6 TRAINING MODULE 6
Wood: From Forest to Mill

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Contents

Wood as a resource

This is the first of two modules looking at wood; that precious resource that we are trying to reuse.

Timber is the oldest building material. Ever since we got bored with living in caves and decided to make a home wherever we wanted; next to a river, a food source, or perhaps a place with the best views over a herd of woolly mammoths, wood has been used to create dwellings.

Most resources are finite; one day they are going to run out. But wood is a 'sustainable' resource because trees can be cut down and new ones grown in their place. It is one of the most environmentally-friendly materials too, because it absorbs CO2 whilst living. It is renewable, biodegradable, non-toxic and very energy efficient. As we know, timber can be re-used and recycled and when it reaches the end of its life it can be disposed of with minimal impact on the environment; to keep us warm or returned to the soil.

The learning outcomes of module 6

After successfully completing this module, you will be able to:

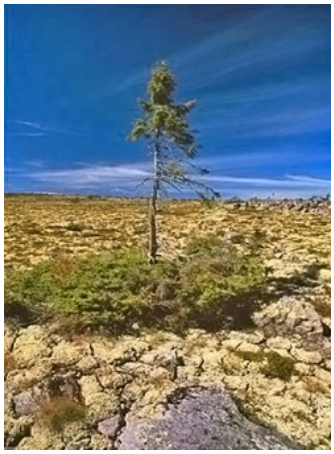
- Understand the basic tree categories
- Recognize the main types of tree
- Understand the main types of forest
- Understand how wood is harvested
- Learn more facts about trees

Section 1—Trees and forests

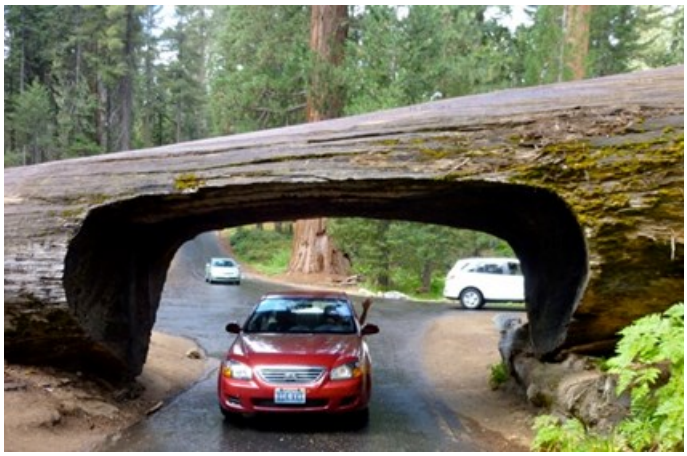
Trees first appeared around 385 million years ago and the first documented tree species is the gilboa tree. Trees have the longest lifespan of any living thing. In fact, a 13-feet-tall norway spruce, called Old Tjikko, has been discovered growing in Sweden that is believed to be more than 9,550 years old. Scientists estimated the age of its root system using radio-carbon dating techniques and reckon that it was established soon after the last ice age.

Many bristlecone pines growing in California were seedlings when the Pyramids were built in Egypt, and Britain's oldest tree is probably the Fortingall yew in Tayside, Scotland which is believed to be over 3,000 years old.

The world's *tallest* tree is a coast redwood in California at just over 380ft, but the world's *largest* individual tree is the giant redwood called 'General Sherman', which is about 275 feet high, has a girth of 25ft, a volume of 52,500 cubic feet and is 2,000 years old.



◄ The world's oldest living thing; Old Tjikko, 9,500 years young.



► A fallen redwood in California; easier to tunnel through than to move.

Hardwoods and softwoods

Trees can be divided into two groups: **conifers** and **broadleaved**. Conifers are often classified as **softwood** and broadleaved trees as **hardwood**. But this does not really relate to how hard or soft the wood is, for example, balsa wood (that we used at school for model making) is a hardwood, whereas yew (often used in high quality furniture) is softwood.

The terms softwood and hardwood actually relate to the cell structure of the trees and how its seeds are stored. But enough of the technical stuff.

