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Woody Plant Physiology

Unit Code: A/602/3922

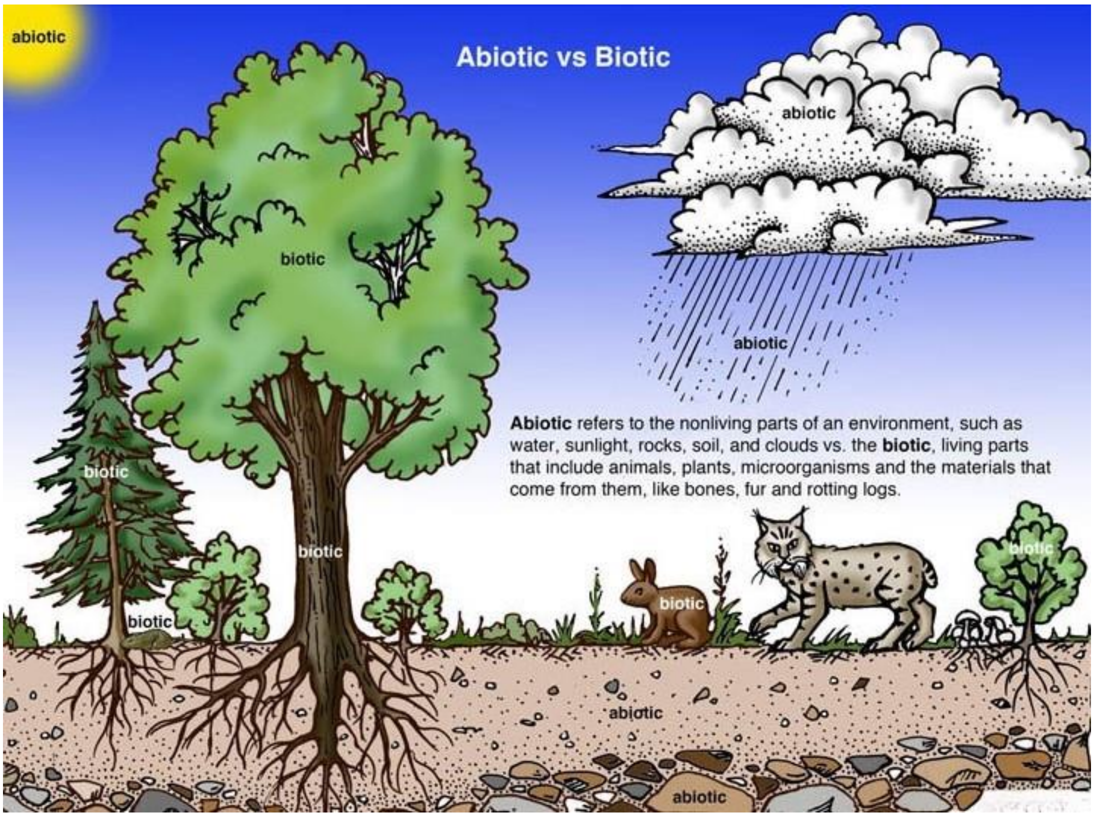
UNIT GUIDE 2023-24

LO 8 Understand the causes, prevention, or control of ill health in woody plants

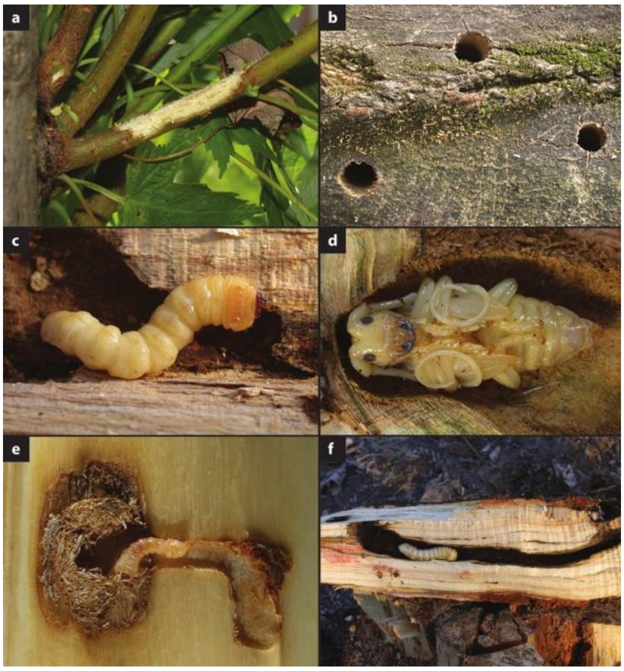
8.1. Identify the signs or symptoms of a named pest, disease, and abiotic disorder

The word **pathology** comes from two Greek words, “pathos” (suffering), and “logos” (study). Therefore, plant pathology is the study of the suffering or diseases of plants. Pathogenic organisms like fungi, bacteria, viruses, protozoa, insects, and parasitic plants are the primary causes of infectious plant illnesses.

Physical evidence (sign) of the pathogen is indicative of a plant disease.
Fungal fruiting structures, for instance, are indicative of illness. The powdery mildew on lilac leaves is a parasitic fungal disease organism.
An obvious consequence of a disease on a plant is called a symptom. A noticeable shift in the plant's colour, shape, or function because of the pathogen's attack could be one of the symptoms.
If external conditions cause a plant's physiological processes to change, disrupting its structure, development, functions, or other characteristics, the plant is said to be vulnerable to infection. Plant diseases are categorised as either infectious or non-infectious based on the type of agent that causes them. The disease's aetiology (study of causes), kind, and impact site location may all affect the symptoms.
Plant diseases can occur through both biotic and abiotic causes. Unfavourable growth conditions are the root cause of non-infectious illnesses, which do not spread from a sick plant to a healthy one. Conversely, as the infectious agent can replicate within the plant or on its surface, infectious illnesses can transfer from one susceptible host to another.
The intensifying effects of global climate change have had a detrimental effect on the growth and development of woody plants in recent years. These stresses include biotic (fungi, bacteria, viruses, and insects) and abiotic (salinity, drought, flooding, low temperature, high temperature, UV radiation, and heavy metal toxicity). To adapt to changes in their environment, woody plants, being perennial species, have developed sophisticated physiological and molecular processes.



