Wood properties and uses

Time needed for activity	Key concepts:	10+ minutes
	Activity 1: Identify	10+ minutes
	Activity 2: Select	15+ minutes
	Activity 3: Carbon	25+ minutes
Location	Indoors or outdoors	
Materials needed	Wood samples Species and durability information sheets	
Context	This activity plan highlights how different kinds of wood have different properties and features.	
Extra resources	https://blogs.napier.ac.uk/cwst/learning-resources/	

What to do

Discuss with your group what they know about different types of wood.

According to the group's knowledge, explain the key concepts of:

- Species
- Hardwood and softwood (be careful not to confuse hardwood and heartwood)
- Evergreen and deciduous
- Native and introduced
- Density
- Strength
- Hardness
- Durability

Allow the group to inspect the wood samples.

Facilitate one or more of the discussion activities:

1. Identify which sample is which
2. Select which type of wood would be best for different uses
3. Discuss carbon footprint, and the use, reuse, and recycling of wood [advanced task]

Summarise the main points:

- Different kinds of wood are useful for different things
- Wood is made from carbon dioxide taken from the atmosphere by trees
- If we look after the forests we can grow more wood – it is a renewable material
- We still need to be careful about how we use wood – to ensure we only get it from well managed forests, it lasts a long time, and is reused and recycled

Activity 1: Identify the wood samples

Using what you already know, and what is written in the properties information sheets, can you identify which samples are which? Discuss what senses you can use to tell one kind of wood from another. What additional tools might help you?

Don't worry if you find this hard. Wood identification can be rather difficult, and the wood of different tree species can be very similar. Even experts can often only identify it as a broad category (e.g. spruce) rather than a particular species.

If you are curious about wood identification, its methods and challenges a good primer can be found at the wood database website, along with a really easy to use wood finder.

https://www.wood-database.com/wood-filter/

YESC would like to thank BSW Timber Ltd and the Logie Estate, and Egger for the generous donation and provision of wood samples for this project.

Activity 2: Selecting wood for different uses

Using what you already know, and what is written in the properties information sheets, think about which of the different kinds of wood you would want to use for the following things.

- The structure of an affordable house
- The structure of an important building
- Furniture
- Flooring
- Garden fencing and decking
- Cladding on the outside of a building
- Paper
- Pallets for moving goods

What are the key considerations? Why did you select certain kinds of wood and reject others? Perhaps you can think of reasons related to the wood properties, and reasons related to where the wood comes from.

We often do not think much about pallets, but they are vital for transporting 95% of goods worldwide. Each year about 50 million new wooden pallets are made in the UK and about the same amount are repaired and put back into service. It is difficult to say how long pallets last – but certainly some have very long lives – the pallets used to hold the barrels when maturing whisky!

Activity 3: Carbon footprint, reuse and recycling [ADVANCED]

When trees grow they *remove* carbon dioxide from the air to make new wood. In contrast, when we make many other materials the opposite happens - carbon dioxide is *released* into the air. This carbon dioxide is mostly the result of burning fossil fuels during the manufacturing process. The amount of carbon dioxide released is known as its carbon footprint. Since we need materials for making things, it is a good thing if we can use wood in place of materials that have a big carbon footprint – so long as we know that the trees cut will be replaced by new ones, and the forest can continue to remove carbon dioxide from the air. This is why using wood in place of other materials has a double benefit:

1. It locks up carbon dioxide in the wood for a long time and
2. It avoids carbon dioxide emissions elsewhere. This is known as avoided emissions.

So long as the wood remains as wood, the carbon dioxide remains locked up, but eventually it will go back into the atmosphere (or perhaps the soil) when the wood decays or is burned. Short lived products can mean the carbon is released before the forest is able to regrow. This is why we need to keep wood in service as long as possible, reuse it when we can, and recycle it when we can't.

