about these causes.

Now, birds specially the pigeons can cause problem when surfaces become covered with their droppings and nest litter because when they make the litters and specially in the corners of the historic structure they bring certain things which are very combustible material. So, that also are very dangerous.

So, as you can see that these are is a picture that how the animal droppings and the pigeon droppings they are really causing a lot of problem not only they can be cleaned, but they if they stay there longer they will as I said that they will cause a damage to the fabric itself as you can see that here also the pigeons, their nest are there and these toxics because these are generally the toxic and corrosive droppings of pigeon in historic structure the many a times the sort of react with the building material and they may cause a certain permanent damage.

Because these faeces is generally contain acidic they are acidic in nature and depending on which are the material because some of the metal like aluminum or some cloths sometimes they actually cause damage to the surface itself and the fabric itself. In

addition to that I mean when there is a large accumulation of these faeces they sort of choke the rainwater gutters and down water pipes and which again cause a further problem. So, these are all interrelated aspects and if they are not taking care of that cause one damage to another damage to another damage to this type.

(Refer Slide Time: 05:35)

Biological and Botanical Causes Animals

NESTING BIRDS ARE PROTECTED BY LAW

- It is an offence to kill or disturb wild birds when nests are in use and to destroy their eggs
- Tourists should not be allowed to feed them
- Prevent nesting of birds

toxic and corrosive droppings of pigeons in a historic structure

The slide features two photographs: the top one shows a row of white stone columns, and the bottom one shows pigeons perched on a wooden beam of a historic building. A small inset video of a presenter is visible in the bottom right corner.

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

But then what is the solution? One, we must remember the nesting birds are protected by the law and so some of the animals are. there is a very strict animal control protection and preservation wildlife law. So, depending on which country well we are working we has to be very careful because earlier there were a lot of measures were taken where sometimes very cruel and these are not possible nowadays. So, one has to look into that particular laws to keep a balance between that.

So, it is an offense to kill or disturb the wild birds especially when the nests are in use and destroy their eggs it is it is it is a punishable offense and so, it is more or less like preventive measures what had to be taken care of and generally the tourists should not be allowed to feed them and there they also should not do picnic type of things where they bring the eating materials and other because that sort of attracts many birds and different types of animals. So, this is one of the things which has to be through proper management it has can be clearly taken care of.

And, so, the preventing the nesting of the bird and depending on their breeding season another one can be careful. So, that this does not accumulate to such an extent that it cannot be prevented.

(Refer Slide Time: 06:50)

Biological and Botanical Causes Animals

- Bats choose old and dark buildings

Vaikuntha Perumal temple turns a den for bats
V. Venkatasubramanian
KANCHI PURAM, SEPTEMBER 06, 2017 01:01 IST
UPDATED: SEPTEMBER 06, 2017 01:02 IST

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES


This is an example of Kanchipuram where you can see a newspaper cutting where Vaikuntha Perumal temple turns a den for bats. Bats is another type of animal which is the very favorite spots or the whole historic structure. Why, because they generally choose the old and the dark buildings. As you can see that they have their nesting pattern or habitat pattern and they have this pattern. So, there are lot of research is going on that how to prevent the bat depending on their habitat system and other.

So, this is also very important aspects because they not only create droppings and other thing there are sometimes dangerous and they cause further damage to the historic fabric because they can cause a lot of smell and mess of the entire area.

(Refer Slide Time: 07:46)

Biological and Botanical Causes **Animals**

- Bats choose old and dark buildings
- Bats can cause mess and smells.



Judicious use of deterrents, especially **high intensity ultrasound**, can mitigate problems caused by bats.

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

So, what is the remedial measure specially judicious use of deterrence specially high intensive altar sound can mitigate problem caused by bats there our research is being done that what sort of intensity it can be done earlier there where electrocution or other things where their spikes were there these are not allowed nowadays and so, one has to take something or measure which does not cause further damage to these animals or birds different types , but also can be also can take care of the historic fabric both are important.

