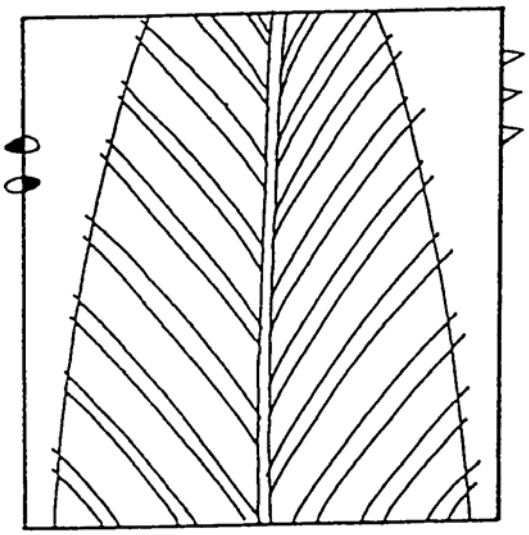
TIMBER



Waitakere City Council
Te Taiao o Waitakere

Contents

This chapter is part of the Waitakere City Council's Sustainable Home Guidelines. The complete set can be obtained through most libraries or from the Waitakere City Council, Private Bag 93109, Henderson, Waitakere City 0650, New Zealand, phone (09) 839 0400, email: info@waitakere.govt.nz.

The guidelines are also available on the council's web site: http://www.waitakere.govt.nz

Timber – The ultimate sustainable building material?

Timber is the primary building material in New Zealand. It is relatively cheap, the Building Code makes designing with timber easy, and builders know timber frame structure like the back of their hands. Native timber was readily available to most of the pioneers – often they had to clear the site of it before they could start building. The tensile strength and flexibility of timber proved better than masonry construction for resisting earthquakes.

They soon found which timbers were best suited for different functions: the hard-wearing quality of matai for flooring, the stability of heart rimu for window joinery, or the resistance to decay of totara for piles or other places where there was moisture.

Large tracts of forest – particularly the lowland forest that offered ready access to the best stands of timber trees – were cleared for agriculture, but by the time the protection of our remaining natural forest became a major issue, we were able to switch to supplies from fast-growing plantation forests. Plantations occupy about 6% of our land area, yet this is more than enough to meet our needs, and it allows us the privilege of locking up our natural forests for protection from further logging.

Although other materials are now more commonly used for some building components – aluminium for window frames, brick and fibrous cement for cladding – the bulk and the structure of most of the houses we build are still timber.

Timber is a renewable resource, produced by solar energy. A tree takes up water and mineral salts from the soil and carbon dioxide from the air. It processes these by photosynthesis. The structural strength of the tree derives from the parallel fibres of cellulose that it lays down in the trunk.

Because the process of growing a tree soaks up carbon dioxide, timber is the only building material you can use that actually has a beneficial rather than negative impact on the greenhouse gases of the earth's atmosphere.

As a building material, timber is valued for its character, warmth and texture. It is a "natural" material – renewable and biodegradable. There are nevertheless two key questions you should ask if you want to choose timber that is both sustainable and healthy:

- Where does the timber come from?
- How is it preserved?

Where does the timber come from?