One way to think about this is to estimate the half-life of a wood product. The half-life describes how long it takes for the quantity of something to reduce to one half (i.e. half of it has been disposed of or recycled). Maintenance, repair and reuse can extend the half-life.

In groups, discuss how long you think the following kinds of wood products might last. What is their half-life? What can be done to make them last longer? How could they be reused or recycled? Does using wood for any of these have advantages for avoided emissions?

- Wooden pallets (6 years?)
- A timber house (70 years?)
- A prestigious timber building (100 years?)
- Furniture (30 years?)
- Paper (2.5 years?)
- Fuel (for making heat or electricity) (0 years?)

One concept for recycling wood products is called cascading. Cascading means that the wood is used again and again, but as its quality decreases over time, it is used in things that have lower requirements. For example, after wood has been used in the floor of a timber house, it might still be used as a fence. Sometimes wood is mixed with other materials or with new wood in between stages, so it can last even longer. The idea of cascade is to make sure that the wood first goes into the highest level use it can.

In groups, try to imagine the ideal life cascade of wood that stores carbon for as long as possible. What would different life stages look like and how long do they last? What could happen to the wood during its life? Where would carbon leave the system? You can draw the product's life in a graph, starting with the felled tree and ending with the disposal of the last bit of wood. Compare your cascade with other groups and see if they agree with your assumptions. There is more than one kind of cascade, and more than one thing the wood can end up as at the end.

Where in the cascade do you think these things fit best?

- Sawn construction timber
- Sawn timber for furniture making
- Paper for books
- Paper for packaging
- Sawdust for animal bedding
- Particleboard
- Fuel
- Chemicals from the wood fibres for making other things

Forests don't always remove carbon dioxide gas – sometimes they can create it. Even completely natural forests do this when trees die of old age, and this is part of the carbon cycle of our planet. It is not just about the trees themselves because there is a lot of carbon in forest soils too.

Carbon dioxide gas can be released when trees are harvested, new ones are planted, and when lots of trees die from storms, forest fire, pests or disease. This is why we need foresters and scientists working together to understand the best way to manage our forests in order to minimise carbon emissions and reduce the effects of climate change – both now and in the future – while also producing the everyday products we all need and providing places for people and wildlife. Even if you do not work in forestry and timber you too can have a positive impact by considering how things are made, what you buy, and how you look after it.

Eilidh Forster is a researcher at Bangor University. She is researching the environmental sustainability of forestry value chains in the UK, using a combination of carbon modelling and life cycle assessment. What that means is she looks at different ways of managing forests, and different things that the wood can be used for, and tries to understand how those things affect the amount of carbon dioxide in the atmosphere. Her research, and the work of others doing similar studies, will help us understand the best ways to manage our forests and find a good balance between the environment and the needs of people.

There are certification schemes like the Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC) and the UK Woodland Assurance Standard, that help ensure the wood comes from responsibly managed sources. The schemes use a Chain of Custody to track the origin of wood all the way to the product when it is bought and used. These schemes aim to do more than just make sure that the trees cut are replaced – they also consider how the forests are managed, the impact of forestry operations, the impacts on the natural and cultural environment, and the people, communities and workers around the forest.

When using wood in a building it's important to plan how it is used. Buildings don't last forever, and quite often they are demolished because they don't suit our needs anymore – long before the materials in them stop being good. We need buildings that can be renovated and adapted, or deconstructed so that the parts and materials can be reused. Wood has good advantages here too because it can be reworked easily, and at the very end of its life it is biodegradable or, even better, can be burned to produce energy.

Fire is an obvious thing to consider when using wood for buildings. Since wood burns it can contribute to feeding a fire, and also help it spread from one part of the building to another. The good news is that, as with durability, good design, detailing and construction solves this problem. Usually this also means we need to use some other materials, in combination with wood, to keep buildings safe and durable. Thankfully, we know how to do that, and almost all buildings are, one way or another, mixtures of different kinds of materials for all sorts of reasons. Even so, we still need to find better ways of doing it so that the different kinds of materials can more easily separated when the building is renovated or deconstructed at the end of its life.

