FOREVERBEECH™ STRUCTURAL QUALITY LAMINATED BEAMS TECHNICAL INFORMATION

Technical Document No.	#038
Title	Foreverbeech™ Structural Quality Laminated Beams
Issue Date	14-08-2017
Version	1.0

Consulting Engineers

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ACENZ

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10th June, 2013

Your Ref: Red Beech Glue Laminated Beams

Dear Sir,

As requested Cook Costello has completed an assessment of glue laminated beams using red beech and conventional radiata pine with a view of determining the equivalent section sizes when using the alternative species. NZ red beech is classified as a native hardwood and is harder and more dense than radiata pine.

NZS3603 Timber Structures Standard lists the characteristic stresses of timber for various timber species and notes that red beech has higher strength and stiffness properties than that of equivalent radiata pine. The Timber Design Guide 2007 published by the NZ Timber Industry Federation lists red beech as an equivalent SG12 grade timber based on modulus of elasticity and it is expected that a glue laminated member of this species will achieve a minimum grade of GL12.

Conventional radiata pine is typically rated as SG8 and GL grades in excess of 10 can be difficult to obtain with NZ radiata pine. The radiata pine GL8 beams are typically formed using 45mm thick laminates.

The GL12 manufacturing process requires the outer laminations to be selected from SG12 grade timber and can be formed from high stiffness species such as red beech. The inner laminations, in the middle half of the member depth, can be of lower grades if required.

It is understood that the red beech GL12 beams are formed using 19mm thick laminates and are available in the following sizes:

- 190 x 45mm
- 150 x 45mm
- 280 x 70mm
- 240 x 70mm
- 200 x 70mm
- 180 x 70mm

The strength and stiffness parameters adopted for assessing the beams are listed in Table 1 as follows:

Timber type	Bending f_b (MPa)	Shear f_s (MPa)	Modulus of Elasticity E (MPa)
Radiata Pine GL8	19	3.7	8.0
Red Beech GL12	25	3.7	11.5

Table 1: Timber properties

The following table lists the beam sizes considered for comparison between conventional radiata pine GL8 timber and red beech GL12 timber. Please note that the shear strength has not been assessed for the differing beams as the characteristic strength value is the same for GL8 and GL12 grades and seldom does shear capacity govern the design of residential timber beams.

Radiata Pine GL8			Equivalent Red Beech GL12		
Section size h x w (mm)	Flexural Strength $\phi f_b Z_x$ (kNm)	Sectional Stiffness EI_x ($x10^9$ Nmm^2)	Section size h x w (mm)	Flexural Strength $\phi f_b Z_x$ (kNm)	Sectional Stiffness EI_x ($x10^9$ Nmm^2)
180 x 65	5.34	253	190 x 45	5.42	296
			180 x 70	7.56	391
225 x 65	8.34	494	200 x 70	9.33	537
270 x 65	12.00	853	240 x 70	13.44	927
315 x 65	16.34	1354	280 x 70	18.29	1473
225 x 90	11.54	683	240 x 70	13.44	927
270 x 90	16.62	1181	280 x 70	18.29	1473

Table 2: Equivalent red beech sections

* A strength reduction factor of ϕ = 0.8 has been used in the above table.

* The lamination factor k_6 and size factor k_{24} have not been included above as GL grades are performance grades which are specifically manufactured to achieve the assigned characteristic stresses.

In addition to the above section sizes for the Red Beech GL12 the following section properties have been determined for a 150 x 45mm beam:

Flexural strength $\phi f_b Z_x$ = 3.79 kNm
Sectional Stiffness EI_x = 146 $x10^9$ Nmm^2

Table 2 above indicates that the red beech GL12 beams have greater strength and stiffness than equivalent radiata pine GL8 and accordingly, smaller sized red beech GL12 beams can be substituted for radiata pine GL8 beams without loss of strength of stiffness.