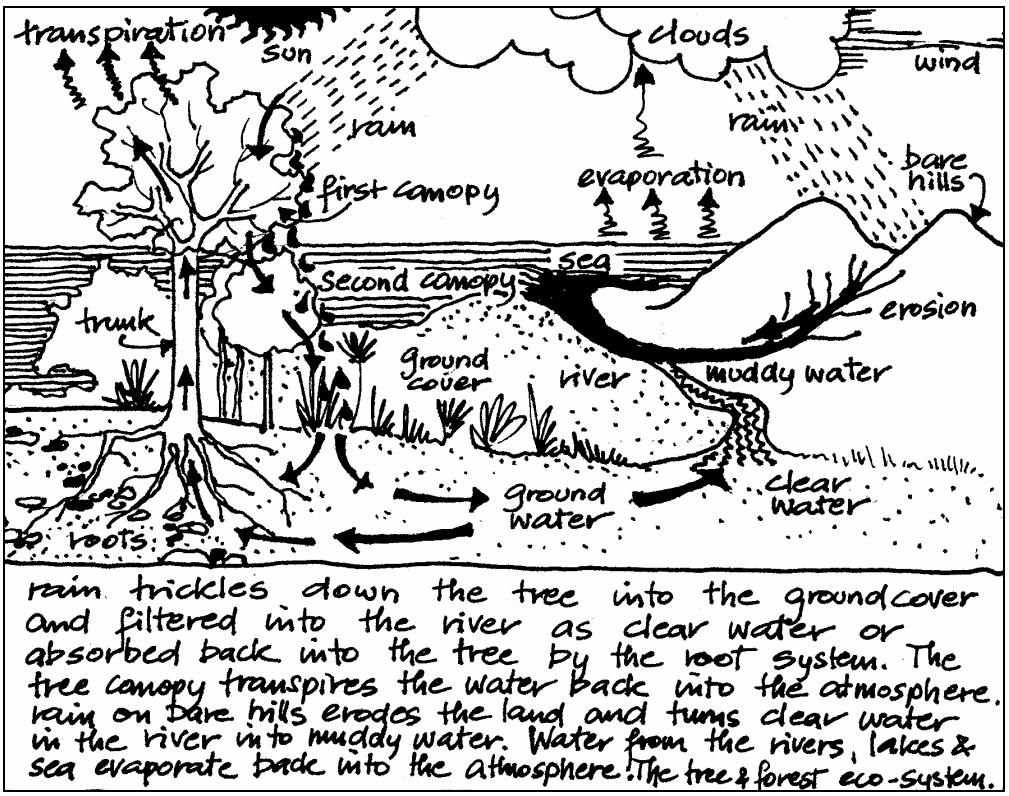
Every year the world's forests deliver up over 1.5 billion cubic metres of timber for milling and industrial processing, as well as supplying fuel for about half the world's population. This timber can come from forests that grow naturally or from plantations.

Natural forests

Natural forests are the richest form of ecosystem on land – supporting huge numbers of species. Three-quarters of terrestrial biomass (the total mass of all living things on land) is in forests. Tropical forests cover less than 10% of the land surface, yet they hold one third of the earth's terrestrial biomass.

Apart from the beauty of natural forests, they support a complex interdependent ecosystem of plants and animals. They are the habitat for most of the world's species, many of them yet to be identified.

Forests act as a climatic flywheel, absorbing excess rainfall and releasing water vapour gradually back to the atmosphere to form rain again. When forests are clear-felled on a large scale, the climate can change irreversibly and deserts form.



