The Guide to Forestry



Forestry for Life



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EASTLAND WOOD COUNCIL

Thanks to those that contributed to the production of this guide and provided funding support.

We recognise these industry groups that are a important part of our industry.













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Although the information supplied in this handbook is thoroughly checked for correctness, no claims can be made based on the content of this document. Please refer to official publications as mentioned in this guide.



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The Guide to Forestry

New Zealand is built on wood—a material that made our towns and cities, brought us power, fenced our lands, assisted our communications, and put roofs over their heads. It was the reason productive plantations were established to provide the country with a rich renewable resource for export and domestic consumption. We are skilled with wood . . . familiar with it. Maori have long treasured its magical properties for building and carving.

And in the scientific development of wood, New Zealanders continue to be world leaders.

When European settlement began in earnest in the mid-1800s, much of New Zealand was covered in native forests and shrub.

Many of these forests were cleared to create sheep, cattle and dairy farms, and the timber from the forests was exported, and used to build the country's growing towns, as well as farm fences and buildings.

Radiata pine was first introduced to New Zealand in the late 1850s to see if it would be a good candidate for widespread planting. Its excellent growth rate prompted seed imports from California in the 1870s, mainly for shelter belts and woodlots.

By the first forestry planting boom in the 1920s and 1930s, it had been adopted as the species of choice. It proved to be versatile and grew well throughout New Zealand on a variety of soil types, including coastal sands, heavy clays, gravels and volcanic ash deposits.

New Zealand now has 1.75 million hectares of planted forest, of which some 90 per cent is radiata pine, much in first rotation forests.

A third of the world's radiata forests are grown in New Zealand, with Australia and Chile other major producers.

The forests of Gisborne-Tairawhiti were historically planted for erosion control, but from the first softwood forest plantings in 1959 they have evolved into an export-earning, employment-providing foundation of the local economy. The forestry industry in Gisborne-Tairawhiti and the dedicated sub-sectors of transportation and softwood make forestry a major contributor to local GDP. The monetary benefits can be valued directly through economic transactions and then there are the indirect benefits, such as the environmental water, air and soil quality; recreation; erosion-related disaster aversion; and social-related cost aversion.

Much of those early plantings have been harvested and replanted, but the significant new plantings of the 1990s are now reaching maturity and within the next decade, the Gisborne-Tairawhiti regional harvest volume is expected to jump 50 %, reaching 3.2 million tonnes with more than 90 % exported in log form.





Today, forests cover **31%** of New Zealand's land surface — **24%** is indigenous (native) forest and **7%** is plantations of mainly exotic species.



Propagation

Forest establishment starts even before a tree is planted in the ground.

First, seedlings need to be propagated from seed, cuttings or tissue culture.

In the case of seedlings, the seed is sown in nursery beds (usually in October) and seedlings readied for planting the following winter (May to August). The seedlings' roots are undercut during the seven-tonine-month growing period, which causes them to produce many fibrous roots near the soil surface. This increases their chance of survival when planted out.

With cuttings, seed is first sown to produce stock plants, which are cultivated to yield a multitude of young shoots. The shoots are removed as cuttings and planted in nursery beds or containers. It takes several months for the cuttings to form roots. Improved varieties planted from cuttings can come from just a single, superior clone or, more commonly, a mixture of clones from several different, unrelated crosses.



Thousands of genetically identical radiata pine trees can be produced using cultured tissue. When seed embryos are placed on a special growing medium in a Petri dish, they develop many little shoots. Each of these shoots can be cut off, grown and induced to form roots. The little plants are then transferred from Petri dishes to pots in a glasshouse until they are large enough to transfer outside to a nursery. Selected clones of young radiata pines are hardened off in nursery beds before being removed and sold for planting.

Scion and the Radiata Pine Breeding Company have been breeding trees for improved traits for years, to try to grow trees which are faster, stronger, disease resistant and have improved wood qualities so seedlings planted out today are far superior to those first trees of the 1920s.

Seedlings and cuttings are ready for planting when 25–30 centimetres tall.