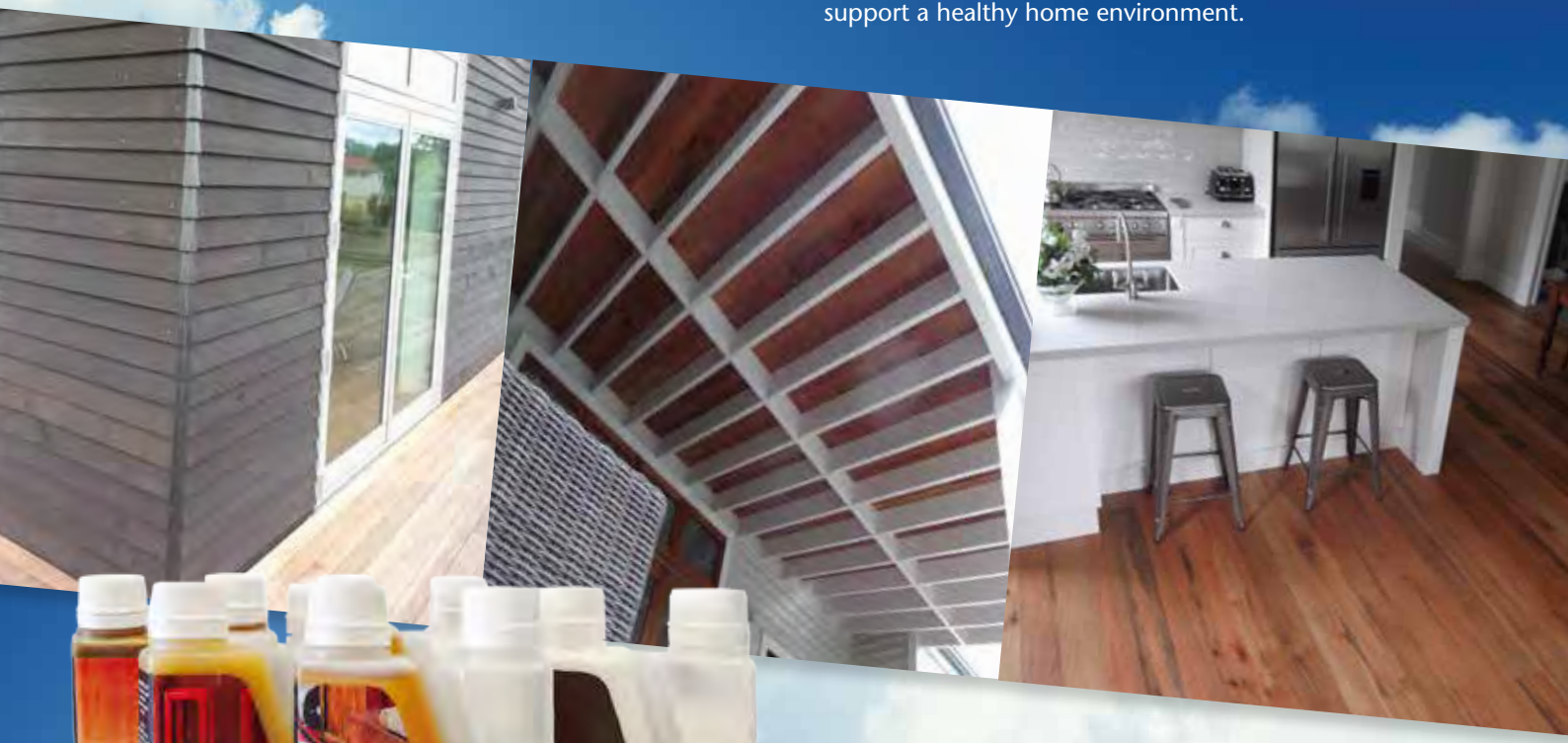
If there are any queries regarding the content of this letter, please do not hesitate to contact the undersigned.

A S MacPherson
Chartered Professional Engineer
BE Civil (Hons), CPEng, MIPENZ, IntPE(NZ)

FOREVER BREATHE™ OIL COATINGS

Natural. Breathable. Beautiful.

Enhance and maintain the natural beauty of your timber surfaces with Foreverbreathe™ Oil Coatings. Developed using innovative plant chemistry, our extensive range of natural oils, waxes and cleaning products provide exceptional performance. Being breathable and free of harmful chemicals they support a healthy home environment.



FEATURES:

- Interior & external applications
- Clear or tinted colours available
- Breathable and free of harmful chemicals
- Made in New Zealand from natural plant chemistry