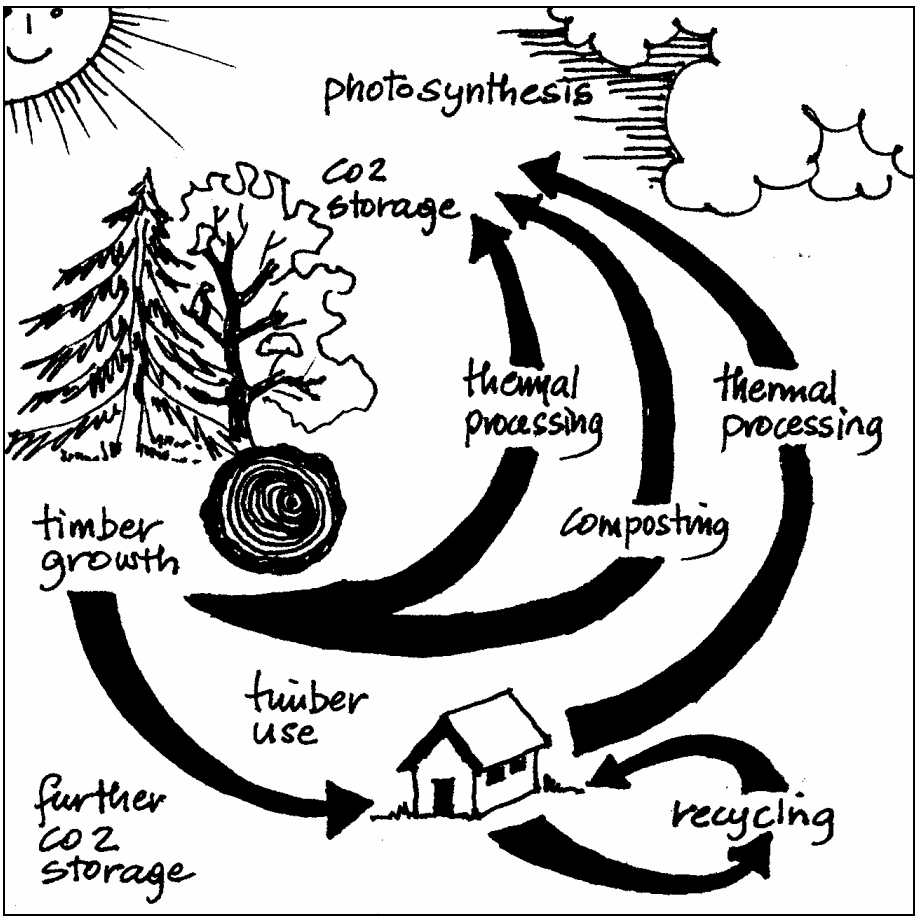
Hydrological cycle of our planet

Forests absorb and hold rainfall, before transpiring it back to the atmosphere or filtering it into the groundwater and streams. They protect the soil and prevent erosion and flooding downstream. A forest is a huge energy exchange system, in which energy is continually flowing from one organism to another.

Trees recycle gases, filter pollution and purify the air. Each year an acre of healthy growing forest produces between 5 and 20 tonnes of new wood, releases about 8 tonnes of fresh oxygen, and consumes about 10 tonnes of carbon dioxide.

This latter characteristic is particularly significant. The fossil fuels we burn in engines and power stations pump excess carbon dioxide into the atmosphere and foster global warming. The ability of growing forests to convert carbon dioxide into oxygen and lock away carbon (at the rate of about 8 billion tonnes a year) is vital.

This carbon storage continues through the cycle of timber products used in our buildings.



Closed loop of forest and timber use

Sustainable logging

Clear felling forest can cause an irreversible decline of productive capacity. The Romans, for instance, created deserts by clear felling huge areas around the Mediterranean in southern Europe and North Africa.

In the last fifty years more than half the planet's remaining tropical rainforest has been destroyed. The remaining two billion hectares or so of tropical forest is at risk both from slash-and-burn felling associated with agriculture (which can be aggravated by drought conditions) and from the inroads of logging companies.

It is possible to log natural forests in a sustainable manner, so that they form a stable ecosystem and timber harvesting can continue indefinitely at the same rate as replacement timber growth. In the Solomon Islands and Malaysia, for instance, where indigenous communities hold customary ownership rights to forests, eco-forestry offers an alternative to outright sale of the land for industrial logging. Single trees are selected, the logs are sawn into timber where they fall with a small portable sawmill, and the timber is carried out by hand. There is minimal damage, forest regeneration is assured, and there is a worthwhile financial return for the indigenous people.

Such sustainably produced tropical timber is available through some New Zealand timber merchants. Many false claims are made, so you should look for certification from an independent scheme such as the FSC (Forest Stewardship Council). The ITTG (Imported Tropical Timber Group) is a partnership of industry and non-governmental organisations which is working towards importing only sustainably-grown timber.

Sustainable logging is theoretically possible in any natural forest, but in practice it is rarely attained. Because everything is done on a small scale it is labour-intensive and therefore uneconomic in a high-wage country like New Zealand. As soon as vehicle access is introduced, or logs are dragged out to be milled, the damage done to the forest increases enormously.

Plantations

New Zealanders are ambivalent about the environmental effects of our vast pine forests. There is no doubt that a monoculture timber plantation is a poor substitute for a natural mixed forest. While some birds like the kiwi, whose food comes from the soil, can live in these habitats, other birds rely on changing food sources from different trees at different seasons. At the time of harvesting and re-planting, a plantation looks ugly and can be especially vulnerable to erosion and other environmental effects.

Nevertheless, if the alternative is farming, as it usually is, then a plantation forest offers a much richer eco-system than pastureland. And a square kilometre of our typical pine forest will lock up 12 - 20 thousand tonnes of carbon per year – ten times as much as pastureland.

There is another compelling reason to use radiata pine to meet most of our timber needs: because it's there. Pinus radiata was chosen as New Zealand's primary timber species as a result of considerable research in the early part of the 20th century. The species grows fast in our benign climate, maturing to saw-log size in 25-30 years and yielding up to 10 times more timber than our native trees in that time (1200–1500 tonnes per sq km per year). There is now a huge and efficient industry based on radiata pine. What we don't process for high-value end-uses like building timber is likely to be exported unprocessed or end up as paper pulp.

One trend is towards mixed plantations of different species. These may take longer to grow to maturity, but the timber is of higher value because different species are suited to different end uses. Mixed or rotational cropping is also likely to be more sustainable in the long term and reduces the risk of an accidentally introduced pest affecting our entire timber resource.