Wilting, spotting (necrosis), mould, pustules, rot, hypertrophy, and hyperplasia (overgrowth), deformation, mummification, discoloration, and destruction of the affected tissue are some of the symptoms of plant diseases. The reduction of turgor pressure within the tissues and cells causes wilting. Both biotic and abiotic elements are responsible for it. The primary cause of spotting is partial plant tissue loss brought on by biotic causes. Fungal damage to a plant results in the formation of mould and pustules. Rot causes the intercellular material and cell membrane to be destroyed (fungal dry rot), as well as the death of the intracellular contents (bacterial wet or fungal dry rot). Pathogen-induced excessive growth and proliferation of the afflicted tissue are represented by hypertrophy and hyperplasia. Deformations, such as threadlike leaves, ugliness in fruit, and double-floweriness, can result from a variety of biotic and abiotic factors, such as an outflow of photosynthesis products, an uneven nutrient intake by the plant, or uneven growth of different tissue elements. The fungal mycelium damages plant organs during mummification, causing plants to shrink, darken, or compress. Chloroplast malfunction and insufficient chlorophyll content in the leaves are the usual causes of colour changes, which show up as light colouration in certain leaf sections (mosaic discolouration) or the entire leaf (chlorosis).
Infectious agents can be spread by air, water, animals, and humans. They can also linger infectiously for several months or even years. Soil, water, and animals, particularly insects, are the natural reservoirs of infectious agents.
One of the most prevalent urban illnesses is wood decay, which is also one of the most significant diseases since it weakens wood and can lead to tree failures. Because it results in a gradual deterioration of the wood's strength and cell walls and might interfere with sapwood function when living cells respond or are killed by the increasing decay. Certain types of wood decay fungi are referred to as canker rot because they can both degrade wood and bark. Most tree failures are caused by decay, frequently in conjunction with other tree flaws. Woody roots, trunks, and branches are susceptible to decay.
A symptom is something that appears abnormal or out of the ordinary; it is the result of the pathogen, or disease-causing agent, on the host. Conversely, observable indications of the pathogen, such as wood-decaying conks, mycelial fans, rhizomorphs, and mushrooms, are signs.
Insect herbivore pests are a significant emerging danger to urban trees' survival and health. Plant-insect interactions in natural forests and urban trees are significantly impacted by changes in environmental conditions brought on by climate change. Many urban woods lack plant diversity and complexity. As a result, urban woods are more sensitive to insect infestations than their natural counterparts. Due to their numerous host species and genera, the pest species Asian longhorned beetle (Anoplophora glabripennis) and citrus longhorned beetle (A. chinensis) are considered to be among the biggest risks to the urban (and natural) tree landscape in the future. Even though Paddock Wood, Kent, England, experienced one outbreak (breeding population) in 2012; after swift eradication, yearly surveys have not shown any sign of its continued presence. Individual beetles have also occasionally been recorded in the UK. The larvae, sometimes known as grubs, of ALB consume living trees' wood by tunnelling through galleries or trunks. The galleries can reach the heart wood from the outer layer, also known as the cambium layer, and a serious infestation can cause the tree to die. The larvae need living wood tissue, but they can survive in the wood of freshly felled trees. Analysis of climate data suggests that south-east England and the south coast are at greatest risk.



8.2. Give an example of a principal decay causing fungus for each named colonisation strategy

All wood decay is caused by fungi. The two primary categories of fungi that cause wood rot are Ascomycota, also known as ascomycetes, and Basidiomycota, also known as basidiomycetes. The most frequent cause of wood degradation is by far the basidiomycetes. Most arborists are familiar with the fungi in this group as conks (Figure 1a) and mushrooms (Figure 1b) that sporulate on tree roots' trunks, stems, and/or ground. While foliar cankers, wilts, and blights are more commonly associated with ascomycetes, certain ascomycetes play a critical role in the degradation of wood.

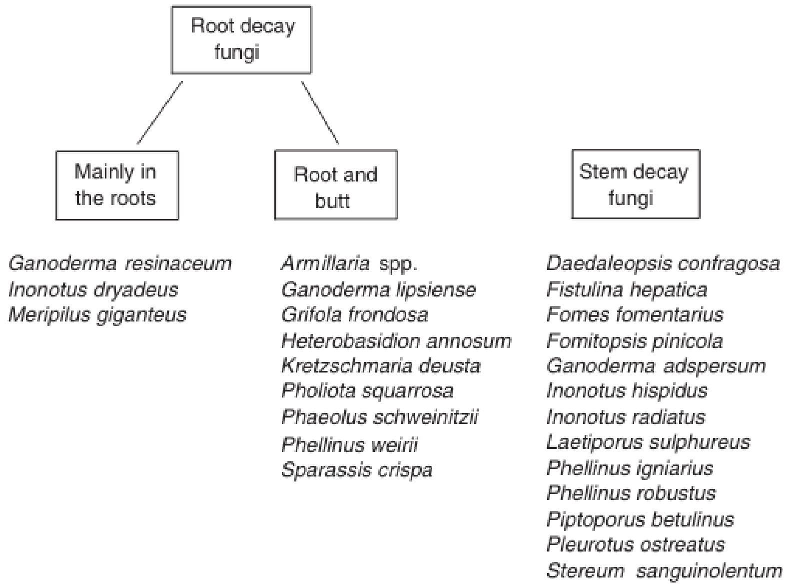


Figure 2 Classification of decay fungi according to the position of rot within the tree. Reproduced with permission from Schwarze FWMR, Engels J and Mattheck K (1999) *Hozzersetzende pilze in Baümen – Stralegien der Holzzersetzung*. Rombach, Freiburg, Germany.