Site Preparation

Before planting, sites are prepared to create the best conditions for tree survival and growth. Preparations include spraying to kill weeds, ripping or ploughing the soil and forming soil mounds.

Planting

Trees are normally planted by hand, using a spade to dig the hole. The number of trees planted per hectare can vary from 600 to 1,400. If the soil is lacking nutrients, fertiliser is applied.



Pruning

Some stands will be pruned to end up with a pruned butt log on the tree. These logs command a premium and will be sawn into appearance grade uses, where a knot free product is required.

Pruning occurs about five years after planting when the best 3-400 trees per hectare are selected for a first "lift" and pruned up to a height of 2.5-4-metres. They may then get a second or even third lift a few years later to get a pruned height of 6-6.5 metres. At around 9-10 years, when the trees are 14-16-metres high, all the unpruned trees are felled to allow the remainder room to grow.

Some forest management systems aim to grow a high-yield of logs with small knots – suitable for structural timber such as house frames, roof trusses and poles. In this case the trees aren't pruned and are grown closer together (450 stems per-hectare) to limit branch growth which keeps the knots small.

Thinning

With a harvest age of 25–35 years, and final tree numbers of around 300-500 stems per-hectare, a half-totwo-thirds of trees planted are usually cut down during the early stages of the growing cycle. This removes the poorer quality trees that are smaller or malformed, and makes more room for the others. The felled trees can be either thinned, left on the ground to rot, or can be production thinned, so logs are removed for posts, poles or pulpwood. This is generally on flatter sites rather than steep country.

The trees are then left to grow until aged 25 or older, with visits to check on forest health or measure growth rates.



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Terrain is a major determinant of where roads are built on steeper country, and environment consideration is another major factor.





Harvest Planning

Forests will have some basic roads put in when they are established but prior to harvest, planning needs to be carried out for the best way to harvest the trees effectively & efficiently. Generally, felled trees won't be pulled more than 600-metres to a skid or landing, where the stems are cut into logs and trucked out. This requires a lot of management as to where best to put the roads and landings. The shorter the distance to the road and landing, the cheaper the harvesting, but the more roads you build, the more costs incurred.

Roading

Once forest harvest is planned, the roads can be built, though often some trees must be removed to make way for the roads. The roading networks play a vital link between the forestry plantations, export facilities and processing plants.

The NZ Forest Road Engineering Manual covers all aspects of the planning, design, construction and maintenance of unsealed forest roads. It is intended to be a detailed guide for those who have a limited engineering background, as well as a reference for more experienced forest roading supervisors and engineers. The best road construction results will be achieved by the application of technical information, combined with knowledge and experience. Manual-users are encouraged to seek out, and draw upon, the knowledge of experienced roading contractors, supervisors and engineers in the forest industry.

Manual aims to promote:

- Technical guidance and techniques for planning, appropriate standards and design of forest roads
- Practical information on construction, maintenance practices and techniques.
- Environmental practices that avoid, remedy or mitigate adverse environmental effects
- A safe working environment.

Also, much of New Zealand's plantations are on steep, erosion-prone hill country that is often a long distance from mills or ports. These factors make infrastructure construction and maintenance an important driver in the economics of overall harvesting operations.





Logging/Harvesting

Harvesting was traditionally a very manual process with men and chainsaws but these days is a more mechanised operation. Trees are felled either using chainsaws or mechanical harvesters, both of which are highly-skilled tasks. It requires expertise to minimise breakage and wastage, and make it easier for extraction. Extraction is when the felled trees are taken to the skid or landing for processing. This can be with wheeled skidders, crawler tractors or overhead cable haulers.

At the skid, the branches are cut off and the stems are cut into logs, either by people with chainsaws or a mechanical processor. The logmaker is a highly-skilled individual who determines which are the best value logs, based on log diameter, branch size and straightness.

Logs are then carefully sorted into categories per their intended use and value, and loaded onto trucks for transport to depots, mills or ports.