We now have a greater choice of sustainable plantation timbers that do not require chemical treatments before use. Timbers grown in New Zealand plantations require less energy input to get to your building site, and you can be more confident of their origin.

Sustainable plantation timbers suitable for various end uses:

Uses	Suitable timbers	Comments
Exterior joinery and weatherboards	Cypresses and NZ redwood Radiata pine (H3.1 treated) Western red cedar (FSC certified or similar)	All heartwood
Decking and flooring	Cypresses Stringybark and eastern blue gums Radiata pine (H3.2 treated)	All heartwood All heartwood
Structural (protected)	Cypresses, Douglas fir Radiata pine (H1 treated)	
Engineering (external beams and cross arms)	Stringybark eucalypts and eastern blue gums Radiata pine (H3.2 treated)	All heartwood
Roundwood (posts, poles, piles)	Stringybark eucalypts and eastern blue gums Radiata pine (H4-H5 treated)	Not all species or provenances are equally durable
Garden and horticultural uses	Cypresses, stringybark eucalypts, eastern blue gums Radiata pine (H4 treated)	15-20 year life for heartwood
Furniture	Cypresses and radiata pine All nominated eucalypts Blackwood, black walnut	Moderately soft timbers Choose colour High quality
Veneer	Same species as furniture	
Turnery	All nominated eucalypt species Blackwood Radiata pine Other species depending on end-use	

Note that some of these suggestions may not comply with the Building Code in specific situations. Check with the council if in doubt.

Durability and how timber is preserved

Rot (a process of fungal decay) and attack by insects have always posed problems for timber construction. In the past, people learnt by trial and error what types of timber to use in different locations for different functions.

Natural durability

As a tree grows it lays down layer upon layer of *sapwood* under the bark. Sapwood has very low resistance to rot and insect attack.

Over time the tree saturates the inner layers of sapwood with resins and other natural preservative substances, creating a strong, durable core of *heartwood.* Different species make heartwood at different rates and with different durabilities. Radiata pine makes heartwood very slowly, so timber from a tree younger than 100 years or so will be all sapwood and therefore non-durable. Heart totara, which was traditionally used in New Zealand for piles, is an example of a timber with very high natural durability. Commonly available plantation-grown timbers with some natural heartwood durability include Douglas fir, some eucalypts, and some cypresses such as Lawson's and macrocarpa.

Remember that for all species, only the heartwood is naturally durable.

As radiata pine became our dominant timber species we became reliant on chemical treatment to prevent rot and insect attack. Use of treated timber in New Zealand is among the highest, per capita, in the world. There are, however, ways of reducing the amount of treated timber we need to use to ensure our homes are durable.

Kiln drying

The organisms that cause decay in timber depend on a certain level of moisture. That's why untreated *Pinus radiata* rots quickly when it's kept damp. An alternative to chemical treatment for some uses is to sterilise and stabilise the timber by kiln drying. When kiln-dried to the appropriate moisture level, radiata pine can then be used as a framing timber for internal walls without the need for chemical treatment. Because of the risk of moisture entry, the Building Code does not permit its use for external walls.

Other methods

Another recent innovation is the development of a process that forces plant-based starch into radiata pine, making it harder than teak. The density, hardness, strength, stability, and machining properties of the timber are all increased, so it becomes suitable for traditional tongue-&-groove flooring.

Sheet materials

A very common flooring material is particle board, mainly composed of wood chips. The binder is normally urea formaldehyde, which can cause health concerns because of the way it continues to give off volatile solvents. Low-VOC products are widely available. Kitchen cupboards and household furniture, though disguised by veneers, upholstery and other surface finishes, are also widely based on variants of particle board such as MDF.

Another useful wood-based sheet material is plywood, which offers qualities of stability and strength unachievable in plain timber or MDF of the same dimensions. Ply veneers come from a myriad of forest sources (though radiata pine is the most common) and the glues that bind them also vary depending on the intended use. Plywoods are available in a wide range of specifications and can be a good way of making valuable or scarce timbers go a long way by using them as the face veneer layer.

Chemical treatment

The aim of chemical treatment is to coat or saturate the timber with a poison that kills any fungus or insects that may live on it. There are many different chemicals used for timber treatment, aimed at producing timber for different end uses. The treatment regime and chemicals are chosen to be appropriate to the intended end use, so it is important that you use them only for that purpose.

The Building Code identifies several hazard levels that timber may be subjected to. The appropriate treatment process depends not only on the hazard level, but on the nature, durability, treatability, and condition of the timber itself. In the past there was a tendency to over-specify timber treatment to a level unnecessary for the situation.