(Figure 1a) The artist's conk, **Ganoderma applanatum**, is a frequent source of white rot in urban trees.

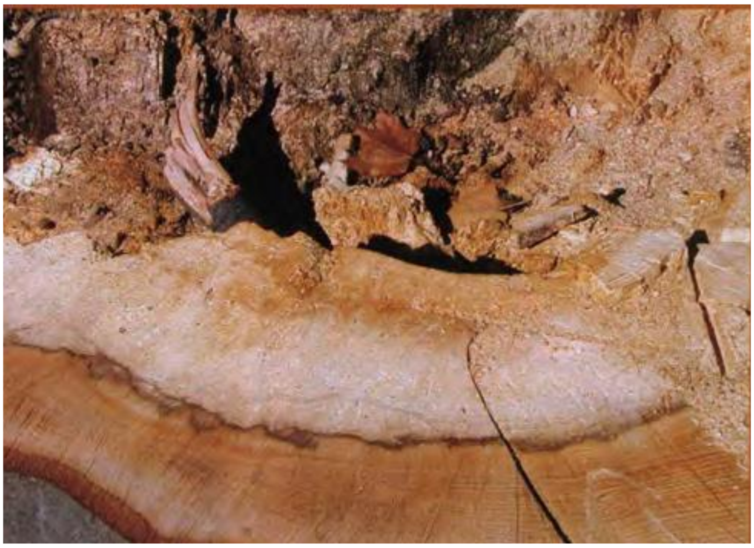
(Figure 1b) mushrooms that sporulate on tree roots' trunks, stems, and/or ground.

White Rot

White rot is mostly caused by decaying fungi on deciduous trees. Before or while they remove the cellulose component of wood, white rot fungi also remove the lignin. When lignin is removed in the later phases of the decay process, the wood appears pale white or bleached because lignin is brown or dark in colour (Figure 2a). The ubiquitous and well-known white rot fungus on deciduous trees is called **Ganoderma applanatum**, or the **artist's conk** (Figure B).

White rot-affected trees are more prone to demonstrate adaptive growth, or active localised growth responses to stress, which can result in variable degrees of stem swelling or changes to the bark's characteristics. White rot has been connected to bottle butt, a peculiar swelling at the base of trees.

(a) White rot fungi break down cellulose and hemicellulose while also eliminating lignin. The result is the bleached or pale wood that is characteristic of decay in its mature stages.



(b) White rot is caused by most decaying wood fungi. **Ganoderma applanatum**, is a frequent source of white rot in urban trees.

Brown rot

Brown rot is caused by far fewer fungi than white rot, and most of them target conifers. The cellulose components of wood are eliminated by brown rot fungi, leaving behind modified brown lignin that gives the decay its distinctive colour.

(a) For both deciduous and coniferous trees, the sulphur shelf fungus, **Laetiporus sulphureus**, is a frequent cause of brown rot.

(b) Another common brown rot on conifers is **Phaeolus schweinitzii**.

Soft rot

While certain basidiomycetes promote degradation that resembles soft rot, the ascomycete decay fungus is the primary cause of soft rot. Like brown rot, soft rot fungus attack by mainly breaking down cellulose. The cellulose in woody cell walls is attacked by soft rot fungi, which results in tiny holes in the secondary wall. When soft rot reaches an advanced stage, its colour resembles straw, making it challenging to visually distinguish it from white rot. Since soft rot in living trees is not notably softer than other types of decay, the common name is inaccurate. The term refers to wood-softening degeneration caused by other ascomycetes, which are not widespread on living urban trees. One of the most common wood decay fungi that cause soft rot in living urban trees is Ustulina deusta.

(a) Soft rot degradation resembles white rot but is more comparable to brown rot due to the fungus' attack on wood.

(b) **Ustulina deusta**, an ascomycete fungus, is a common cause of soft rot.

Decay Symptoms in Living Trees
Most of the urban tree decline occurs when there are no wood decay conks or fruiting. When there are no conks or mushrooms present, arborists often use signs of degradation to indicate their existence. Positive indicators point to the presence of degradation. Possible signs point to the possibility of worsening.

(a) Positive signs of decay, such as exterior cavities, indicate that decay is present.

(b) Possible indicators of decay—signs that emerge from decay or from a tree's response to deterioration—indicate the possibility of degradation. Bulges in the stems are a good indicator of degeneration.

Conks or mushrooms; exterior cavities that show visible signs of decay in exposed wood; and activity or nests of carpenter ants, birds, or mammals in rotted wood are among the few good markers of degradation. The list of possible signs is longer and includes a variety of bark breaches, such as ancient wounds, topping or heading cuts, and huge cankers that reveal sapwood or heartwood. Other possible signs include fractures or seams caused by decay, or stem swellings, bulges, or flattening caused by the tree's response to the deterioration. Arborists value indicators of decay because they help them identify trees that may or may not be decaying and may need further examination. Indicators can also help you determine where to test for deterioration in a tree. Indicators of decay are especially significant in risk assessment and for arborists working with trees, because failing to recognise their significance might put clients or tree workers at risk.