▼ A European spruce

Conifers

Conifers (botanical family name: gymnospermae) were one of the first trees to grow (after the gilboa)—around 300 million years ago and at least 90 million years before the first land mammals. It is thought that for much of pre-history, conifers covered more than 70% of the entire land surface of the planet. Their seeds are produced and held in cones and they have leaves that are like waxy needles or small scales. Conifers are also known as 'evergreen', as they keep their leaves the year through.

◄ The needle-like leaves of a fir tree

They are associated with the cooler, northern regions, such as Canada, Scotland, Siberia and Scandinavia. The vast majority of commercial timber for construction comes from conifer species.

▲ The cone of a Scots pine

Broadleaved

Broadleaved (or hardwood) trees have been around for about 120 million years. The first to be documented was the maple. Unlike conifers, hardwoods (botanical family name angiospermae) encase their seeds in a fruit or pod. Think of an apple, cherry or 'conker' (horse chestnut) tree; they are all examples of trees that protect their seeds. This is also very useful for distributing them; an animal eats the fruit, the seeds pass through the animal and end up away from the tree on the forest floor—with the chance to grow.

As their name implies their leaves are broader and are shed in autumn. This is to conserve moisture in the trunk in winter, because when the temperature drops to below about 5˚C, they are unable to draw water from the soil. Broadleaves are also known as deciduous trees and are generally slower growing, so their wood is denser than softwoods.

Again, in broad terms, there are two types of hardwood: **Temperate**—coming generally from Europe, North America, southern South America and New Zealand; and **Tropical**—from Central South America, Africa, India, Southeast Asia and Australasia.

◄ The mighty oak tree—king of the hardwood forests.

Section 2—Types of forests

Different trees grow in different forests. The main types of forest and the tree species they contain, are determined by climate. This in turn depends on their location (the nearer the Equator, the warmer the climate) and on altitude (the higher the altitude, the cooler the climate and the poorer the soils).

The 'tree line' is the line beyond which the climate is too severe to support trees. In the Alps, the tree line is approximately 7,000 feet above sea level, whilst in north Wales it is only around 1,800 feet. Of course the trees that grow in each location have evolved to cope with the particular conditions. Although there is a lot of overlap in the kinds of trees found in each type of forest, the main forest types are discussed below.

Coniferous forest

This forest stretches around the globe in a kind of huge band from Siberia, northern China and Japan through to northern Europe, and on to Canada and Alaska. It is also known as taiga or boreal forest and it ranges from a latitude of about 60 degrees north (about level with the Shetland Isles and southern Norway) to within 2,000 km of the North Pole, where the trees give way to the barren, treeless lands of the tundra.

Coniferous trees thrive where summers are short and cool and winters long and harsh, with heavy snowfall that can last for 6 months of the year.

▼ Scandinavian coniferous forest.

The needle-like leaves of trees in this region have a waxy outer coat that prevents water loss in cold weather and the branches are soft and flexible and usually point downwards, so that snow slides off them. The most common trees in this kind of forests are spruces, hemlocks, pines and firs. The larch, also a very common coniferous tree found in some of the coldest regions, is unusual as it sheds its leaves in winter.
There are however many coniferous trees such as cypresses, redwoods and cedars that are found in warmer regions, such as on the eastern coast of the USA.

Mixed broadleaved and coniferous forests

In much of the area directly below the coniferous forests—where the summers are warmer, there is good rainfall and the winters are less harsh—there is a big block of mixed hardwood and softwood forests.

It is a kind of intermediate zone where conifers dominate in the north (think of Scotland) and broadleaved trees, such as oak, ash, birch, beech and maple, are prevalent in the south. This is the kind of forest that can be seen throughout Britain and much of northern Europe. Vast areas of this kind of forest can be found in north east USA and eastern China.