So, we have to take a balance within the two and it is not only just taking some of the measures one has to depending on which fabric where which type of animals come there not only the preventive measures, but also take care of the special advice from the expert to see that which type of preventive measures can be applicable in a particular situation.

(Refer Slide Time: 08:42)

Biological and Botanical Causes Animals

Try to minimise any places of entry into the building

- If they are already present and could pose a real health hazard, need to seek professional advice to remove them
- Take care when cleaning bat and birds droppings and urine

The slide features two photographs: the top one shows several monkeys in a courtyard in front of a historic building, and the bottom one shows pigeons perched on the ornate arches of a building's entrance. At the bottom left are the logos for IIT KHARAGPUR and NPTEL ONLINE CERTIFICATION COURSES. At the bottom right is a small video inset of a woman speaking.

So, so, as we see that varieties in animals or whether it is pigeons you can see that how I mean how much tetorent to the building fabric it is causing. So, we have to try to minimize any places of the entry of this building. So, sometimes netting and other aspects are also taking care of ASI has taken. Many of places this netting so that the birds and animals cannot enter the thing because it also sometimes may interfere the aesthetic attribute of the historic structure.

So, as I said that there is a balance which has to be taken care of. So, that to prevent this does not happen do not do not go out of control see if they are already present these animals or the bird pigeons or monkeys or whatever they could pose a real health hazard they may be unsafe to the tourists. So, we need to seek a professional advice to remove them depending on where. So, it has to be a multidisciplinary team which has to work depending on that.

But it is absolutely necessary that we create a balance we need to create a balance between these two and also we have to remember that when take care when cleaning the bats and bird droppings and urine because we may use something which may ultimately damage the fabric. So, which material what is the material what type of detergent where we use what type of chemical we are using all are very important and as I said that it has to be taken through some expert advice, but these are very very common causes which

cause a problem and until and unless it is you may immediately taken care of it can cause a long term negative effect.

(Refer Slide Time: 10:25)

Biological and Botanical Causes

Insects

Organic materials (such as wood) are most vulnerable to insect attack
Wood eating insects – e.g. **Masonry bees**

- propensity to attack the old or badly maintained mortar or cement between the bricks of masonry structures
- create or make use of existing horizontal, cylindrical holes in which they complete their life-cycle, burrow in soft stone, weak bricks and crumbling mortar joints.

bee damaged mud wall

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

Let us come to another thing the insects specially the organic materials like wood are most vulnerable to the insect attack. Many of our historic structure as the timber components either in beam rafters or different types of furniture different types of joinery; So, these can the insects of very types it can cause.

One of the example is the wooding eating insect, the masonry bees. As you can see that, they generally prefer the holes and others and their propensity to attack the old or badly maintained mortar or cement between the big or masonry structures. So, when this they are not properly maintained the cement or the mortar joints then they have a chance to come and sometimes they try to in between the tiles or in between some of the cracks or joints this masonry bees try to make their habitat.

The differences that they do not like unlike bats and other they do not stay in a group they are very individually they make their own habitat and they also have their breeding season and until and unless it is taken care of it can cause a further damage within the to the fabric and you can see that here is an adobe wall where bee damaged a mud wall we can see that other things, but sometimes it can be only at an upper level. So, it is possible to remove that and make some preventive measure or repair to the damage done,

sometimes it may be far reaching it is actually making damage to the core of the structure. So, one has to be very careful and do some preventive measures.

So, one has to create or make use this is what they do actually we have to understand their behavior what they do is that the create or make use of the existing horizontal or cylindrical holes in which they complete their life cycle, burrow in the soft stone and weak bricks and crumbling mortar joints. So, if the mortar joints are in a good condition then probably this type of insects cannot make that place their habitat.

So, that means, that we have to take care not only by netting or preventing them we have to sort of repair the crumbling mortar joints with proper material so that they cannot make it their habitat. So, one has to find out the cause understand their behavior.