Naming Decay

Once decay has been established, naming it according to its location within the tree is a straightforward convention. Although simple, the naming strategy is far from ideal. While some fungi that cause root rot just damage the roots, others can also cause the base of the tree to rot. The bottom trunk of trees is usually home to the butt rot fungus. But some fungi are even capable of rotting a tree's trunk and massive buttress roots.

Naming decay in trees

Root rot—decay in roots. Root decay develops from the bottom of roots up and may or may not produce visible crown symptoms.

Butt rot—decay in the butt or lower trunk and base of the tree.

Heart rot—decay in the centre of the tree.

Trunk rot—decay above the lower trunk.

Branch rot—decay in larger branches.

Sap rot—decay in sapwood after bark and cambium have been extensively damaged or killed. Sap rot is evidenced by the presence of numerous, small fruiting structures.

Fungi that cause butt rot are typically found in a tree's lower trunk; however, they can also eat away at roots. It is also known as heart rot since most of the degeneration occurs in the middle of the stem.

Classifying by location can also be a little misleading. For example, some fungi are also capable of decomposing sapwood. Once established, several fungi that induce sap rot can also kill the cambium and weaken the wood of living stems. Because sap rots can decompose dead stems' heartwood, they are essential natural wood recyclers.

The presence of several tiny fruiting bodies is indicative of sap rot. Fungi that cause sap to rot suggest that the branch may be entirely decomposed and that the bark and cambium are dead, at least where the fruiting bodies are.

Arborists value determining the location of deterioration for various reasons, despite its ambiguity. The presence of conks or rot in a tree's butt suggests potential deterioration in the larger buttress roots. Conks or mushrooms on roots indicate deterioration, which can extend to the base of the trunk. Both options should be explored. Arborists should not use a rope or rely on branches with sap-rot fruiting structures, as they may be fully degraded.

Life Cycle of Wood Decay Fungi

Infection of Wounds

Many fungi that cause wood deterioration enter tree stems or roots via wounds that expose sapwood or heartwood; however, these fungi cannot infect plants via unbroken, living bark. Trees can be wounded through several means, including fire, pruning, arboriculture treatments (e.g., drilling into stems for cabling, bracing, or injection), and scrapes that remove bark and expose sapwood or heartwood. A few fungi can enter the main stems via small diameter branches. **Phaeolus schweinitzii**, a conifer root decay fungus, can infect roots via cambium and dead bark caused by the fungus Armillaria, which causes root disease.

Decay of Wood

Wood decay fungi grow microscopic hyphae (single, segmented strands of a fungus) between cells, in the lumen, or centre, of woody cells, and inside cell walls. Fungal invasion and decay of wood occur predominantly in non-living, structural wood fibres and nonfunctional water-conducting tissues, which are also known as apoplastic trees or wood decay fungi. Hyphae emit enzymes that break down lignin and cellulose. Certain fungi responsible for wood degradation actively enter and destroy living cells in the sapwood. On the other hand, few decomposing fungi cause damage to healthy bark or cambium, and they seldom attack living ray cells.

Tree Reaction to Decay

Most arborists employ a model called the compartmentalization of decay in trees, or CODIT, to describe how trees respond to and manage the invasion of decay fungus. The finding of reaction zones prior to the progression of decay suggests that sapwood reacts actively to decay everywhere, even outside the well-defined bounds of CODIT. Reaction zones are areas of discoloured sapwood where there may have been chemical alterations, such as an increase in antifungal compounds like polyphenols.

According to another theory, the high moisture content of sapwood prevents degeneration of the heartwood and inner sapwood. The low oxygen and high carbon dioxide levels produced by functioning (water-conducting) sapwood are thought to hinder the formation of decay fungus. Understanding the mechanisms underlying the decay response in living trees is critical for developing intelligent decay management strategies. For the time being, CODIT provides a good generalised model of how trees respond to wounds and, if degradation occurs, to them.

Spread of Decay Fungi

Most rotting fungi spread via ascospores or basidiospores released from fruiting structures on living or dead plants. A single conk can disperse millions of spores. Conk removal will halt one spore supply, but it will not prevent the tree's interior degradation. Almost all fungi that cause wood degradation are saprophytes, which means they consume wood and non-living trees for food. Almost all decaying wood fungi can produce fruit or spores on decayed woody tissues or dead trees. Thus, eliminating large, woody roots, stumps, and dead trees can help prevent the spread of some fungi that cause root deterioration while also removing a source of wood for the fungus to sporulate on. Wood-rotting fungus can spread by a variety of additional mechanisms. Some root decay fungi can spread through root contact with nearby trees. Insects can also spread decay; at least one decay fungus (Cerrena unicolor) is spread by a horntail wasp that oviposits on vulnerable trees. Armillaria is also well known for spreading in soil from infected roots and stumps by vegetative rhizomorph growth.

Significance of conks on living trees

If you detect conks or mushrooms attached to the woody stems or roots of living trees, it means the tree is deteriorating. Determining the type of wood decay fungus present, as well as any other characteristics known about a given fungus, can sometimes help determine the state of decay. The appearance of specific conks may indicate how much degeneration there is. For example, serious internal degeneration is commonly associated with Ganoderma applanatum. Where Ganoderma applanatum's conk is connected to the tree, rot is usually more advanced. **Polyporus squamosus**, a scaly polypore, is commonly associated with wounds caused by pruning or other injuries, as well as limited degradation around the site. However, Polyporus squamosus is regarded as an important decay fungus in Europe, causing stem fractures. However, most conks simply indicate that the tree has internal degradation, and the extent needs more testing.

8.3. Give an example of a woody plant fungus for each named type of rot

Please see 8.2 where each Fungai is explained and shown in pictures.