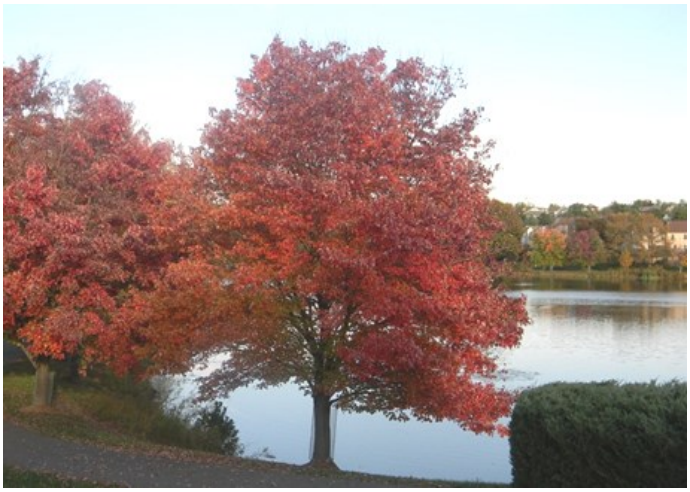
Until the English Channel formed around 425,000 years ago, separating our island from mainland Europe, this kind of forest would have stretched virtually unbroken from western England to the Ural Mountains.

▲ Mixed broadleaf forest in the Lake District.

Temperate hardwoods

The world's Temperate zone in the northern hemisphere stretches from about 60̊N (southern Norway) to 40˚N (in line with mid Spain and northern Greece).

This is the area in which hardwood forests dominate and the biggest are found in the eastern and central part of the USA, Eastern Europe and in Iran. Each has their own particular dominant species of trees, but they will generally include oak, beech, ash, birch and maple.



▲ A beautiful red maple; a typical temperate hardwood tree.

◄ Ash trees; typically found in temperate forests. These examples were planted in the 1930s.

► A beech forest in the temperate forest zone in central USA.

Mediterranean Forest

This is found (as its name suggests) almost exclusively around the Mediterranean Sea in southern Europe and North Africa, but also in parts of California and Chile.

The mixed conifers and broadleaved trees —such as pine, oak and olive—found in this type of forest must be able to cope with hot, dry summers. Because the temperatures do not fall particularly low any time of the year, even broadleaved trees don't shed their leaves in winter.

► Mediterranean forest in Spain.

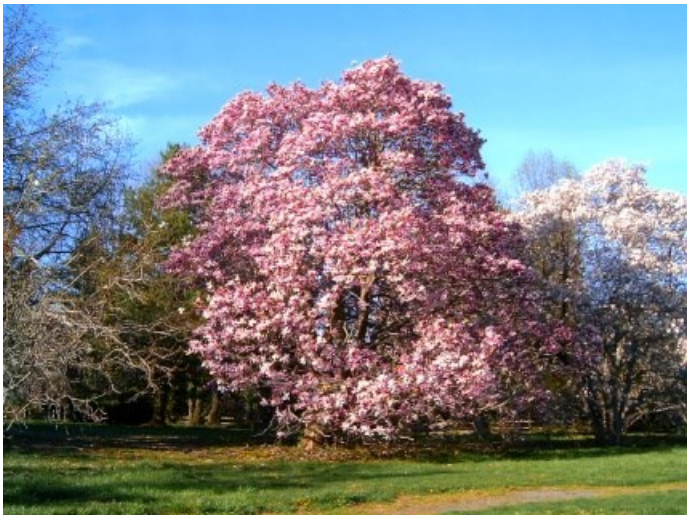
Sub-tropical forests

The sub-tropical region of the globe stretches from the edge of the temperate zone to the tropics of Cancer and Capricorn. Although temperatures may vary only slightly over the year, rainfall will be high but may be uneven so that wet and dry seasons occur.

Subtropical rainforests cover large areas of central and west Africa, Asia and central and South America. Each has its own characteristic tree types but broadleaved evergreens, like laurels, oaks, magnolia, redwoods, eucalyptus and cypress, are common along with certain pines.

◄ Sub-tropical forest

▼ Magnolia tree—cultivated varieties are found in many English gardens, but the tree is native to the sub-tropical forest.