Types of Log

No matter what kind of management system is followed,

the forest will yield a range of log types. For example, large pruned logs are used for clear timber and veneer, large knotty logs for structural timber, and small logs from the top of the trees for wood chips, wood pulp, fibreboard and particleboard.







Trucking

To get logs to the processing plant or port we need trucks.

It would seem many truck drivers are on the road 24/7. In the Gisborne-Tairawhiti region, their days often start at 2am with the door closing on the cab at 3pm each day, five days a week. The early morning rise enables the drivers to get out to the skid sites well in time to manage about three return trips a day. Over a five-day week, they are putting in 70 hours, and clocking close to 2,500kms. Each driver can legally work a 14-hour day, with a half-hour break every five and a half hours. The earning capabilities of this job are good but they do put in many hours over-and-above a typical eight-hour a day job.

Logging trucks are the face of the industry and at the forefront of public concern for not only the frequency of the numbers of vehicles on the roads, but the perceived damage they are doing to the roads. To suggest that logging trucks are costing the ratepayer money to repair the roads is just not right. Anyone using New Zealand's roads contributes towards their upkeep. Most road-users pay levies when they buy fuel and drivers of light diesel vehicles and heavy vehicles, like logging trucks, pay through Road User Charges (RUC). LTSC (Log Transport Safety Council) is a pan industry collaborative of truck operators, transport researchers, trailer manufacturers, forest owners, legislators and enforcement agencies. It is recognized as the premier source of log transport research and industry knowledge that leads the world in innovative, sustainable and safe best practice log transport operations.

The vision is underpinned by four strategic goals:

- The LTSC to be recognized Internationally as providing leadership in all areas of the log transport industry
- Develop industry guidelines which promote safety in the workplace
- Provide a reliable source of accurate industry information
- Develop clear and effective communication with the wider community.





Forest Management

Forest management is the management of all the above processes and is the key to producing the right trees for making the right logs for the right products. The industry takes pride in the way it manages and takes care of the forests – from land preparation, seed selection, planting, disease and pest control, through to thinning, pruning, and harvesting. There is supervision along with quality control at each step of the forestry cycle. It's a deliberate, methodical and continuous process to ensure the product requirements of customers are met. It is well-suited to the innovative and high-quality products made.

As part of forest management, good forest mapping provides many benefits to forest owners:

- Due diligence and feasibility studies-make sure that what is described is there with no unpleasant surprises for anyone
- Budgeting and forecasting provide an accurate definition of the planted/stocked area, treatments, costs and revenues
- Planning and operations include maps which are an important tool for harvest planning and engineering, and play a vital role in tracking, recording and reporting operations that are performed on a forest
- Legal and compliance also includes maps to provide an excellent support for resource consent applications and are helpful in cases where legal boundaries may not line up with planted boundaries. Mapping hazards makes operations safer

Productivity

The amount of wood a hectare can produce depends on the rotation (lifespan) of the trees, how many are grown to maturity, and the productivity of the site, which in turn is related to soil depth and fertility, and climate. On average, a hectare of forest will grow 23 m3 of wood per-year but under very good conditions, such as a deep pumice soil and mild climate, this could be as high as 30 m3 a year which would produce 840 cubic metres of wood at 28 years.

Different sections of a felled pine tree are used for different purposes.

The top five metres are often too small to be recovered so are left in the forest.

The next eight metres of timber are used as industrial logs and may be processed to paper, medium-density fibreboard (MDF) or particleboard.



The bulk of the tree is used for saw logs, which are put to a variety of construction uses. The pruned butt of the tree produces clear timber for furniture, house building and beam construction. The stump is not recovered from the plantation.



Domestic processing

The New Zealand pulp and paper industry began in the 1950s at Kinleith and Kawerau, in the central North Island. Mills produced newsprint, industrial paper, tissue and pulp.

Other wood-processing companies, such as Juken NZ are producing:

- fibreboard (hardboard and softboard)
- particleboard
- plywood
- medium-density fibreboard
- heavy-duty engineering timber
- timber for furniture, house sidings and mouldings
- laminated veneer lumber.

These products are sold locally and exported.