(Refer Slide Time: 12:47)

The slide is titled "Biological and Botanical Causes" and is divided into two main sections: "Insects" and "Remedy".

Insects

Organic materials (such as wood) are most vulnerable to insect attack
Wood eating insects – e.g. **Masonry bees**

Remedy

- Identify the insect , study life cycle
- Specialist advice for appropriate chemicals
- No toxic to human beings and wild life

On the right side of the slide, there are two photographs. The top photograph shows a close-up of a masonry bee entering a hole in a brick wall. The bottom photograph shows a cross-section of a mud wall with significant damage and crumbling material, with the caption "bee damaged mud wall" below it.

The slide footer includes the IIT Kharagpur logo and the text "NPTEL ONLINE CERTIFICATION COURSES". The slide number "10" is visible in the bottom right corner.

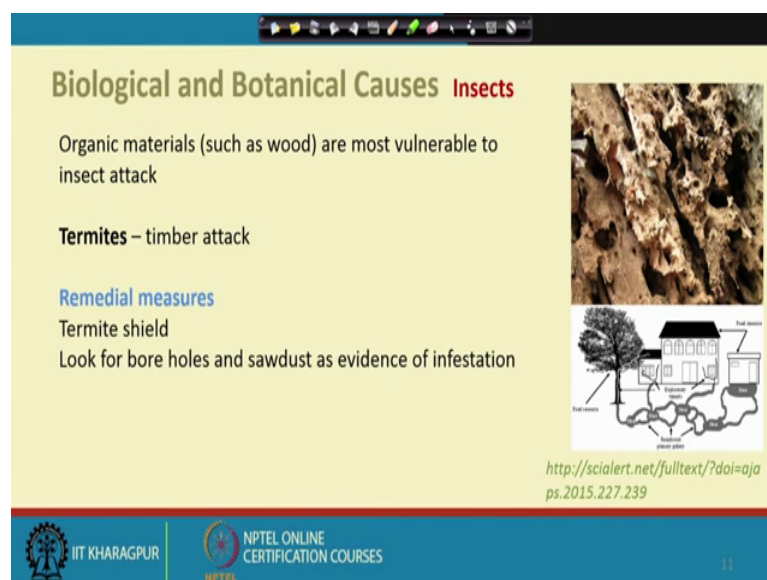
So, one whatever I have just giving one example, so, there can be varied types, so, can take depending on the climate, depending on the place, depending on that local habitat system.

So, first is that we have to identify the insect and the study the life cycle. So, with the help of the biologist, geologist depending on the expertise they have we have to study the life cycle of this insects and then the specialist advice for the appropriate chemical this is a very important that if we need to use some of the chemicals is rather not going to a market and buying any chemical and buying them because we are dealing with a very

sensitive fabric we must be very aware that what we are using and what can be the effect or impact on the historic fabric.

Also we have to understand that sometimes it is very tempting to use some toxic material which are available in the market we must understand that it can be deterrent or damaging to the human life and to the wild life. So, these are very very sort of sensitive issues though it creates a lot of problem to the and damage to the historic fabric, but as I say that one has to study very carefully not take a very hurry decision and study that and take a proper expert advice and depending on what is the problem and what can be the cure one has to go in a sort of a slow caution and the take a proper state and which is of course, a long term affect.

(Refer Slide Time: 14:30)



Biological and Botanical Causes Insects

Organic materials (such as wood) are most vulnerable to insect attack

Termites – timber attack

Remedial measures

Termite shield

Look for bore holes and sawdust as evidence of infestation

<http://scialert.net/fulltext/?doi=ojs.ps.2015.227.239>

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

The other very important thing and which is quite damaging is the termite attack and this is something which is quite dangerous because sometimes we cannot even understand or cannot even know that something is happening.