Tropical rainforests

Tropical rain forests cover less than 2% of the earth's surface and are characterized by huge amounts of annual rainfall and consistently high temperatures. They are found in Africa, India, south east Asia, Australia and South America, particularly Brazil, which is main home to the Amazon rain forest—the largest in the world. The Amazon covers an area of more than 6.7 million km^2 and has over 10% of all known species in the world residing inside it.

Tropical rain forests are the most biologically-diverse areas on the globe; there are about 700 different species of trees in the whole of Canada—yet more than 750 different species have been found in just 1 hectare of rainforest. The total number of tree species in the Amazon is around 16,000.

▲ The Amazon rain forest is an invaluable, but fast-diminishing resource.

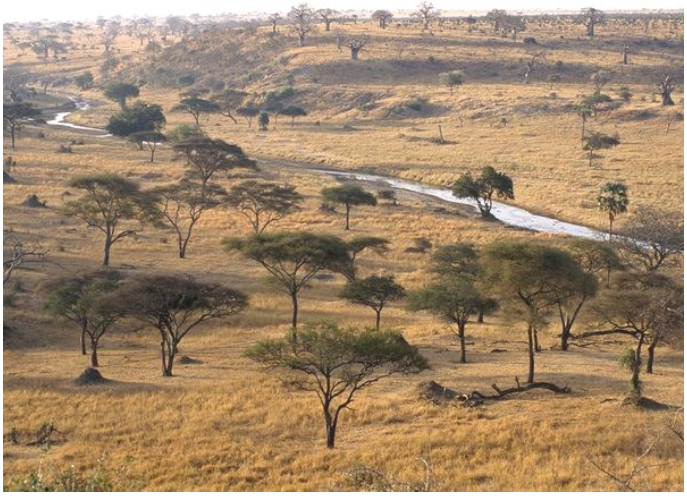
These forests are a hugely important resource. Not only are they considered to be the 'lungs of the world' (they produce about 20% of the world's oxygen) they provide us with the ingredients for a huge number of important medicines and a gene pool of up to 30,000,000 different species of plants and animals. In fact, it is estimated that two species of flora and fauna become extinct every day in the rain forest—before they are even discovered.

But of course the main economic crop of these forests is timber, largely sold to fulfill the worldwide demand for furniture and other wood products. We are losing rainforest to logging—both legal and illegal - at a terrifying rate. In addition, huge areas of rain forest are being cleared to grow crops such as palm oil (as a foodstuff and petrol substitute) and soya, of which 70% goes to feed cattle and livestock (and only 6% of is consumed by humans, mostly in Asia).

The important commercial trees of the rainforest that we might come across at community wood recycling include teak, mahogany, sapele, utile, purpleheart, greenheart and meranti. These woods have been widely used in the furniture and construction industries for centuries. However, as they have become scarcer and better protected (and so more expensive), a wide range of other lower quality hardwoods are being used.

◄ A teak tree; slow growing, dense timber that is prized for ship building.

Savannah forests



▲ Typical Savannah forest in Sub-Saharan Africa.

Vast areas of this type of forest occur in Africa and South America. They sit north and south of the rain forests on poorer soils and are typified by short, well-spaced trees such as acacia. Generally rainfall in such forests is limited to one short season a year. In Africa the savannah is the habitat of the lion, elephant and much of the big game.

Savannah forests are not useful for commercial timber but provide fuel for cooking and warmth for many millions of people. Like all the natural forests of the world, they are under great threat and are being lost to demand for firewood and the need to grow foodstuffs. Once cleared of trees, the soil can more easily be eroded - leading to loss of fertility and eventual desertification.

Montane forest

This is found at higher altitudes, occurring around the mountain ranges of the world—such as in Ethiopia, China, Tibet, Mexico and around the Andes in South America.

Conifers dominate in these forests because the climate is relatively dry and cool. They occur at altitudes of around 1,500 metres and extend up to the tree line. As the areas where they grow are often hard to access, these types of forests are often not commercially exploited. These forests generally contain a mix of both conifer and broadleaved species, including pine and juniper.