Fibreboard is made with low-grade pine wood, which is chipped and then further reduced to fibres. Hardboard and insulation board is manufactured from wet fibres pressed together. Medium-density fibreboard is a composite of dry wood fibres that have been mixed with resin and pressed into boards.



Plywood consists of thin sheets of wood (veneers) joined together by glue. The veneers are cut in thin peels from a rotating log and dried before being glued together in layers, or to a solid wood core. Radiata plywood is mainly used in building.

Laminated pine is lengths of timber bonded together with strong adhesives. The laminates can be glued together to form beams and curved shapes, and are used extensively for structural work.





Exports

Exporting logs is important, as New Zealand produces far more than required by the domestic market. Logs are sold mainly to China, Korea, India and Japan. High quality logs, such as pruned trees, are made into furniture and other high value products, but much of the rest is used as timber or made into plywood for use in construction work (concrete boxing), packaging, and pallets. New Zealand also exports logs and chips for wood pulp.

Eastland Port in Gisborne is the district's only primary seaport, with about 92–95 % of the region's export production being shipped from it. The Port is expecting to handle about 4.2 million m³ per annum by 2020 and more in the longer term as forest's outputs reach sustainable levels. Over the past few years the Port has invested in several initiatives to support wood product exports. They have the largest log scaling facility in New Zealand, and on-site is a debarking/fungicide treatment plant processing up to 1200 m3 of high-value pruned logs daily.

The three-hectare cargo storage yard at Matawhero can handle an additional 30,000 m3. The site is completely selfcontained with its own scaling and weighbridge facilities. The Port sits on 12 hectares and the associated log yards can store approximately 115,000 m3 with on-going projects to expand to increase storage capacity. In addition, there is an on-going project to asphalt seven hectares of the log yards which will increase log capacity by 10 % and improve storm water management and quality. The wharves have been refurbished and the entire length of the breakwater is undergoing refurbishment as well. There are also plans to deepen the channel so more logs can be loaded on ships year-round along with the possibility of expanding towards the sea by reclamation should the need arise.



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Multi-purpose Bark

Bark from harvested pine trees was once viewed as a waste product, but is now used for fuelling kilns and dryers at wood-processing plants, and made into plant-propagating mixes, mulches and composts. An extract from the bark is even used in a dietary supplement, enzogenol.

Careers in Forestry

The forest industry and its dedicated service sectors have become a major employment source for the country and the Gisborne-Tairawhiti region. Locally, forestry provides an estimated 1,600 jobs – roughly 3.1 % of the district's population. Given there are around 15,000 households in the region, with 4,434 FTEs then more than one in four households have a person whose job is dependent on forestry. The growth performance of the sector is promising for employment and career development. It plays a significant role in regional economic development as a large employer, an employer of youth, in attracting new residents and in driving up-skilling and continued learning to produce productivity gains for Gisborne-Tairawhiti and New Zealand.

By 2025 the New Zealand forestry industry is expected to need over 25,000 more trained workers to replace those retiring or leaving the industry.

Many of the country's new forests — those planted since the 1960s — are in areas, such as Northland and Tairawhiti (East Coast), where unemployment has traditionally been high. The need for a highly-trained workforce is recognised by all sectors of the industry. Forestry workers produce 98% of all the wood New Zealand uses. Most of the work is outdoors in the forests but there are also engineering, research, planning and management jobs available. There are jobs that can be done by school-leavers or others that require higher qualifications. Forestry work is varied with plenty of opportunity.

Forestry and logging workers plant, prune, measure, cut and clear trees from forests. They have good knowledge of trees and timber types, knowledge of tree pruning, felling, cutting and trimming methods, good mechanical operations skills (from chainsaws to heavy vehicles) along with fire-fighting, and health and safety skills.

They often do a 10-hour working day, and sometimes weekend work is also required. The industry calls for people to be absolutely safety conscious, practical and with the ability to work well in a team. Forestry and logging workers need to be reasonably fit, healthy and strong, as their work can be quite physical. They also need to have quick reactions, good hand-eye co-ordination and a plenty of stamina. Useful experience for forestry and logging workers include those who may have worked in a timber-mill environment.