White rot = **Ganoderma applanatum**
Brown rot = **Laetiporus sulphureus, Phaeolus schweinitzii**
Soft rot = **Ustulina deusta**

Root rot = **Phytophthora**
Prolonged waterlogging can result in phytophthora infection. Severe infections cause Phytophthora to infiltrate the plant's collar or stem base, resulting in a brown or black discoloration beneath the bark that is sometimes observed as an inverted "V" at the stem base. Bark discoloration and/or weeping may be outward signs of infection in this location, while these symptoms can also be brought on by other conditions like drought, waterlogging, or pest infestation.

Yellow Yew tree is affected by **Phytophthora** root rot and will likely turn brown and die.

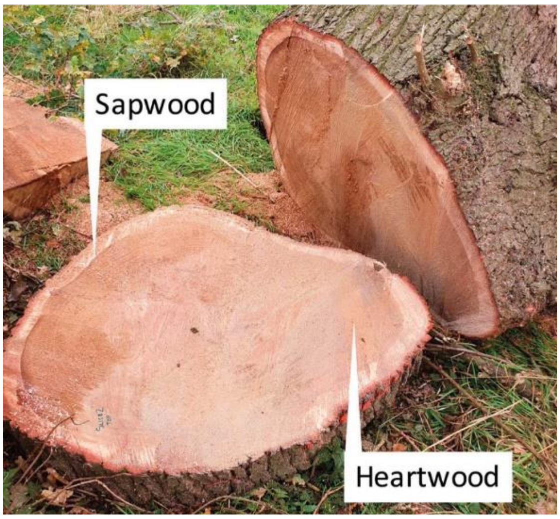
Butt rot = **Heterobasidion annosum** (H. annosum); 'Conifer rot'
It is caused by the basidiomycete fungus Heterobasidion annosum (H. annosum), which attacks the roots, butts, and stems (trunks). The fungus previously had the scientific name Fomes annosus.
The fungus is present in the UK and continental Europe.
There are high levels of H. annosum infection in continental Europe, and there is a risk that spore levels in the UK's conifer forests might increase over time, causing more trees to become affected.
Tree stumps left over from recent clear-cutting or thinning procedures become colonised by the fungus.
It descends via the stumps of the roots.
If the roots of infected stumps meet the roots of living trees, the living trees may become affected. It is known as conifer root and butt rot because it degrades many coniferous species' lower stems.
In susceptible locations, it destroys pines or trees in the Pinus genus.

Heart rot = The two main heart-rotting species in oak trees are **Laetiporus sulphureus**, also known as chicken-of-the-woods, and **Fistulina hepatica**, often known as the beefsteak fungus. These species are typically seen growing from trunks or larger branches.

Over time, heart-rot fungi can grow over sizable sections of heartwood, and as the wood deteriorates and loses structure, they can form hollows. Eventually, all that is left is an empty space where the heartwood used to be and a very thin coating of bark and sapwood. In severe situations, as in the case of the Lady in Waiting Oak, most of the trunk's heartwood may be destroyed; despite some loss of sapwood and bark, the tree can sustain itself and grow for many years.

The Lady in Waiting Oak on the Cowdray Estate, Midhurst, West Sussex. The heartwood of this tree has rotted away to leave four pillars of cambium supporting the crown and a deep pile of woody mulch. (© Rich Wright)

Fistulina hepatica on oak.



Trunk rot = Thielaviopsis trunk rot is caused by the fungus **Thielaviopsis paradoxa**

The disease causes the palm trunk to either collapse on itself or, abruptly and often without notice, the canopy to fall off the tree. When it comes to collapse, the palm canopy could seem healthy.
Aside from stem bleeding, which is typical in Cocos nucifera (coconut), there could not be any indications before the palm collapses.
Since the fungus only infects recently healed trunk wounds, disease management involves restricting artificial wounds to the palm trunk, particularly the upper third of the trunk.
This condition has no known cure or preventative measures. The infected trunk section should be destroyed rather than recycled, and the palm should be cut off right away.

An example of "stem bleeding" on a Cocos nucifera trunk. The top of the blackened area was very soft and could be easily pushed in with the fingers. Photo by M. L. Elliott.

<u>8.4. Identify the significance for each a named pest, disease and abiotic disorder when found on a tree</u>

Pest

Between 1876 and the 1920s, **grey squirrels** (Sciurus carolinensis) were brought to Britain. Since then, they have spread quickly, gradually displacing the native red squirrel due to a combination of food competition and squirrel pox virus transmission. In wooded environments, grey squirrels can do significant damage by removing bark from tree branches and main stems. Serious damage can occur to a wide range of tree species, including oak, birch, larch, pines, and Norway spruce. Usually, beech and sycamore trees sustain the most damage. Serious lesions to the bark can kill the tree and cause distortion, discoloration, and deterioration of the lumber. Landowners attempting to build fresh wood are now seriously discouraged from doing so due to squirrel damage. Bark stripping damage lowers the value and yield of the timber by causing structural flaws and discoloration (caused by fungal infection). Trees with ring bark may break at weak spots in their stems, and they will eventually perish. Damage is unpredictable and varies between locations and years. The most vulnerable trees are those between the ages of 10 and 40. Sycamore, beech, oak, sweet chestnut, pine, larch, and Norway spruce are among the thin-barked species most at risk.