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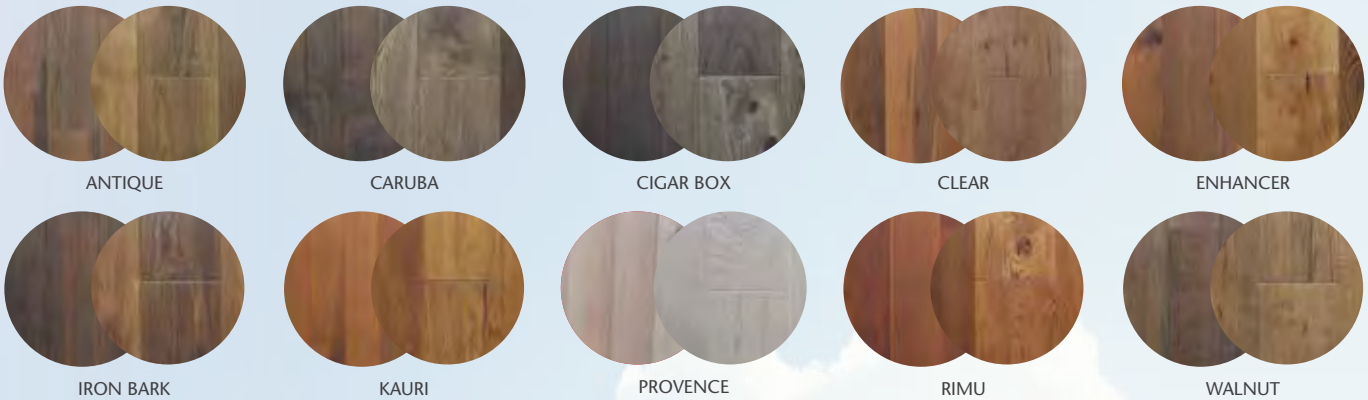
FOREVER BREATHE™ OIL COATINGS

FLOORING

Decorative appearance on **Foreverbeech™** (left) and **American White Oak** (right). Available in clear and the colours below.



CLADDING

Decorative appearance on **Foreverbeech™**

Decorative appearance on **Earthen Radiata**

DECKING

Decorative appearance on **Foreverbeech™**

Decorative appearance on **Earthen Radiata**

Disclaimer: Colours are demonstrated on Foreverbeech™, American White Oak & Earthen Radiata and are as accurate as print and digital displays allow.

HEALTH BASED BUILDING™ natural selection

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www.healthbasedbuilding.com

IDEATION_NZS0144

28 April 2016

Hardie & Thompson Ltd
1062 Colombo Street
Edgware
Christchurch
Via email: shane@hardie-thomson.co.nz

To Whom It May Concern

RE: Compatibility of Fireshield 1FR over FOREVERBREATHE™ plant oil based stain.

We can confirm that the Protega laboratory in Sweden reviewed the supplied FOREVERBREATHE™ stain and carried out adhesion tests, including attempting to ignite the product once coated with Fireshield 1FR system.

FOREVERBREATHE™ stain did not have any adverse effects or adhesion issues when used with the Fireshield 1FR system.

If applied in accordance with our application instructions by an approved applicator, timber coated with FOREVERBREATHE™ plant oil based stain, and the Fireshield 1FR system, will achieve a Group 1-S surface finish for compliance purposes.

Please do not hesitate to call or email if you have any questions.

Sincerely,

Matthew Hughes
Business Development Manager
matthew@fireshield.co.nz

Forestry Philosophy

Ensuring Sustainability

New Zealand is extremely fortunate to have in place rigorous and detailed legislation governing the management and utilization of natural resources.

In the Forests Act, sustainable forest management is described as:

"The management of an area of indigenous forest land in a way that maintains the ability of the forest growing on that land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values"

Part II, section 5 of the Resource Management Act 1991 defines “sustainable management” as:

“managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while- sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonable foreseeable needs of future generations, and safe-guarding the life supporting capacity of air, water, soil and ecosystems and avoiding, remedying, or mitigating any adverse effects of activities on the environment.”

Our forest management systems incorporate lessons learned from over 50 years of experience and research. The system follows a philosophy of productive protection and accounts for conservation and environmental values by recognizing the importance of:
- wildlife protection
- plant protection
- water protection
- historic site protection
- landscape protection
- recreational protection

Our sustainable management system involves carefully selecting and harvesting small variable groups of trees of similar size and occurrence to natural forest replacement patterns. Annual harvest rates are such that every year the volume of harvested trees is less than the volume grown naturally.
Our operations are monitored and audited by Ministry of Forestry officials and are in compliance with Part IIIa of the Forests Act and our field staff regularly consult with the Department of Conservation for updates on conservation research.

Independent 3rd Party Certification.
Currently NZSFP does not support the 3rd party certification of its forest management systems as the attainment of such certification is prohibitive to the scale of the business. Instead we contend that the heavily regulated system we operate under guarantees legality and ensures producers are at least meeting definitions of sustainability as outlined under the Forests Act and The Resource Management Act.