Forest managers plan and manage whole forests. They might work for the forest owner or a specialist forest management company. Forestry scientists research forest growth, wood processing, environmental issues and different types of trees and their uses. Forest engineers plan and manage forest development and lead the development and introduction of new technologies and prototype equipment.







There are many exciting career paths and opportunities to be had in forestry based around forestry management and opportunities ranging from planting through to harvesting.



Typically, they will all work an eight-to-nine hour day, sometimes working long hours or weekends on projects. Most of the work is done in laboratories and offices with many other people including researchers, lab technicians, forestry companies, foresters, engineers and equipment suppliers and some work is carrying out research in the forests. Key to these positions is good communication skills, attention to detail and the ability to learn and understand a great deal of information.

Competenz is a lead education provider and assessor in the forestry sector. It develops national qualifications and makes it easy to learn on the job. It partners with employers, apprentices, schools, training providers and assessors across the country to help Kiwis build skills and careers. Competenz provides training materials and eLearning, and visits workplaces to check on progress and arrange for learners to complete any off-job training needed (eg at a polytechnic). Competenz assess (or arrange assessments) to confirm learners have built the necessary skills, moderate the assessors to make sure they are fair, valid and consistent across the country and register learners' successes with the New Zealand Qualifications Authority.

Institutes of technology and polytechnics are New Zealand organisations that provide education and/or training and/or assessment services to learners. A wide range of programmes and qualifications are available throughout the country.









Environmental

Once young radiata become established, they rapidly stabilise steep hillsides, protecting the soil and regulating the rate at which water runs off the land. The vegetative litter on the forest floor acts as a sponge — holding and slowly releasing water for many days after the last rainfall. This helps prevent destructive flooding.

On average, radiata pines grown in New Zealand are harvested at 29 years. The timber has excellent nailing, gluing and painting properties and is also used as a feedstock for the manufacture of paper and industrial packaging materials.

Researchers compared pastoral farming with forestry over 12 years and found that a forest produces less sediment, uses slightly more water, reduces soil erosion, has a more positive effect on stream environments, and makes no real difference to water quality.

Begun in 1993, the land use study was a response to public concern about the environmental effects of forestry on Hawke's Bay hill country. It was completed in 2005.





A paired catchment study approach was used, with one catchment in forest (Pakuratahi) and the other in pasture, farmed with sheep and beef, as a control (Tamingimingi). The catchments represented North Island hill country. Researchers compared the environmental effects of commercial forestry and pastoral farming through various stages of the forest rotation. The sequence of pre-harvest, harvest, replanting, and canopy closure covered time of major environmental change.

Habitat for Native Species

For long periods while they grow, plantation forests are relatively undisturbed ecosystems, and provide habitats for many species of native plants and animals. For example, kiwi and falcons have found planted forests to be a ideal habitat and feeding ground.

Although the biodiversity of plantation forests is not as rich as indigenous forests, the number of native species that live there contribute to the biodiversity of the country.

Soil Improvement

New Zealand's radiata pine forests are mainly planted on soils that were not considered suitable for intensive agricultural use. Some examples are the large volcanic ash fields of the central North Island, drifting coastal sand dunes and shallow, less-productive hill-country soils.

Growing trees on these soils often improves them because organic material in the form of leaf, bark and woody litter adds nutrients. The trees also extract mineral nutrients from deep in the soil. Because of this, the second crop of trees on such sites will often grow better than the first. Some areas that have produced one or two crops of trees have, with fertiliser treatment, been successfully converted to agricultural land.







Protecting the Forest

Radiata pine can suffer from pests, diseases, wind storms and fire. Dothistroma needle blight, a pathogenic fungus that attacks the needles of young pine trees causing reduced growth, is the most widespread disease. It is most serious in places with higher rainfall or prone to prolonged misty conditions. However, it can be controlled with a fungicide spray.