▲ Montane forest

Section 3—Taking timber to the market

Logging

Thankfully an increasing amount of commercially-used timber comes from plantations rather than from natural forests. Timber harvesting, especially in the coniferous forests of the USA, Canada and Scandinavia, takes place on a huge scale and is heavily mechanised, with the felling, trimming, de-barking and cross cutting to length often carried out by a single machine.

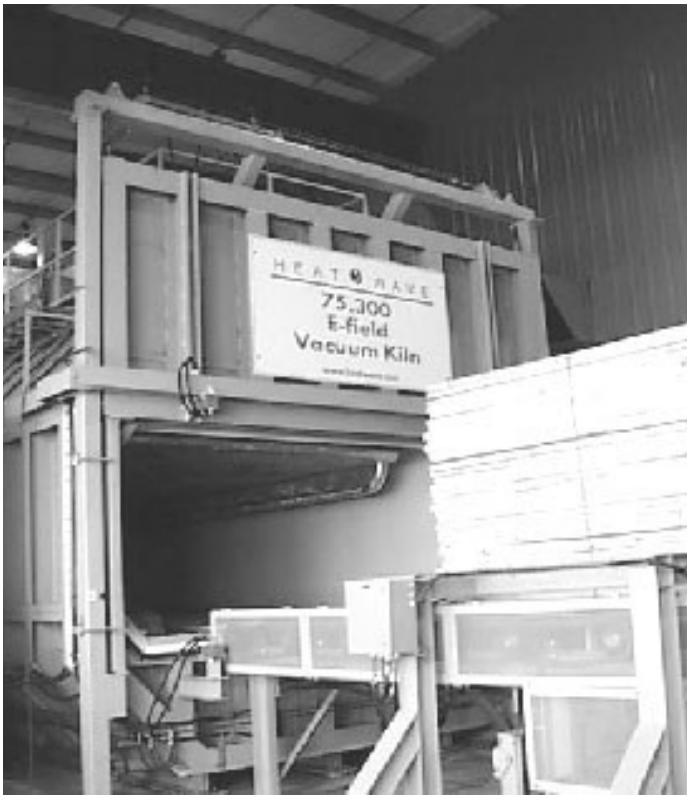
In some parts of Asia and Africa, logging is still a much more labour-intensive industry with elephants still used for dragging the timber through the forest to the roadside for collection by truck.

▲ In some parts of Thailand and Burma, elephants are still used in the logging industry.

Seasoning

Most trees contain 30–50% water (elm being up to 60%) and timber is hygroscopic, absorbing moisture from the atmosphere and releasing it in drier conditions. So once felled, wood must be 'seasoned' before use. This simply means removing some of the moisture either by air-drying or in a kiln. For use in construction and joinery, the moisture content needs to be taken down to around 12% and to make furniture, even lower at between 6% and 8%. Even after drying, wood will always move with the seasons, or with the moisture it is exposed to, for example in a bathroom.

▼ A commercial-size kiln preparing softwoods for the timber market.



Air-drying is the traditional way of drying timber. In this method, wood is cut into planks and stacked off the ground with spacers between each row of planks in open -sided barns or sheds so the wind can blow through the stacks. But it is a very time-consuming process, with some wood often needing several years to become sufficiently dry for use.

Drying in kilns is much faster—usually taking only a few days to bring the wood down to the right moisture content. The wood is very carefully placed in the kiln so it is flat and properly spaced (for effective air flow) and the temperature and humidity in the kiln has to be carefully controlled. It is fast, but very energy-intensive as a lot of heat needs to be produced.

Even after correct seasoning, wood for certain jobs, such as floorboards or interior cladding, should be left 'airing' on site for a few days before fitting, so that any residual movement can happen before fixing into place.

Forest Accreditation

Thankfully, an increasing amount of timber is being managed sustainably—especially in the developed world.