Foreverbeech forest resource was documented by the United Nations Food and Agriculture Organization as one of the twenty examples of exemplary forest management in the Asia Pacific region. http://www.fao.org/docrep/007/ae542e/ae542e00.htm

Applied Sustainability

About the Author:

Helmut Janssen M.Sc. (Forest Ecology); B.Sc. (Resource Management);
Helmut Janssen is an environmental scientist, experienced in policy advice on soil quality and biodiversity and its implementation; specializing in resource information and integrated management of useful natural resources via ecological reforestation of native forests. He founded and co-directs Adaptive Resource Management Ltd - www.bushvitality.org.nz and the charity Reciprocate Biocapacity - www.lifecapacity.org
He is the author of "Bush Vitality Assessment" and representative of Tanes Tree Trust.

Recently he attended field trip to view modern beech forest silvicultural regimes in practice and here interviews NZSFP forester Jon Dronfield...

Question. Are you advocating clearing our remaining forests?
Not at all! Our natural forest ecosystems are unique and our ecological forestry retains permanent forest-cover and supports indigenous re-forestation initiatives elsewhere.
Historic forest clearances and pests have put indigenous biodiversity at risk throughout NZ.
Ecological forestry however, can reverse biodiversity decline, enhance the resilience of remaining forests and its resource value to the community. We recognize that beech forests are very robust and productive ecosystems. We are able to harvest small volumes of timber from private forests, (often previously modified) and over time improve the quality of timber and ecosystem health.

Question. What comes to mind when I ask you to tell me what Sustainability is?
Before anything else, sustainability has always been about maintaining the organizational integrity of the environment. On a broad scale it's how we as a species recognize our consumption is a burgeoning debt on the planet, while also realizing that we can't get off. How, when we project population growth forward 25, 50, 200 years and the corresponding energy and raw materials demands, we can find logical solutions to live in balance. In a nut shell societies must find a way to produce what they require while protecting and strengthening the life supporting capacities of all ecosystems.

Question. What then is Applied Sustainability?
Quite simply it's DOING what needs to be done to sustain environment and people. To do this well one needs to understand how indigenous forests evolve and survive in the face of natural and man-made disturbance., the needs of people and how people must apply themselves to enhance ecosystem productivity and maintain environmental and cultural resilience.

Question. What does your ecological forestry look like in practice?
The simple message of ecological forestry is: what stays behind is more important than what is removed.
This is the difference between managing forests long-term and unsustainable clear-felling. There are many examples around of high-graded forest, where the best trees have been removed to suit economic objectives. Our challenge is to go beyond this rather short-sighted approach.
Ecological forestry replicates small scale natural disturbance patterns from natural death or wind-throw to establish an uneven-aged stand structure with high productive and biodiversity values. We target our harvest at sites to recover dying trees and then build on gaps to promote regeneration while retaining cavity bearing trees and standing dead snags, to preserve the forest's naturalness, productivity and diversity. We thin tight cohorts of younger trees before intense competition has to detrimental an effect on trees with best vitality. I like to call it "swimming with the current", because remember our goal is to retain a highly productive and functioning ecosystem, the existence of which is the basis for any yield in the first place, so why would you ever exploit and degrade that productivity?
There are many examples around the world of this approach leading to healthy forest ecosystems and improving timber quality and value.
In the past Germany's foresters, like their NZ colleagues, implemented plantation strategies for incompatible trees (spruce, pines, eucalypts) with disastrous results for soils and long-term ecosystem productivity. Today ecological forestry strengthens forest structures and sustains multiple species and values. Forests are managed as continuous-cover stands and are thriving. So yes you can certainly manage and plan for increasing timber quality and yields by working alongside indigenous forests' ecological processes.

Question. How do you then align demand and supply?
Well, both need to develop together and have been out of synch for some time.
The local market is in a weakened state and we use more specialty timber than we produce. We import vulnerable hardwoods from Africa and threatened hardwoods from Indonesia.
This understood, it is crucial that we recognize and market the true value of our natural timber resources. Where wood was discarded, or chipped in the past, due to tree damage and rot, today we make best use of the resource (for example as veneer). We need to retain the capacity and skills to add value to our timber products and maintain a demand as a price-taking commodity - in other words an appreciative market needs to grow in synch with our productive capacity and pay the true costs of developing sustainable production methods.