Marlene Cramer is a researcher at Edinburgh Napier University. She is working in a project that investigates how we could use timber over and over again, especially in construction. Marlene, and other researchers, look at how to improve building designs and construction methods, so we can easily take buildings apart and reuse the timber inside. The research also looks for ways to confirm that timber that has been inside a building for years is still suitable to be used again, or made into other building products. This all helps to make timber use more circular, and to ensure we have enough wood now and in the future.

Properties information sheet: Spruce

Name	**Spruce**
Source	UK grown
Species	Either Sitka spruce or Norway spruce *Picea sitchensis* or *Picea abies*
Hardwood or softwood	Softwood (conifer)
Evergreen or deciduous	Evergreen
Native to the UK or introduced	Introduced
Appearance	Generally creamy white in colour and with little or no difference between sapwood and heartwood. The wood is non-resinous and without a strong smell. (This, and its light colour, are reasons why it is favoured for paper production.) There is a gradual transition from earlywood to latewood and the contrast between them is medium, (but usually a little less than for pine).
Density (kg per metre cubed)	400 kg/m^3
Strength (a force per area unit)	70 N/mm^2
Hardness (a force unit)	2 kN
Natural durability against fungi	4 to 5 Slightly durable to not durable
Availability	Inexpensive, and the main, commercially grown, kind of wood in the UK. Sawn timber is available in many sizes from small to large. Trees can be grown to sawlog size relatively quickly.
Other information	Spruce is very strong for its weight. The shrinking and swelling with moisture is quite small.

Properties information sheet: Pine

Name	**Pine**
Source	UK grown
Species	Usually Scots pine (although there are other species) *Pinus sylvestris*
Hardwood or softwood	Softwood (conifer)
Evergreen or deciduous	Evergreen
Native to the UK or introduced	Scots pine is native
Appearance	The sapwood is creamy white to yellowish in colour and the heartwood is usually pale yellowish brown to reddish brown. The wood can be resinous and has a very familiar pine smell. The earlywood to latewood transition is fairly abrupt and the colour contrast is medium. The timber is prone to blue-stain – a kind of fungus that colours the wood blue, grey or black before it can be dried. Blue stain fungus does not damage the wood.
Density (kg per metre cubed)	500 kg/m^3
Strength (a force per area unit)	90 N/mm^2
Hardness (a force unit)	3 kN
Natural durability against fungi	3 to 4 Moderately durable to slightly durable
Availability	Inexpensive, and a common, commercially grown, kind of wood in the UK. Sawn timber is available in many sizes from small to large. Trees can be grown to sawlog size relatively quickly.
Other information	Pine is attractive and takes a good finish. Although it is called Scots pine, it has a wide natural range covering as far south as Turkey and as far east as China.

Properties information sheet: Larch

Name	**Larch**
Source	UK grown
Species	European larch, Japanese larch or hybrid larch *Larix decidua*, *Larix kaempferi* or *Larix* × *marschlinsii*
Hardwood or softwood	Softwood (conifer)
Evergreen or deciduous	Deciduous
Native to the UK or introduced	Introduced
Appearance	The heartwood is pale red-brown colour, and distinct from lighter-coloured sapwood. It is a resinous wood. The big difference in density between earlywood and latewood, and the sharp transition from earlywood to latewood makes very prominent growth rings. Sometimes it can be difficult to tell larch and Douglas-fir timber apart.
Density (kg per metre cubed)	500 kg/m^3
Strength (a force per area unit)	90 N/mm^2
Hardness (a force unit)	3 kN
Natural durability against fungi	3 to 4 Moderately durable to slightly durable
Availability	A common commercially grown kind of wood in the UK, but now severely threatened by a disease called *Phytophthora ramorum*. Sawn timber is available in many sizes from small to large, and typically more expensive than pine and spruce.
Other information	The shrinking and swelling with moisture is small. Larch goes a pleasant silvery grey when exposed to sunlight for a long time