A common timber preservative in New Zealand is CCA (copper chrome arsenate). Often known by the trade name of Tanalised timber, it has a distinctive greenish colouration. CCA is a mixture of metallic salts of arsenic, copper and chromium, which protect wood from damage by microbes, fungi and wood-feeding insects. The treatment chemical is highly toxic, but once chemically fixed to the timber it is relatively inert. Be suspicious of timber that shows surface wetness from excess chemicals or which has crystalline chemical deposits on it. There is evidence that the treatment chemicals leach out over time, particularly in the ground, so it is wise to avoid using it in skin-contact uses such as handrails and play equipment. If you buy timber with the Timber Preservation Authority's "Woodmark" brand you can be confident that it has been processed in a modern treatment plant to the standards of NZS 3602.

Typical uses for CCA-treated timber include fenceposts, decking, and structural timber which will be in contact with concrete or the ground or could become wet in use.

Less toxic than CCA is LOSP treatment (light organic solvent preservative), which is a method of impregnating chlordane, permethrin, tributyltin, quaternary ammonium, copper, or other compounds as fungicides and insecticides. It leaches easily so is used only up to the H3.1 hazard level – timber which may be exposed to weather, but not ground contact, and will be painted, like window joinery and weatherboards. LOSP-

treated timber should be well ventilated to remove outgassing solvent before use, as the solvents and preservative chemicals are health hazards.

Boric treatment, used for H1 situations like wall framing, is relatively benign to humans although highly toxic to plants. Furthermore it does not chemically fix to the timber until you dispose of it – but then it is blocked off inside the walls. It also acts as a fire retardant.

With treated timber the environmental concern is more about the beginning and end stages of the product life cycle than about the period when it is in place as a component of your home.

Modern timber treatment often involves placing the wood in sealed pressure vessels where it is immersed in preservative and then subjected to applied pressure. The excess chemical is vacuumed from the vessel before the treated wood is removed. Older plants though are far less sophisticated and toxic chemicals often enter the soil. There are hundreds of such sites around New Zealand, which are now virtually unusable for anything else, and cause ongoing problems with toxic chemicals leaching into groundwater.

You should wear skin and lung protection while working with chemically treated timber, and dispose of offcuts and sawdust as hazardous waste. Never burn them, especially on a barbecue. Exposed to organic acids (in swampy ground or soil with high humus levels, for instance) treated wood will leach readily.

Treated timber and alternative solutions:

Common use of treated timber	**Alternative solutions**
CCA – H4/H5 poles and piles, etc (in ground contact)	• Use concrete piles or strip foundation • Use recycled hardwood, e.g. jarrah telephone poles • Use concrete block retaining wall
LOSP treated H3 weatherboards, decking etc (exposed to weather)	• Use cypress or eucalyptus heartwood • Treat boards with low impact finish (e.g. CD50) • Paint and maintain boards with a 3-coat system of certified Environmental Choice paints
Boric treated H1 timber framing (protected from weather)	• Use *Douglas fir*, *Lawson cypress* or similar species with natural durability. Use kiln-dried *Pinus radiata*.

Note that some of these suggestions may not comply with the Building Code in specific situations. Check with the council if in doubt.

Further information

Advice at the Waitakere City Council:

Phone the call centre (09) 839 0400
Ask for : Eco-Design Advisor
Building Consents

In print

NZS 3604 Light Timber Frame Buildings not Requiring Specific Design. Standards New Zealand

NZS 3602 Specifying Timber and wood-based products for use in building. Standards New Zealand

NZ Timbers: Indigenous & Imported – The Complete Guide. N.C. Clifton (G.P. Books, 1989) (out of print)

Your Home Technical Manual, Australian Government. Comprehensive printed resource, much of it relevant to New Zealand.

On the web

www.smarterhomes.org.nz is a mine of up-to-date and independent information. Designed for the general public, it's easy to use, has case studies, and includes features such as Homesmarts, a calculator you can use to find information relevant to your needs or simply to run a home-health check.

If there are questions you can't find answers to on Smarterhomes, www.level.org.nz goes into more depth and is aimed at the design and building industries, with drawings and links to Building Code compliance documents.

Eco-building Products and Services Directory, Building Biology and Ecology Institute, phone Auckland (09) 376 6767, Wellington 0800 223 272. This is updated regularly and can be obtained from the website www.ecoprojects.co.nz.

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