Question. Is there a need to inform potential customers to acknowledge the true costs and buy into accepting a uniquely sustainable native forest product?
Exactly, I talk about "informed consumerism", and I mean we have to empower the consumers with information so they can make ethical choices. So often choices are price driven, but there's a growing number of buyers who demand sustainability. In other words, people who care as much about the source of the product as we care in producing it. Secondly, we have to re-educate consumers that natural products contain features and character that define and describe the past history of the tree and forest, in essence they reflect the wild beauty of New Zealand. This is why we refer to 'natures perfect imperfection'

11 May 2010

CONFIRMATION OF SUSTAINABLE FOREST MANAGEMENT PLAN PURSUANT TO PART 3A FORESTS ACT 1949, NEW ZEALAND

At the date of this letter, the forest listed below is subject to a registered Sustainable Forest Management (SFM) Plan, approved by the Ministry of Agriculture and Forestry (MAF), pursuant to Part 3A, Forests Act 1949.

Trees harvested in compliance with this registered SFM Plan and associated Annual Logging Plans approved by MAF, meet the requirements of the Forests Act 1949 regarding the sustainable management of indigenous forests.

Explanatory notes on sustainable forest management are on page 2.

SFM Plan/ No:	4 / 09 /0055
Forest Owner / Landholder:	New Zealand Sustainable Forest Products Limited
Date of Approval:	20/02 /2001
Date of Expiry	19/02/2101
Location:	Rappahannock Valley, Maruia
Forest Area:	355 hectares
Species Under Management:	Red Beech, Silver Beech
Approved Annual Harvest	Red Beech - 859 m^3 (standing volume) Silver Beech - 227 m^3 (standing volume)

Yours faithfully

Robert Miller

Robert Miller
Manager, Operations

Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere
MAF Policy – Sustainable Programmes

Pastoral House, 25 The Terrace, PO Box 2526, WELLINGTON 6140, New Zealand
Telephone: 64-4-894 0100, Facsimile: 64-4-894 0300, Web: www.maf.govt.nz

Sustainable Forest Management (SFM)

The Forests Act 1949 provides for the sustainable forest management of privately owned indigenous forests in New Zealand through the issuing of SFM Plans and Permits. Sustainable forest management means the management of indigenous forest land in a way that maintains the ability of the forest growing on the land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values.

SFM Plans

SFM Plans generally have a 50 year duration and provide for the long term management of the forest. They are registered on the land title and bind the forest owner or land holder. In addition to requiring harvests of timber from the forest to be sustainable, SFM Plans require replacement of harvested species, either through natural regeneration or planting, protection of the forest from fire, pests and weeds and maintenance of natural and amenity values, including flora and fauna.

SFM Permits

SFM Permits are of a shorter duration (10 years), and provide for a capped maximum harvest of 250 cubic metres in total of timber from kauri, or podocarp or shade tolerant or exposure sensitive broadleaved hardwood species, and 500 cubic metres of beech or light demanding hardwood species. Where these quantities are more than ten percent of the timber of each species on the forest subject to the SFM Permit, the harvest is limited to ten percent in each case. Like SFM Plans, Permits require replacement of harvested species (either through natural regeneration or planting), protection of the forest and maintenance of natural and amenity values. SFM Permits must also be registered on the land title.

Annual Logging Plans

Harvesting under a SFM Plan or Permit must be undertaken in accordance with approved Annual Logging Plans.These require coverage of such matters as:

- Selection and marking of trees to be harvested
- Approval of harvesting areas
- Approval of harvesting methods
- Requirements for protecting water ways or other special logging requirements
- Location of roads and landings

Auditing and Compliance

MAF carries out periodic forest inspections and auditing of Annual Logging Plans for compliance purposes. MAF forestry officers have powers of entry and log seizure under the Forest Act. Penalties of up to $200,000 may be applied by the Courts for some of the offences under the Act.

Ministry for Primary Industries
Manatū Ahu Matua

Sustainable management of **privately owned** native forests

New Zealand's native forests provide economic, environmental, cultural and recreational value. In New Zealand there are 6.4 million hectares of native forest, 5.2 million hectares of which are protected as conservation land; this accounts for 24 percent of total land area.

The remaining 1.2 million hectares are in private ownership and approximately a third of this is suitable for harvest.

Landowners have the opportunity to sustainably harvest a portion of their resource under the Forests Act 1949. The purpose of the Forests Act is to promote the sustainable forest management of New Zealand's privately owned native forests. This is achieved through managing the harvesting, processing and export of indigenous timber on a sustainable long-term basis. The Act also controls the manner in which harvesting occurs particularly with regard to the specific character of the forest concerned, for example, the topography, riparian areas and areas of special biological significance.