Properties information sheet: Douglas-fir

Name	**Douglas-fir**
Source	UK grown
Species	Douglas-fir *Pseudotsuga menziesii*
Hardwood or softwood	Softwood (conifer)
Evergreen or deciduous	Evergreen
Native to the UK or introduced	Introduced
Appearance	The heartwood is light reddish-brown in colour, and usually distinct from the lighter coloured sapwood. The big difference in density between earlywood and latewood, and the sharp transition from earlywood to latewood makes very prominent growth rings. It has a distinct resinous smell when cut. Sometimes it can be difficult to tell Douglas-fir and larch timber apart.
Density (kg per metre cubed)	500 kg/m^3
Strength (a force per area unit)	90 N/mm^2
Hardness (a force unit)	3 kN
Natural durability against fungi	3 to 4 Moderately durable to slightly durable
Availability	A fairly common commercially grown kind of wood in the UK. Sawn timber is available in many sizes from small to large, and typically more expensive than pine and spruce.
Other information	The shrinking and swelling with moisture is small. Douglas-fir is not true fir. The botanical name, *Pseudotsuga*, means false (pseudo) hemlock (tsuga) because it is not a hemlock either!

Properties information sheet: Oak

Name	**Oak**
Source	UK grown
Species	Pedunculated oak or sessile oak *Quercus robur* or *Quercus petraea*
Hardwood or softwood	Hardwood (broadleaf)
Evergreen or deciduous	Deciduous (although there is also an evergreen kind of oak)
Native to the UK or introduced	Native
Appearance	A distinctive appearance due to broad rays appearing as flecks on the sawn surface. Light to medium brown in colour, often with sapwood of a noticeably lighter colour. The vessels are large and vary between the earlywood and latewood making the growth rings very easy to see.
Density (kg per metre cubed)	700 kg/m^3
Strength (a force per area unit)	100 N/mm^2
Hardness (a force unit)	5 kN
Natural durability against fungi	1 to 4 Very durable to slightly durable
Availability	Despite being a very well-known and traditional kind of timber in the UK, most of the oak used is imported. Not much of our oak forest is currently managed for timber.
Other information	Oak is often described as the hardest timber, but actually many native species produce harder wood!

Properties information sheet: Birch

Name	**Birch**
Source	UK grown
Species	Silver birch or downy birch *Betula pendula* or *Betula pubescens*
Hardwood or softwood	Hardwood (broadleaf)
Evergreen or deciduous	Deciduous
Native to the UK or introduced	Native
Appearance	Whitish to light brown in colour and with little or no visible distinction between the sapwood and heartwood. The annual rings are hard to see because the earlywood and latewood looks very similar. The vessels are medium sized and evenly distributed in the rings. Like spruce, the pale colour of birch wood makes it a good kind of wood for papermaking. It is quite common to see thin brown streaks in the wood. These "pith flecks" are the result of insect damage to the tree.
Density (kg per metre cubed)	700 kg/m^3
Strength (a force per area unit)	120 N/mm^2
Hardness (a force unit)	5 kN
Natural durability against fungi	5 Not durable
Availability	It is a common tree in the UK, but not usually grown for timber so it is currently hard to obtain in large quantities except as firewood and chips for making panel products. In other countries, birch is particularly important for making plywood veneers.
Other information	Birch trees can grow on a wide range of sites and are often used to improve the soil so that other broadleaves, or conifers, can be planted at a later time.