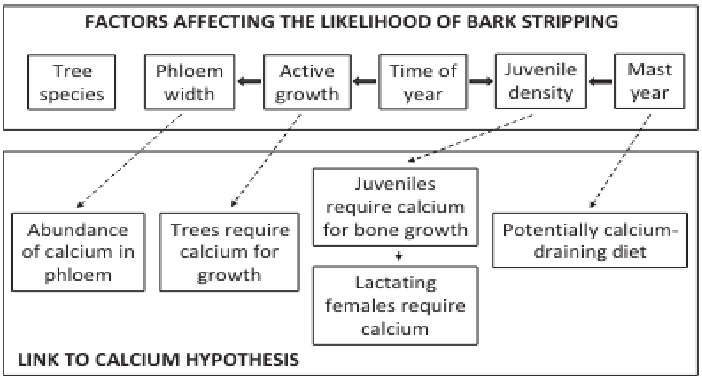
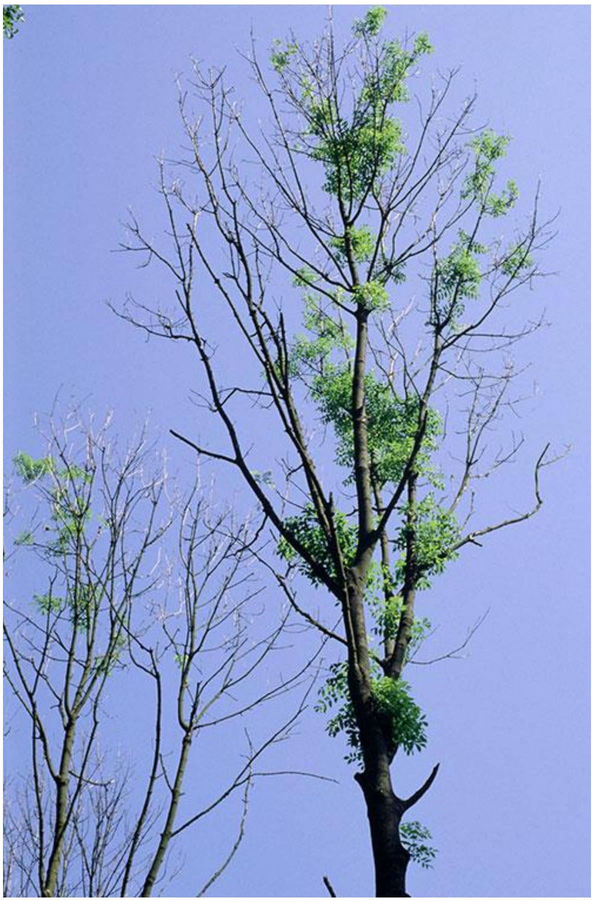


Fig. 1. The link between factors affecting the likelihood of bark stripping and the Calcium Hypothesis that grey squirrels damage trees to ameliorate a seasonal calcium deficiency.

Disease

The fungus **Chalara fraxinea** is the source of the ash dieback disease that affects ash trees. Infected trees have leaf loss, crown dieback, and frequently die because of the disease. The symptoms of Chalara fraxinea, which affect ash trees, are now common in Europe. In 2012, the disease was discovered in Britain, first in a shipment of infected trees that were sent from the Netherlands to a nursery in the south of the country, and then in trees that were planted in their natural habitat. Ash dieback disease has now been found in over 150 sites in England and Scotland, including well-established woods, according to surveys. As part of the national emergency protocol, Chalara fraxinea is being treated as a quarantine pest. The following are the indications and symptoms:

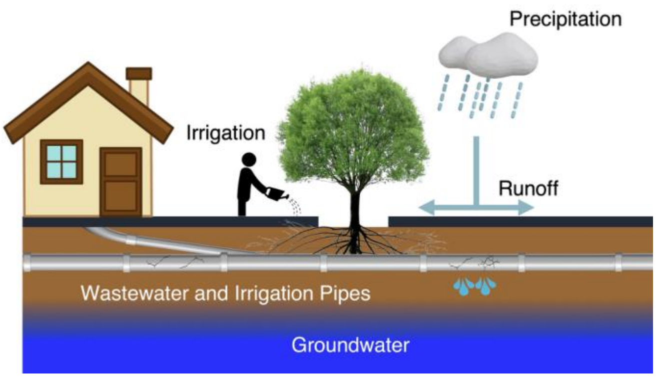
- Mid- to late-summer leaf withering and blackening
- Dark spots on the bark, often shaped like diamonds
- Some spots may dry out and split the bark.
- Dead leaves and shoots at the top and sides of the tree



Abiotic Disorder

Water for street trees

The majority of the global population currently lives in cities in will increase according to United Nations Department of Economic and Social Affairs Population Division. Harmful urbanisation-related environmental conditions that urban residents must deal with, such as increased heat exposure, poorer air quality, and a greater risk of flooding, can harm public health and well-being. As a result, cities are searching for targeted ways to lessen the negative effects of urbanisation on the environment. One such technique that has gained great acceptance worldwide is planting trees. Urban populations benefit greatly from trees because they regulate the climate, reduce the risk of flooding, improve physical and mental health, and may even be able to remove airborne contaminants. The focus of tree planting campaigns is on street trees, which are characterised as trees restricted to tree pits and planters and maintained by networks of multi-stakeholder governance in public rights-of-way. To realise the ecosystem service benefits associated with tree planting initiatives, however, a better understanding of street tree management, maintenance, and resource acquisition is required. This is because street trees have high mortality rates, particularly among large, mature trees and recently planted saplings. Water availability is a major barrier to the development, health, and survival of urban trees. Water flows differently as a result of urbanisation because it is pumped, piped, added, removed, and diverted to satisfy population and economic demands. Cities' comparatively large percentage of impermeable surfaces raises surface runoff, which may prevent street tree roots from receiving precipitation that has seeped through. Residents and stakeholders may be encouraged to water in cities because they frequently lack specialised irrigation techniques for established vegetation. On the other hand, seedlings receive most of the domestic irrigation for public street trees. Groundwater sources may be used by certain trees in urban green areas and natural ecosystems; however, compaction and limited soil volume may prevent street trees from accessing groundwater. Through soil leakage or root infiltration into pipes, introduced water sources from below-ground water and sewer lines make up new water sources for street trees. For managing street trees and conserving water, it is crucial to know which of the several possible water sources are used by street trees.