More and more wood is sourced from plantations where more seedlings are planted than trees felled. To help encourage the spread of this kind of good practice, various accreditation schemes have been set up so that organisations that buy timber, such as furniture manufacturers, construction companies or DIY chains, can be sure that the wood they are buying comes from sustainable sources.

The main accreditation scheme is the FSC (Forest Stewardship Council) which is an independent not-for-profit organisation set up in 1993.

The FSC is helping to ensure sustainable forestry.

It operates in more than 84 countries (2019) and there are nearly 200 million hectares of forest managed to FSC standards. This represents around 14% of the world's productive forests. By only buying wood with the FSC label, consumers can help ensure that it is much harder for illegally felled logs to find a market.

Section 4—Wood and tree facts

- It takes approximately 2 tonnes of timber to make 1 tonne of paper.
- The energy value of 2 tonnes of timber is the same as 1 tonne of coal.
- Dendrochronology is the science of dating trees from their rings.
- Tree rings can provide precise information about environmental events (including volcanic eruptions) that occurred throughout a tree's life.
- Britain has the largest population of 'ancient' trees in Europe.
- Compounds from yew leaves are used in the treatment of cancer.
- In a good year, a fully-grown oak produces and sheds 250,000 leaves and produces around 10,000 acorns.
- A mature birch tree can produce up to 1 million seeds a year.
- The trunk of a mature fir tree can be made into about a million matchsticks.
- Broadleaved trees change colour in the autumn because the green chlorophyll in their leaves breaks down and is reabsorbed by the tree, prior to leaf shed.
- Tree fruits are designed to be dispersed, so many berries are red, as this seems to be the preferred food colour of birds.
- Deforestation was a contributing factor to the downfall of the Roman Empire because they couldn't keep up with the demand for wood (for building and burning).
- More than 150 acres of rainforest is lost every minute of every day.
- It is predicted that nearly half of the world's species of plants, animals and micro-organisms will be destroyed or severely threatened over the next 25 years due to the destruction of the rainforest. In 100 years the rainforest is predicted to have disappeared.
- If Amazonia (the area of the Amazon rainforest in Brazil and neighbouring countries) were a country, it would be the ninth largest in the world.
- More than half of the world's estimated 10 million species of plants, animals and insects live in the tropical rainforests. One-fifth of the world's fresh water is in the Amazon Basin. One hectare of rainforest may contain over 750 types of trees and 1,500 species of other plants.
- At least 80% of the developed world's diet originated in the tropical rainforest. This includes: fruit such as avocados, coconuts, figs, oranges, lemons, grapefruit, bananas, guavas, pineapples, mangos and tomatoes; vegetables including maize, potatoes, rice, winter squash and yams; spices like black pepper, cayenne, cinnamon, cloves, ginger—along with chocolate, sugar cane, coffee and vanilla and nuts including Brazil nuts and cashews.

Section 5—Trainee exercises and questions

There is an exercise for you to complete below and on the following page.

Remember: don't hesitate to ask for help from your Trainer.

Module 6: Exercise 1

1. Why is wood a sustainable resource?
2. Name a gas that trees absorb?
3. What are the main differences between softwood and hardwood trees?
4. When did trees (softwoods) first appear on earth?
5. Name 5 broadleaved trees:
6. Name 4 conifers:
7. What kind of forest grows in the far north of Europe and in Siberia?
8. Is cedar broadleaved or coniferous?
9. Where are the biggest temperate hardwood forests found?
10. Why do deciduous trees shed their leaves?

11. Where would you find Montane forests?
12. What are two ways of seasoning timber?
13. What is the approximate range of water (moisture) content of most trees?
14. What approximate moisture content is wood meant to be for use in joinery?
15. Name a hardwood species that has very soft, very lightweight wood (often used in woodwork classes at school!):
16. How many species of trees are there in Canada?
17. How many species of tree have been found in one hectacre of rainforest?
18. What is the benefit of buying FSC-certified timber?
19. What is the tree line?
20. What can you tell about a tree from its rings?

Office use only		**Number of correct answers required to pass Module 6: 16**			
Passed:		**Retake:**		**Date:**	
		Trainer's signature:			