Properties information sheet: Western red cedar

Name	**Western red cedar**
Source	UK grown
Species	Western red cedar *Thuja plicata*
Hardwood or softwood	Softwood (conifer)
Evergreen or deciduous	Evergreen
Native to the UK or introduced	Introduced
Appearance	The heartwood reddish to pinkish brown, often with streaks of darker red and brown colours. The sapwood is pale yellowish white. The wood is non-resinous and has a strong, cedar-like smell when cut. The transition from earlywood to latewood is can be abrupt or gradual, and the contrast between the earlywood and latewood is quite high.
Density (kg per metre cubed)	400 kg/m^3
Strength (a force per area unit)	70 N/mm^2
Hardness (a force unit)	2 kN
Natural durability against fungi	1 to 3 Very durable to moderately durable
Availability	Western red cedar is a well known wood in the UK, but we currently import most of this. There are some trees, managed for timber, and this is one of the species that might be more common in future. It is a relatively expensive softwood, especially for knot free boards.
Other information	Western red cedar wood is valued for its distinct appearance, appealing smell, and its high natural resistance to decay. It changes to silver-grey in the sun. The shrinking and swelling with moisture is small.

Properties information sheet: OSB

Name	**OSB (Oriented Strand Board)**
Source	UK produced
Species	Mainly spruce and pine, but can include smaller amounts of other species
Hardwood or softwood	Mostly softwood but can contain some hardwood
Evergreen or deciduous	Mostly evergreen, but can contain deciduous
Native to the UK or introduced	Mixture
Appearance	A distinctive appearance, and easily identifiable from a distance due to the compressed wood flakes it is made from. The flakes vary in colour from pale to dark reddish brown.
Density (kg per metre cubed)	Varies, but typically about 600 to 700 kg/m^3
Strength (a force per area unit)	Varies but typically about 30 N/mm^2
Hardness (a force unit)	4 kN
Typical product durability against fungi	Suitable for use class 2 to 1
Availability	Comes in panels of standard sizes. Easy to obtain, relatively inexpensive compared to solid wood and plywood. Available in standard grades for different uses.
Other information	A very commonly seen engineered wood product and a good way of using logs that are too small for making sawn timber.

Properties information sheet: Particleboard

Name	**Particleboard**
Source	UK produced
Species	Can be made from a mixture of wood types, including a high proportion of recycled wood
Hardwood or softwood	Mixture
Evergreen or deciduous	Mixture
Native to the UK or introduced	Mixture
Appearance	Commonly called chipboard because the wood chips from which it is made. The colour depends on the types of wood it is made from. It can be made to look very different with a face of real wood veneer or an artificial decorative finish. Sometimes it is hard to tell it is particle board if you cannot see the chips inside.
Density (kg per metre cubed)	Varies, but typically about 600 to 700 kg/m^3
Strength (a force per area unit)	Varies but typically about 20 N/mm^2
Hardness (a force unit)	3 kN
Typical product durability against fungi	Suitable for use class 2 to 1
Availability	Comes in panels of standard sizes. Easy to obtain, relatively inexpensive compared to solid wood, and available in a very wide range of finishes
Other information	A very good way of using wood that is not suitable for other things.

Durability information sheet

You might find this table easier to use if you colour in the different categories

Use class	Durability class 1 Very durable	2 Durable	3 Moderately durable	4 Slightly durable	5 Not durable
1 – the wood is inside, and not exposed to the weather, and only gets wet if there is an accident.	Natural durability is OK	Natural durability is OK	Natural durability is OK	Natural durability is OK	Natural durability is OK
2 – the wood is under cover and not exposed to the weather, but it might occasionally get wet	Natural durability is OK	Natural durability is OK	Natural durability is OK	Natural durability is usually OK	Natural durability is usually OK
3 – the wood is exposed to the weather so gets wet regularly, but it is not in contact with the ground	Natural durability is OK	Natural durability is OK	Natural durability is usually OK	Natural durability might be OK	Natural durability might be OK
4 – the wood is exposed to the weather and is also in direct contact with the ground or fresh water.	Natural durability is OK	Natural durability is usually OK	Preservative treatment advisable	Preservative treatment necessary	Preservative treatment necessary
5 – the wood is permanently or regularly submerged in sea water.	Natural durability is OK	Preservative treatment advisable	Preservative treatment advisable	Preservative treatment necessary	Preservative treatment necessary

Note: The durability class is for heartwood only. The sapwood of all species is considered class 5: Not durable

Background information sheet 1

Species: A way of describing living things by naming the group they belong to, and the specific type. For example: *Betula* is the group of birches and *Betula pendula* refers to the specific kind of birch we call silver birch. We use this formal Latin-based naming system because there are so many different common names and they can be easily confused with one another. Some species are quite similar to one another, and can even mix, producing hybrids.