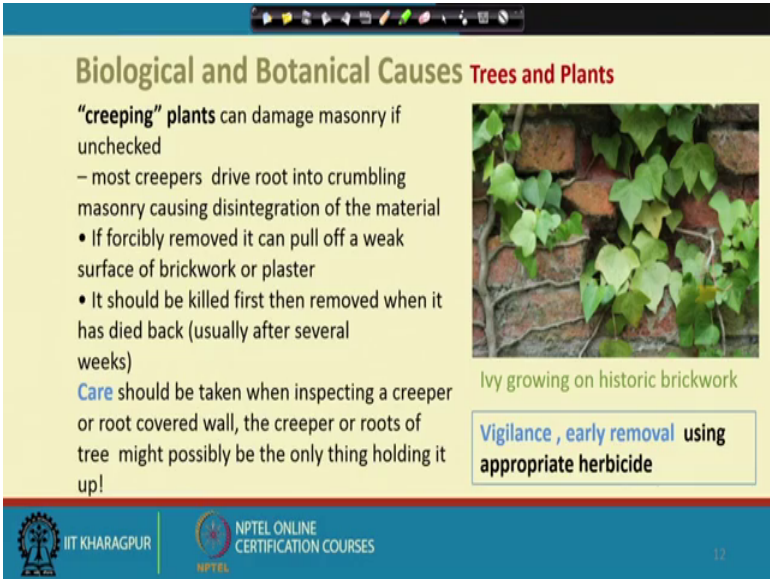
So, this is especially the old effects you can see that within beneath the surface termite can really deteriorate a historic wooden, element component and especially because termites actually they make a huge colony under the these ground on the surface and then they climb up and there is certain particular condition particular temperature and other a particular component which are more sort of comfortable for them to that. So, we must

understand that what are these condition, what are the temperature and other things so that it discouraged this type of effort.

And, of course, one must also that there are remedial measures like termite shield which are there we have to look for the bore holes and sawdust as. So, termites affects which is happened it does not come suddenly, there are some indication. One can daily cleaning and other things people can understand that there is some indication and one can take care rather than suddenly finding one day that everything is gone beneath the surface.

So, this is again as I say a specialist advice is required, but what is again more important is to the regular inspection, regular cleaning as a part of the maintenance and management system.

(Refer Slide Time: 16:23)

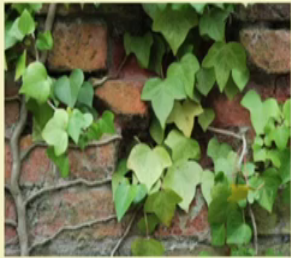


Biological and Botanical Causes **Trees and Plants**

“creeping” plants can damage masonry if unchecked

- most creepers drive root into crumbling masonry causing disintegration of the material
- If forcibly removed it can pull off a weak surface of brickwork or plaster
- It should be killed first then removed when it has died back (usually after several weeks)

Care should be taken when inspecting a creeper or root covered wall, the creeper or roots of tree might possibly be the only thing holding it up!



Ivy growing on historic brickwork

Vigilance, early removal using appropriate herbicide

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

12

Next we will talk about the trees and the plants and again there are various types and various types of problem one is the creeping plants. They can damage the masonry if unchecked. As you can see that, here the ivy growing on a historic brickwork they are really putting the roots within the fabric and some of this old mortar joints are very good sort of a good food for the creeper plant.

So, they survive on them then they put their roots within the joints and then ultimately not only deteriorate the joint they actually go much deeper into the surface and that causes further problem like not only the blocking the gutters, but sometimes they sort of

crumble the mortars, they make deep roots and sometimes they become so unmanageable that it is very difficult.

So, though they drive their roots as I say crumbling the masonry causing disintegration of the material this is and it can be handled if it is detected at a very early at in very early age time; If forcibly removed, because if you just want to cut it and forcibly remove it can pull off a weak surface of brickwork and plaster. So, one has to be very careful that what before taking any action.

And, one must understand that rather than pulling it off from the surface one must first kill it and then remove and it has died back and for killing what should be the use for the cleaning also one should be taking some expert advice that what should be the chemical, what type of things depending on what is the material or the component one has to take an expert advice.