Symtoms of drought:

The colour of the leaves might be pale, dark, or yellowish. One essential component of photosynthesis is water. Water limitation causes photosynthesis to sputter and leaves to lose their vibrancy, much like a restricted power flow dimming a lightbulb.

The leaves are twisted, wilted, or limp. There are thousands of plant cells in each leaf. Consider every cell as a little balloon. When leaves are "inflated" and protrude horizontally, it indicates that the cells are filled with water. The cells "deflate," and the leaves start to droop or curl if the amount of water decreases.

Affected trees have less energy to photosynthesize and produce more energy for themselves if drought stress lasts into late summer. Certain trees have an early dormant season, with autumn colours appearing in August or September. The tree is reducing its losses now in the hopes of having a more "profitable" growth season the following year. The leaves of the tree are small, and the canopy is small. This symptom is indicative of ongoing stress from past dry years. Trees under prolonged drought stress may produce fewer and smaller leaves in the spring because they have less energy to grow new leaves. Twigs can be fragile or rigid. Thousands of plant cells also make up woody stems. Water that is flush with woody cells functions as a lubricant, enabling twigs to bend and flex. Woody cells get rigid when they dry up. If branches break easily in your hands, your tree is severely stressed by the drought. The leaves seem burnt, shrivelled, or brown. This represents a sign of severe drought stress. The summer heat practically cooks cells to death when wilting leaves are stripped of all their water content. The leaf overheats in the sun. You most likely have fragile twigs if your leaves are brown. The tree may be dead in affected areas. Bark cracks. This is yet another sign of a catastrophic drought. The bark will split, fracture, and come away from the trunk if the living cells behind it die off. The future looks bad if the trunk of your tree is this dry.

8.5. For each named pest, disease, and abiotic disorder, identify a preventative or cultural or chemical control measure

Grey squirrel **pest** management UK
A regulation that forbade their importation and retention in Great Britain was passed in 1937. Because of their detrimental effects, they are currently categorised as **invasive non-native species in the UK** (invasive alien species in the EU).

- Land managers, conservationists and volunteers currently use approved trapping or shooting methods to humanely manage grey squirrel numbers.
- Fertility control that would provide a non-lethal management strategy that is both efficient and requires less work.
- Life traps and kill traps (https://www.britishredsquirrel.org/wp-content/uploads/2019/09/TRAPS-.pdf)
- The use of air rifles is another method for managing grey squirrel numbers.
- Capsaicin mixed with wheat derived from chilli peppers (Capsicum sp.) was the most effective treatment and showed the greatest potential as a repellent.

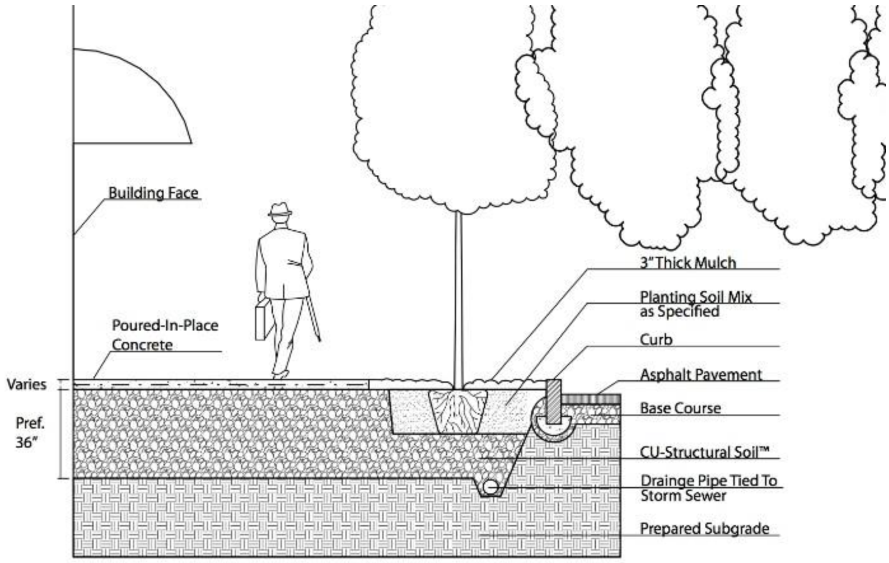
Ash dieback (hymenoscyphus fraxineus) **disease** UK
Since Dutch elm disease was discovered in the 1960s, ash dieback, has been the most serious tree disease to impact the UK. It has the potential to infect over two billion ash trees1 (about 1.8 billion saplings and seedlings to more than 150 million mature trees) across the nation, which will result in the decline and potential mortality of most ash trees in Britain. Currently there is no cure.

- By gathering the fallen ash leaves and burning, burying, or deep composting them, gardeners and managers of parks and other locations containing ash trees can help halt the local spread of ash dieback. The fungus's life cycle is thrown off by this.
- Given that the disease kills or weakens trees, owners of ash trees in woodlands, parks, and near roads, railroads, walkways, parking lots, etc. are likely to have public safety as one of their top management concerns.
  Because of this, trees in places where a lot of people visit should be closely watched for hazards to public safety. If risk assessments reveal that a tree poses a concern, it may be necessary to cut it down or prune it. When evaluating the health of trees, keep an eye out for any indications of lesions (cankers) or honey fungus (Armillaria) close to the base of the trunks. These conditions can weaken the trunks and increase the risk of a tree falling.
- Preventing and minimising spread: It is possible to reduce the spread of Chalara ash dieback and other plant diseases by encouraging people to visit woodlands, forests, parks, and public gardens. Before departing the location, they can accomplish this by cleaning dirt, mud, twigs, leaves, and other plant material off their shoes and wheels, including those of cars, bicycles, mountain bikes, strollers, and infant buggies. Before going to another location that is comparable, they ought to wash these things at home. When visiting such sites, try to park cars on hard-standing surfaces like tarmac, concrete, or gravel instead of grassy areas. A lot of mountain bike paths are in forests, and we highly recommend that riders use the restrooms that are offered at many trailheads before they depart. To avoid unintentionally bringing Chalara or any other plant disease into the forest, if you do bring a dirty bike, please use the wash-down area before entering.
- Research: however, by keeping as many ash trees standing as possible, we can identify individuals which appear to survive exposure to the fungus and which can be used for breeding tolerant ash trees for the future.