Native and introduced: Trees are often defined as native to the UK if they arrived here during the time between the end of the last ice age, and the flooding of the land between what is now the UK and mainland Europe. Some kinds of tree, such as Norway spruce, were growing here before the ice age, but it is not common to consider those kinds to be native. Some trees were introduced so long ago that they are considered like native (sometimes called naturalised), while others are relatively new introductions. Since trees live a long time, and cannot move around like animals can, it is becoming ever more important to think about the different species are suited to the climate of the future.

Hardwood and softwood: Wood from broadleaved trees such as cherry, oak, birch and chestnut is called hardwood. These kind of trees are flowering plants (although the flowers might be very small). Wood from conifers such as spruce, pine, larch and yew is called softwood. These kinds of trees have cones instead of flowers (although the cones might not look like cones). The terms hardwood and softwood are old, and don't necessarily indicate the actual hardness or softness of the wood. Balsa is a very soft hardwood, and yew is a very hard softwood. You can usually tell the difference between softwood and hardwood by looking at the end grain with a hand lens or microscope. Hardwoods have vessels - which look like tiny holes in the wood. These are pipelines for conducting the sap in the living tree, allowing the rest of the wood to be dense and strong. In some species, the vessels are so big you can see them with the naked eye. Softwoods do not have vessels, instead they have much smaller pipelines in the cells that also provide strength to the wood. There are other woody materials that come from plants that we classify separately from broadleaves and conifers - this includes bamboo and palm.

Evergreen and deciduous: Evergreen trees keep their foliage all year round, while deciduous trees shed their foliage in the autumn. The foliage of broadleaf trees are called leaves. The foliage of conifers are called needles. Most conifers are evergreen, but there are a few deciduous examples; particularly the larches. Most native broadleaves are deciduous, but there are a couple of evergreen examples; holly and box.

Background information sheet 2

Sapwood and heartwood: Sapwood is the outer rings of the log that were active in conducting sap when the tree was living. The sapwood is not naturally durable (with a few special exceptions). Heartwood is the inner rings of the log that are no longer active in conducting sap in the living tree. Depending on the species, heartwood can be darker in colour, have a stronger smell, and be more naturally durable due to the additional chemicals the tree puts into the heartwood. As a tree grows, its sapwood is slowly converted into heartwood.

Moisture content: Wood in the living tree is wet - in fact there can be a more water by volume in the tree than there is wood. This is possible because wood is full of tiny holes. Even when we take wood and kiln, or season it, and call it “dry”, there is still always some water in the wood. This water is not as liquid – it is molecules of water inside the cell walls. Many things that like to eat wood require some liquid water, so as long as the wood is “dry” (only molecular water) it is well protected. The wood will shrink and swell depending on the amount of molecular water in the wood cell walls, varying with the air temperature and humidity. This means a piece of wood will get heavier if you leave it in a humid room.

Engineered wood: A term used to refer to woody material that is, in some way, processed from its original form. Examples include products made from wood fibres, chips or flakes (e.g. MDF, chipboard, OSB); wood made from glue-laminated sheets (e.g. plywood), and wood made from glue-laminated pieces of sawn timber (e.g. glulam and cross-laminated timber). Other examples include wood modified with chemicals, heat or pressure, or mixed in to a composite with other materials, such as plastic.