So, care should be taken when inspecting a creeper or root covered wall. The creeper or roots of tree might possibly be the sometimes it happened then that creeper has grown over and we can cut we see the entire building or the wall crumbles because it does not have that mortar joints at the creeper has actually grown inside and it is actually holding the structure the wall or the whatever we are talking about. So, if we just remove the creeper without understanding that it may so happen the entire structure collapses. So, one has to be very careful that what has to be done in during this time.

So, vigilance as I said that one has to be very careful a regular maintenance management can prevent a structure becoming or in such a horrible state unmanageable state. So, vigilance in early removal using the appropriate herbicide is very important. Again, I am I am insisting that it is very important what herbicide to be use to give a get an expert advice for that.

(Refer Slide Time: 19:24)

Biological and Botanical Causes **Trees and Plants**

- The presence of plants growing in a wall is usually an indication of decayed mortar and excess moisture
- Large plants or shrubs growing at the base of walls can trap moisture and their roots can damage underground drains
- Trees near buildings can undermine their foundations and cause ground heave
- In clay soils trees can withdraw ground moisture causing the surrounding soil to shrink, thus causing movement of the foundations and subsequent cracking of walls



IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

13

Sometimes it is the huge trees as I say that until and unless it starts as a sapling, but ultimately it grows so huge that it becomes very unmanageable. As I say sometimes it is almost holding and supporting the every structure is a small temple as you can see it is near in our Midnapur district it is Midnapur district temple very well known temple it is really almost covered with the trees and the tree roots have really penetrated within the structure.

So, it is very important to understand. First of all it is do not allow this thing to happen that is what is important. So, the presence of plants growing in a wall is usually it is also an indication. Indication of a decayed mortar or excess moisture, until and unless this type of situation happen the own grow. So, either the mortar is very weak or there is a huge moisture. So, they are all sort of a complementary to each other.

So, large plants or shrubs growing at the base of the walls also can be very dangerous because it traps the moisture and the roots can damage the underground drains. Sometimes the roots grow so deep underneath that they sort of block the drains they sometimes cause cracks to the foundation.

These are the things which has to be understood and then before taking any measure and trees near the buildings can undermine their foundation has also caused the ground heave because when the trees sort of spread a network under the surface depending on which soil and where it also can cause a ground heave and which again put a thrust on the

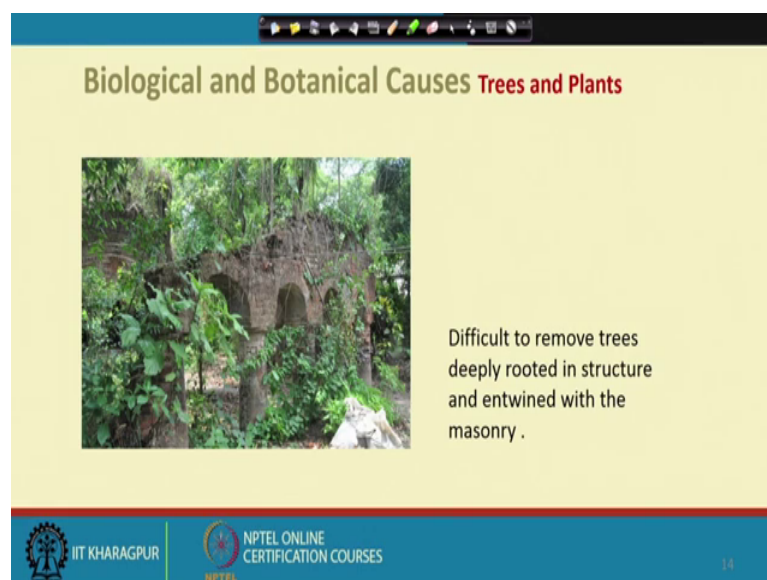
structure. So, these are all sort of a certain one damage or type of decay happening this is it is a snowball effect it is causing further problems causing further problem.