Strong wind is a hazard to forests in New Zealand and has sometimes caused severe damage to pine plantations. Young trees can be toppled by wind on sites with puggy soils, and older trees can be uprooted completely or snapped off.

Fire is an ever-present risk, particularly during prolonged droughts.

In a world increasingly concerned by dwindling resources, atmospheric pollution and global warming, wood is the resource we can consume indefinitely, because we can constantly replace it. The more we use, the more we grow. And the more we grow the better it will be for the planet. Growing forests absorbs CO_2 from the atmosphere and by choosing wood over other products, we reduce the amount of CO_2 emissions. Forests and wood fight global climate change.

Carbon Sinks

Trees store carbon, making radiata pine plantations useful 'carbon sinks'. About 50% of the dry matter in the wood is carbon – largely cellulose (about 65%) and lignin (about 30%). Depending on growth-rate and wood density, a hectare of pine trees locks up four to seven tonnes of elemental carbon per year, which is equivalent to 15–26 tonnes of carbon dioxide absorbed from the atmosphere. A 1,000-hectare forest can absorb 15,000–26,000 tonnes of carbon dioxide per year.

Carbon Footprint

When burnt as fuel in a car engine, petrol releases 2.62 kilograms of carbon dioxide per litre. On this basis, a typical car produces one tonne of carbon dioxide for every 5,555 km driven, or three tonnes in an average year's driving (16,666 km). This is equivalent to the amount of carbon dioxide that 33–60 pine trees absorb in one year.

Growth and production of one tonne of wood absorbs a net 1.7 tonnes of CO_2 from the atmosphere. (Based on the amount of carbon stored in the timber – making an allowance for all the energy used, and CO_2 produced, in its growth, harvesting and processing.)



One tonne of steel has added 1.2 tonnes of CO_2 into the atmosphere.

But timber is not only better for the planet. We are creating a new, value-added market which will benefit suppliers, consumers, the economy and the environment – not only for this generation, but for generations to come.

It is imperative the industry and region are prepared to take advantage of the economic and social opportunities this will create, including employment generation, soil conservation and stimulation of regional development.

All members of the Eastland Wood Council recognise the value and importance of environmental responsibilities, health and safety regulations and best-practise guidelines. Safety rules and best-practice guidelines ensure work is carried out to the highest safety standards, preventing harm or death.

The Plantation Forestry Approved Code of Practice (ACOP) has been developed in partnership with industry representatives and other agencies and it focuses on improving safety practices and reducing workplace accidents in the industry.







Health and Safety in the forest

To support health and safety, which is strongly advocated in forestry, IRIS (Incident Recording Information System) through NZFOA (NZ Forest Owners Association) is used to record all accident and incidents which includes:

- Hours worked
- Near hits
- Medical injuries
- Lost time injuries

The system is used to monitor improvements in health and safety to compare data against industry and is aligned with our system and goal of zero harm by 2020. The system calculates LTIFR; a definition and calculation of Lost- Time Injury Frequency Rates which are the number of lost time injuries within a given accounting period relative to the total number of hours worked in the same accounting period.

Eastland Wood Council proactively commit to forests and employees that are drug and alcohol free on the East Coast.

And finally, FISC (Forest Industry Safety Council) has been established in response to the Independent Forestry Safety Review (IFSR). It is a national industry-lead body with the mandate to work in collaboration across the full plantation forestry sector, representing one voice in health and safety. Its overall objective is zero fatalities and serious harm- "Together towards Zero". There is real opportunity to work in partnership and embrace the new health and safety legislation to think differently about achieving safe outcomes.

Trees, forests and wood are intrinsic to every New Zealander's cultural, spiritual and emotional landscape. We need to promote the value and importance of New Zealand wood as the immensely versatile resource it is – to growers, processors, specifiers, retailers and consumers alike. We need to do it in a way that is compelling, cohesive, positive, productive and ultimately life enhancing.

For more information about our industry contact...

Prue Younger | CEO Eastland Wood Council M 021 276 5484 E prue@eastlandwood.co.nz.co.nz P O Box 262, Gisborne 4040



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