Availability: Price and availability are very important considerations. Some types of wood are plentiful and inexpensive, while others are hard to find and expensive. Some are restricted because the trees are in danger of extinction. It is important to use wood that is good enough for the job, but often it is not sensible to use wood that is much better than it needs to be. Even though we can grow more trees, wood is still a limited resource and we should use it wisely. This means we should also try and reuse and recycle wood as much as possible – and in fact we already do recycle almost all of the waste wood produced in the UK. About half if it is burned for energy but about a quarter is used to make new products, such as particleboard, that give the wood a whole new life.

Using wood provides an income for the forest, and so encourages people to look after the trees. If people want a certain kind of forest it is therefore good to encourage a market for the kind of wood that forest produces.

Background information sheet 3

Earlywood and latewood: Earlywood is the lower density, lighter colour part of a tree ring. The latewood is the denser, darker colour part.

Density and strength: Density describes how heavy a piece of wood (with a particular size) is. Strength describes how much force it can take before it breaks. Dense species tend also to be strong, but for a particular species there is not a direct link between the density of pieces of wood and the strength of those pieces. The strength of wood is complicated – not least because trees grow wood according to their own interests and are very clever in how they do that. Contrary to what a lot of people think, softwoods like spruce and pine are not less dense the faster the trees grow. The fast growth of trees in Scotland is a good thing, because it provides more wood, faster.

Like all properties of natural materials, the density of wood varies. The numbers given for the wood samples are averages – but there is a good chance the actual samples you have are quite different. Your piece of spruce might easily be denser than your piece of larch.

A dense, or strong, kind of timber does not always mean it comes from a kind of tree that grows tall. Tallness is only one of the reasons that trees produce wood. The kind of tree might grow dense wood to protect it from things that want to eat it. The properties of different species of wood are different because different species of tree have different ideas about how to be a tree.

Hardness: Hardness describes how resistant the wood is to being scratched and dented. The higher the hardness number, the more resistant it is. Very hard woods can be difficult to cut because they blunt the saws. One of the very hardest kinds of wood is called Quebracho – which comes from the Spanish for axe breaker! On the scale we have used for the wood samples it has a hardness score of 20!

Durability: The natural durability of wood is a very complicated subject so we will try and simplify things for this exercise. The main concern in the UK is fungi. Fungi need some moisture to be able to eat the wood. Fungi are everywhere, so the most important factor is how wet the wood can get, and whether it is in contact with the ground. We can describe this using five “use classes” (see the durability information sheet). For wood species, the natural durability refers only to the heartwood. Sapwood is always regarded as not durable, unless test data provides different information.

The durability of wood can be improved with chemical treatments (pushed inside the wood, or applied as a coating), but it can also be protected by good design – ensuring that the wood can always dry if it ever gets wet.

Additional notes:

The wood properties are quoted for a moisture content consistent with air temperature of 20 degrees Celsius and 65 % relative humidity.

Density is the mean average in kilograms per cubic metre. Strength is the mean average bending strength of clear (defect free) wood in newtons per square millimetre. An approximate equivalent is quoted for OSB and particleboard. The bending strength of sawn timber with knots and other defects is typically about half of the clear wood strength. Hardness is the Janka hardness rating quoted in kilonewtons. This is the force required to push a standard sized metal ball, a standard distance, into the wood. An approximate equivalent is given for OSB and particleboard.

The numbers have been rounded for simplicity, with an attempt to represent the relative performance of the different species. However, due to the variability of wood, a single species, grown in a particular area, has a wide range of density and even wider range of strength. As an approximate guide, the density of individual pieces will vary between 0.75 and 1.25 times the mean average. The strength of individual pieces will vary between 0.3 and 1.7 times the mean average.

The data is based on the following sources:

BS EN 350:2016, “Durability of wood and wood-based products. Testing and classification of the durability to biological agents of wood and wood-based materials”, British Standards Institution

Gwendoline M Lavers, “The strength properties of timber”, BRE publications, BR241, 2002

The wood database website https://www.wood-database.com/

Test data from Edinburgh Napier University

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