So, until and unless we understand that what is really the issue and we take a proper care at the initial stage this sometimes become unmanageable and we said, demolish the structure specially in clay soil trees can withdraw the ground moisture and causing the surrounding all to soil to shrink; This causing movement of the foundation and subsequent cracking of the wall.

As I said that these are all interrelated and this has to be checked, it is very very important again and again I am saying that when a small sapling is coming sometimes what happen is that if the drainage blocked and some sort of a dust particles accumulate sort of a bird brings a sort of a seed and that seed sort of becomes a sapling and it can may be a banyan tree or some other huge tree and this saplings starts growing and these not only penetrates the roots within the surface, but it also blocks the sort of a flow of water and these are as I say interrelated and sometimes it become.

So, huge and it penetrates the root to such an extent that it is become unmanageable and then we try to cut the roots the entire structure collapses.

(Refer Slide Time: 22:44)



Biological and Botanical Causes **Trees and Plants**

Difficult to remove trees deeply rooted in structure and entwined with the masonry .

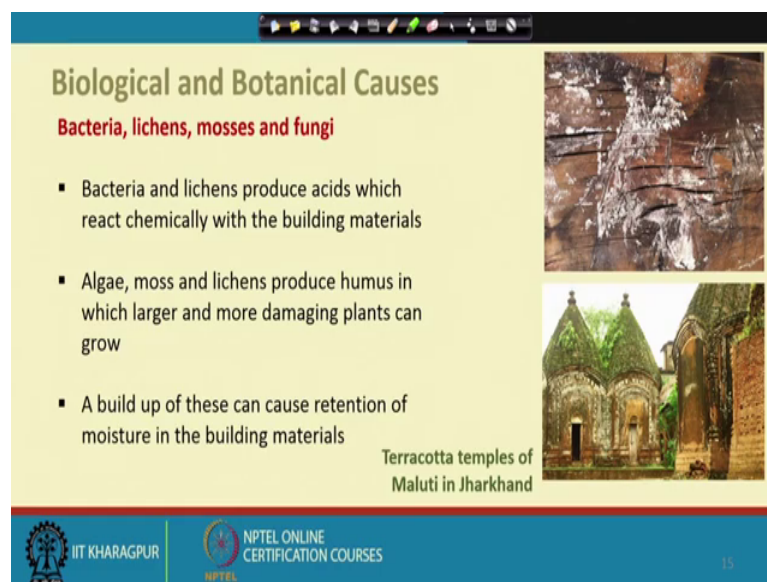
IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

Now, you can see that this is a structure which is really know unmanageable it is a very important temple and this is the exterior outer building of that temple which is does not

have roof any longer, but even the wall is in a very difficult state because depending on the just before the rainy season if the trees are trimmed or cut or some measures are taken the nutrient have grown. It is a I mean it is an accumulated effect of years of negligence which is causing this problem and there may be were just simple measures which can prevent certain thing certain these type of things to happen.

As I say it is very difficult to remove trees which are deeply rooted and in structure because these sort of entwine the entire structure and holding the entire structure and ultimately it becomes like a neglected in ruins and it suddenly it will fall one day and we would not have any measure to take care of this type of thing.

(Refer Slide Time: 23:50)



Biological and Botanical Causes
Bacteria, lichens, mosses and fungi

- Bacteria and lichens produce acids which react chemically with the building materials
- Algae, moss and lichens produce humus in which larger and more damaging plants can grow
- A build up of these can cause retention of moisture in the building materials

Terracotta temples of Maluti in Jharkhand

The slide features two photographs: the top one shows a close-up of a terracotta surface heavily covered in white, fuzzy growth (likely fungi or lichen), and the bottom one shows a wider view of several terracotta temples in Maluti, Jharkhand, with significant green moss and vegetation growing on their roofs and walls.