The Ministry for Primary Industries (MPI) is responsible for administering the Forests Act including setting harvest levels and implementing a comprehensive monitoring and auditing regime to ensure harvest levels are sustainable.

Commonly harvested species include red beech, silver beech, rimu, matai and totara.

MPI ensures harvest levels are sustainable

Under the Forests Act, harvesting must occur either under an approved sustainable forest management plan or a limited use permit.

Plans can only be approved if they consist of a comprehensive forest inventory and describe the management processes and ecological safeguards that must be followed to maintain the health of the forest into the future.

Harvest limits are set at a level that ensures the volume of timber removed is always less than annual growth rates across the forest. If natural regeneration, following harvesting, is insufficient MPI can require seedlings to be planted at the harvest site.

Before harvesting can take place, operators must also provide MPI with an annual logging plan. This provides information on the area the trees shall come from, approved harvest volumes (by species), proposed harvest methods, location of tracks, and any requirements for specific actions, for example, directional felling to protect any adjacent forest. Operators are also encouraged to actively harvest trees with different ages and sizes and to source trees that are at risk of dying naturally.

Auditing and monitoring harvest levels

MPI audits the harvesting, milling and export of native timber. Sawmills processing native timber must be registered with MPI, and operators are required to provide regular production records.

This ensures that New Zealand has a robust, workable regulatory system which supplies assurances to consumers around legality of source and underlying principles of sustainability.

In addition, over 60 percent of the native timber produced in New Zealand has secured international recognition and certification by the Forest Stewardship Council.

MPI ensures harvesting has minimal environmental impact

Forestry, like all human activity, has some degree of impact on the natural environment. However, plans and permits are only approved by MPI if the forest's natural values are maintained. Natural values include maintenance of forest flora and fauna, soil and water quality, and the control of pests and weeds.

MPI monitors these activities closely to encourage best management practices and to ensure impacts are kept to an acceptable level.

All harvest activity is also regulated under the Resource Management Act through regional and district plans.

Did you know:

- Forests act as a carbon sink continuing to store carbon long after a tree is harvested. Every cubic metre of native timber harvested removes almost a tonne of CO_2 emissions from the atmosphere.
- The total volume of native timber harvested annually over all species in New Zealand will take around 50 days to replace through natural regeneration.
- Habitat trees containing hollows for use by forest fauna are set aside during harvesting to provide important habitats for birds and insects.
- Stumps, roots and heads of trees are left to decay in the forest after harvesting. This breakdown of organic matter helps to return important nutrients to the system.
- Selected harvesting of native trees can create canopy gaps which provide young trees and seedlings with space and sunlight to help them grow.

This leaflet provides a high-level overview of the New Zealand indigenous forestry management regime. To find out more about how New Zealand's forests are managed to enable sustainable forestry for future generations, go to: **http://www.mpi.govt.nz/forestry/forestry-in-nz/indigenous-forestry.aspx**

December 2013

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Robert Miller

Robert Miller
Manager, Operations

Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere
MAF Policy – Sustainable Programmes

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SFM Plans generally have a 50 year duration and provide for the long term management of the forest. They are registered on the land title and bind the forest owner or land holder. In addition to requiring harvests of timber from the forest to be sustainable, SFM Plans require replacement of harvested species, either through natural regeneration or planting, protection of the forest from fire, pests and weeds and maintenance of natural and amenity values, including flora and fauna.

SFM Permits

SFM Permits are of a shorter duration (10 years), and provide for a capped maximum harvest of 250 cubic metres in total of timber from kauri, or podocarp or shade tolerant or exposure sensitive broadleaved hardwood species, and 500 cubic metres of beech or light demanding hardwood species. Where these quantities are more than ten percent of the timber of each species on the forest subject to the SFM Permit, the harvest is limited to ten percent in each case. Like SFM Plans, Permits require replacement of harvested species (either through natural regeneration or planting), protection of the forest and maintenance of natural and amenity values. SFM Permits must also be registered on the land title.

Annual Logging Plans

Harvesting under a SFM Plan or Permit must be undertaken in accordance with approved Annual Logging Plans.These require coverage of such matters as:

- Selection and marking of trees to be harvested
- Approval of harvesting areas
- Approval of harvesting methods
- Requirements for protecting water ways or other special logging requirements
- Location of roads and landings

Auditing and Compliance

MAF carries out periodic forest inspections and auditing of Annual Logging Plans for compliance purposes. MAF forestry officers have powers of entry and log seizure under the Forest Act. Penalties of up to $200,000 may be applied by the Courts for some of the offences under the Act.