Managing and watering street trees **Abiotic Disorder**

- Volunteers and community engagement to look after street trees water, condition, and health
- Waterbags or waterpipes for newly planted trees
- The tree species' feature about water use (High, Medium, Low)
- The water that the tree has access to-stressed trees require less water than those that have easy access to it.

- Tree size: the most important measurement is the crown area
- The Leaf Area Index (LAI) indicates the area and density of leaves.
- Evaporative demand and site climate
- The state or well-being of the tree
- The tree's developmental stage
- Research in managing street trees and urban environment
- Engineering solution to highway street trees and kerf, footways, and pathways
- Tree based solutions to planting systems and space for newly planted trees
- Root pruning
- Root shaving.
- Root barriers and root guidance panels.
- Excavation beneath the roots damaging the footway.
- Tree growth retardant.
- Creation of larger tree pits around existing trees.
- Heavy tree crown reduction/pollarding to stunt tree growth.
- Retain dead, dying, dangerous and diseased trees for their habitat value.



A range of compactable aggregate and soil mixtures that preserve a sizable amount of void space while still being solid enough to sustain pavement are referred to as structural soils. The method was developed in Europe to increase tree survival rates in urban areas. Water can seep right into the root zone when combined with permeable pavement or cobblestones.

The constraints of traditional surface-water drainage techniques have been made worse by drainage issues brought on by increased urbanisation. When it comes to managing stormwater in urban settings, street trees can be crucial elements. Conventional surface water runoff drainage systems are made to move rainfall as quickly as possible from the place it has fallen to a river or a soak-away. This technique raises the dangers of flooding, environmental harm, and diffuse pollution in cities because runoff water typically contains pollutants such chemicals, heavy metals, oils, fertilisers, pesticides, and other urban debris.

Using constructed tree pits, which increase the availability of high-quality soil to support optimal root growth and increase runoff infiltration, is a new way to enhance street tree growth and reduce urban stormwater runoff.

Sources

https://mrec.ifas.ufl.edu/lso/SCOUT/Plant%20Pathology.htm
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7604890/
https://www.canr.msu.edu/news/signs_and_symptoms_of_plant_disease_is_it_fungal_viral_or_bacterial
https://www.uky.edu/Ag/Entomology/PSEP/cat2disease.html
https://joa.isa-arbor.com/browse.asp?Journals_ID=1
https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/decay-fungi
https://www.umass.edu/urbantree/factsheets/25wooddecayfungi.html
https://arboriculture.wordpress.com/category/fungi-2/colonisation-strategies/#:~:text=There%20exist%20four%20different%20colonisation,et%20al.%2C%202000)
https://arboriculture.wordpress.com/2016/02/24/fungal-colonisation-strategies-pt-iii-specialised-opportunism/
https://faithwongblog.wordpress.com/orphantrees/fungaly/
https://ipm.ucanr.edu/PMG/PESTNOTES/pn74109.html
https://arboriculture.wordpress.com/2016/02/22/fungal-colonisation-strategies-pt-i-heart-rot/#:~:text=There%20exist%20four%20different%20colonisation,et%20al.%2C%202000)
https://idtools.org/palm_symptoms/index.cfm?packageID=1111&entityID=3350
https://edis.ifas.ufl.edu/publication/PP143
http://extension.msstate.edu/publications/guide-abiotic-disorders-woody-plants-the-landscape
https://www.uky.edu/Ag/Entomology/PSEP/cat2disease.html
https://savesheffieldtrees.org.uk/engineering-solutions/
https://www.purdue.edu/fnr/extension/equipment-damage-to-trees/
https://forestpathology.org/general/wood-decay/
https://www.rhs.org.uk/biodiversity/bracket-fungi
https://www.fungiflora.no/intro-poroide-fungi-decay
https://www.treerot.com/fungi/kretzschmaria-deusta/
https://forestpathology.org/foliage/ash-dieback/
https://streets.mn/2014/04/03/soil-and-water-in-the-life-of-a-street-tree/
https://www.sciencedirect.com/science/article/abs/pii/S0048969723070390
https://www.prefabworldbali.com/wood-damaging-pests-and-wood-decay
https://www.nature.com/articles/s41598-022-20377-3
https://www.sciencedirect.com/science/article/pii/S161886672400044X
https://assets.publishing.service.gov.uk/media/5d304a5aed915d2fefd0bda8/ON051_Highway_Tree_Management_v1.0_issued_190719_FINAL.pdf
https://nationalhighways.co.uk/our-work/environment/biodiversity/tree-management/
https://www.daera-ni.gov.uk/articles/controlling-grey-squirrel-population
https://icwdm.org/species/rodents/tree-squirrels/tree-squirrel-damage-prevention-and-control-methods/
https://assets.publishing.service.gov.uk/media/5a7c49a1e5274a2041cf2fe6/pb13936-chalara-management-plan-201303.pdf
https://treenet.org/resource/water-management-strategies-for-urban-trees-in-an-uncertain-environment/