In this category also comes the bacteria lichens, mosses and fungi it is a it is a huge family and as I can see there this is the terracotta temples of Maluti in Jharkhand beautiful a groups of hundred temples more than hundred and they are on a tentative list, world heritage list, it is in the Jharkhand border and this is another picture that where the mosses and fungi are sort of affecting the timber surface.

As I see these mosses, fungi, lichens and bacteria there are various species, various categories, various types and each has their own favorable habitat, favorable environment and also their remedial measures also vary and until and unless we really specifically know, so, we need the expert advice depending on which type and which species it can be tasted and they have their pores and this pores can lie dormant for some

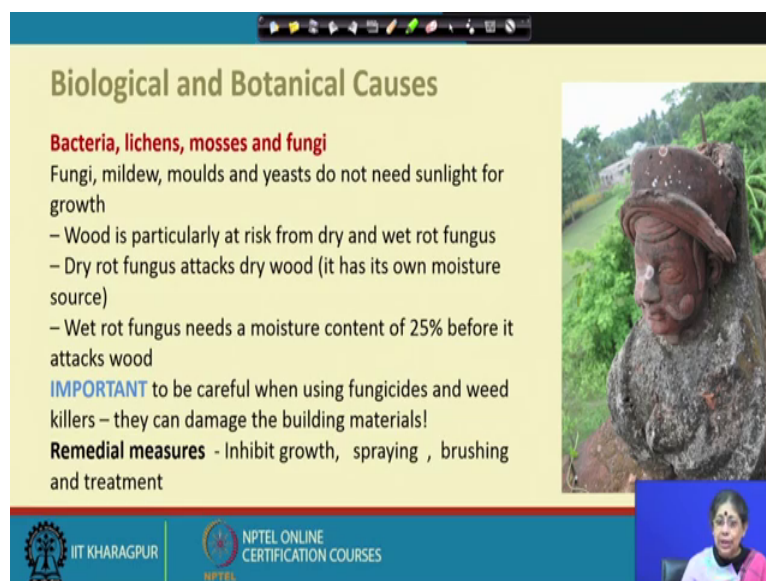
time and they can sort of depending on the environmental condition they again can sprout.

So, I have just give a brief introduction to this category. The bacteria lichens produce acid and this is quite dangerous which react chemically with the building materials and it is not only that it looks bad , but just to cushion or cleaning it, but actually it reacts chemically with the material component and the fabric and which is something which is quite alarming.

So, algae, moss and lichens produce the humus in which larger and more damaging plants can grow. As I say that they are all interrelated, so, they produce something and on which the other plants sort of grow and then they give the roots. So, it is all interlinked. A buildup of this can cause retention of moisture in the milling, which is again as I we talked about the moisture and how it can be very damaging for the entire fabric.

You can see that not only these places are covered with the lichens and other thing they are also the trees and other things saplings are going on the roof and ultimately it will cause that roofing system to crack and the roots will penetrate and the moisture will develop. So, there will be a water seepage ultimately it becomes an unmanageable things.

(Refer Slide Time: 26:18)



Biological and Botanical Causes


Bacteria, lichens, mosses and fungi

Fungi, mildew, moulds and yeasts do not need sunlight for growth

- Wood is particularly at risk from dry and wet rot fungus
- Dry rot fungus attacks dry wood (it has its own moisture source)
- Wet rot fungus needs a moisture content of 25% before it attacks wood

IMPORTANT to be careful when using fungicides and weed killers – they can damage the building materials!

Remedial measures - Inhibit growth, spraying , brushing and treatment



The slide is a presentation slide from NPTEL. It has a yellow background with a blue header and footer. The title 'Biological and Botanical Causes' is in bold black text. Below it, 'Bacteria, lichens, mosses and fungi' is in red. The text describes the growth of fungi and the risks of dry and wet rot. It includes an 'IMPORTANT' note about fungicides and 'Remedial measures'. A photo of a lichen-covered statue is on the right. The footer contains IIT Kharagpur and NPTEL logos.

As you can see that this is a beautiful a small temple near Panskura in Bengal, West Bengal and on the roof of the temple it is actually a rush mansion it is a beautiful terracotta figurine and which has an influence of the European influence you can see the dress and other things the figures and it is totally damaged by the most fungi and other types and depending on the whether it will again sprout and it will become active.

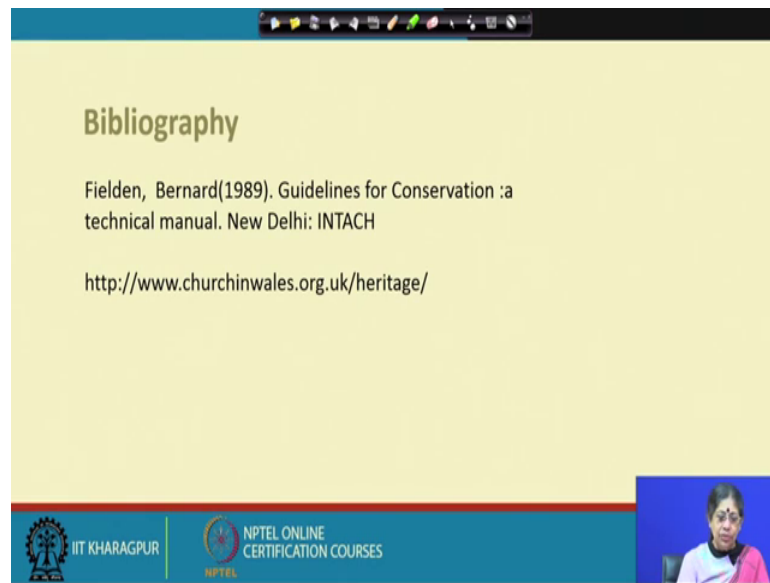
So, the fungi will do moulds and yeasts they do not need sunlight one must understand that that they also as I say there they have their own habitat. So, we also know the wood is particularly at risk from dry and wet rot fungus. So, we have to understand some of the principles that which type of environment is suitable for them. So, that we have to ensure that this does not happen and dry rot out fungus attack. Generally, the dry rot it has it is own moisture source and wet rot fungus needs a moisture content of 25 percent before it attacks the wood.

So, again I am saying that it is just a very cursory introduction, but one has to understand that what are their favorable condition and see that this does not happen. What is important is to be careful when use the fungicides and weed killers it is, again and again I am saying it is very easy to go and buy something and use the fungicide, but it can also be damaging to the building materials and a very freshest fabric which probably irreversible.

So, one need a specialist advice and see that what is the maintenance and management policy. As I say sometimes a regular maintenance management and with some of the good expert advice it is very very sort of easy sometimes to keep the building or the historic fabric preserve it in its existing state. Not allow these type of aspects animals or plants to as I say they are interrelated to take the fabric to such a state that there is no going back.

As I say that one has to inhibit the growth the spraying with proper treatment material proper chemical, then after that brushing and treatment under an expert advice these are important and this can be taken as from the expert and taken as a maintenance regular maintenance policy and used.

(Refer Slide Time: 29:10)



Bibliography

Fielden, Bernard(1989). Guidelines for Conservation :a technical manual. New Delhi: INTACH

<http://www.churchinwales.org.uk/heritage/>

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

I have used mainly so, Bernard Fielden's Guidelines for Conservation for this part and this reference. So, we have briefly discussed the biological and the botanical causes and the animals and different types of fungus and what they can do the type of damage as I see that they are all interrelated factors, some of the major causes of decay which can happen and which can be prevented and taken care of and one has to think about a proper balance between the human life the visitors, the maintenance of the historical fabric, the protection of the animals.

So, there are very laws and very many laws that. So, we have to take a balanced view and with the proper expert advice and proper maintenance policy, this is possible to keep the historic fabric in our proper state.

So, next lecture we will talk about other types of decay, what damages the historic fabric.

Thank you.