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A Framework and Portal for Planted Forest Sustainability Reporting

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EXECUTIVE SUMMARY

The New Zealand forest industry remains under continuous challenge over its licence to operate. Our neighbours want assurances that our management practices are 'sustainable' or at least have no specific adverse effects on them and the wider environment and community. A constant series of plan and rule changes under the Resource Management Act (RMA) means that public perceptions against forestry can enter into the regulatory framework, often with little actual scientific justification. Internationally, markets want 'green labels' associated with products. Trade agreements are increasingly requiring information to support green credentials and proof of legality.

Many of the problems have a root cause in the lack of readily available, reliable, public information that clearly portrays the industry's sustainability credentials, especially in relation to other landuses. To provide this information to the public and regulatory authorities, data that demonstrates forestry sustainability needs to be easily accessed and interpreted.

We reviewed sources of data and information for New Zealand's planted forests. We found a wide range of data sources, wide variability in data quality and also lack of data on some important criteria such as chemical use, harvest area, biodiversity or erosion impacts. It was also apparent that there was no easy single point of access to this data.

To address these issues we the overall goal of this project was to design and tested a prototype web-based information portal that provides easy access to a range of forestry data.

We began by ranking the applicability of the Montreal Process (MP) sustainable forest management indicator set to NZ's planted forests and developed a series of new operational indicators on harvest area, erosion, abiotic impacts, forest access (visitors) and contribution of forestry to local economies to fill identified gaps.

We then designed and tested a prototype database to collect data from forest companies on these operational indicators. A prototype web-based information portal was developed that provides a one stop shop for planted forest data, trends and supporting information. In summary:

- The portal will provide a web-based one stop shop for greatly enhanced forestry trend data – 'e- Facts and FiguresPLUS'.
- Data on operational indicators supporting forestry's license to operate will be available nationally for the first time.
- Companies will have a standard and consistent methodology for accessing? these operational and other indicators enabling them to benchmark themselves against national figures to assist with certification.
- Aligning data collection mechanisms means that companies will spend less time acquiring and standardising data.
- Aligning various international forestry reporting mechanisms that utilise NZ forest data will also lead to data collection/searching/reporting? efficiencies and a clearer message.
- The forest sector will be able to more easily respond to topical questions with sound data – for example chemical use trends, offsite impacts from debris flows.
- The system will be able to evolve to include indicators on future issues or topics of interest.

We make recommendations for the establishment of an implementation and management committee for 'operationalising' the prototype and its on-going management, review and development.

PROJECT PURPOSE

This project began in response to industry concerns that its licence to operate was under constant challenge and that responding to those challenges is difficult due to the fragmented nature and quality of information – especially information about erosion, debris, flooding events, chemical use, roading and harvesting impacts. Due to the fragmentation of this data, it is difficult to obtain, standardise and present in a consistent and industry-useable way.

In response to this very real industry challenge, we designed a forestry information portal that is capable of acquiring at the least possible cost, and a high likelihood of contributory financing and data-sharing, a wide range of data that:

- Indicates the sustainability of forests across a wide range of key indicators and across time.
- Contributes automatically to the Governments objectives of reporting to the Montreal process.
- Contributes to national State of the Environment reporting at both regional and national levels.
- Provides a web-based hub where industry users can access summarised research across a wide range of forestry environmental information.
- Enables rapid and easy public access to industry performance information and allow individual to contributing companies to view their own data in greater detail.
- Assists industry promotion through semi-automated provision of data for publications such as Facts & Figures.

APPROACH

This project:

- Reviewed the needs for reporting on the state of New Zealand's planted forests.
- Reviewed possible indicators of sustainable forest management that may be adopted for the forests.
- Undertook a gap analysis to identify and develop any new indicators required.
- Designed and tested a prototype web based portal and associated indicators database.
- Developed recommendations for implementation of a web-based portal with planted forests information.

WHY DO WE NEED TO REPORT ON THE STATE OF OUR PLANTED FORESTS?

Domestically, the planted forest industry struggles to retain or improve its license to operate. Public opinion or competing landuse perceptions continually feed their way into Resource Management Act (RMA) process resulting in constant cycles of litigation over what should be well understood basics of environmental sustainability. As a result, the industry remains highly regulated with significant cost disadvantages relative to pastoral agriculture.

Understandably, our neighbours and politicians want assurances that activities we are undertaking are 'sustainable' or at least have no adverse effects on them and the wider environment and community. This is reflected in regulatory mechanisms from councils or costs of doing business with communities and environmental groups who may have concerns about forest operations.

Internationally, more and more markets want 'green labels' associated with products they purchase. This has led to a proliferation of green market labels which are both government and consumer driven. In New Zealand forestry, FSC is the most commonly recognised green label. International and intergovernmental trade agreements increasingly require information to support green credentials – currently for example there is an increasing emphasis on the legality of forest

products with the need for mechanisms to demonstrate this. Government procurement policies are also demanding demonstration of green credentials.

Inability to provide information can be a significant cost to the forestry sector. Improved understanding of forests and forestry by stakeholders can provide many tangible and intangible benefits. An example of this is the reduced environmental activist pressure on a major New Zealand company (Fletcher Challenge Forests) following their adoption of FSC certification in the late 1990s. The interactions between an ENGO and the company increased the understanding of both and made business easier. More recent examples would be the support the forestry sector received from the ENGO's over the proposed National Environmental Standard for Plantation Forestry and to some degree an ability to mediate pragmatic solutions to the Horizons "One Plan"

From a sector business perspective, reporting should be focussed towards supporting industry goals such as public acceptance and licence to operate, decreased regulatory compliance costs, market access and market share, or increasing productivity and lowering the forests' environmental footprint.

Sound and scientifically robust forest information is key to help communicate forestry's economic, environmental and social credentials.

The outcome of adopting a single scientifically based reporting framework for NZ's planted forests will be to increase the sector's ability to communicate and defend its environmental credentials in a range of national and international forums. A single framework with associated databases and reporting protocols will save individual companies resources and also offer the ability to provide company specific or sector wide reporting. This framework will complement Forestry Facts and Figures and add depth to New Zealand's Montreal Process reporting.

WHAT SHOULD WE REPORT?

Identifying forest values and issues: We should report what people want to know about, not what we think they need to know. This relates to the values of various groups of stakeholders. The emphasis on specific topics can vary with time but generally values and issues are quite enduring.

> *New Zealand Values and Issues:* Workshops in identified that NZ-based stakeholders (councils, ENGOs, central government and the wider public) were mainly interested/concerned about environmental issues (water, soil, biodiversity) and forest access and therefore would benefit from more knowledge in these areas [1, 2, 4].
>
> *International market values and perceptions* of our planted forests are less well understood than New Zealand values and perceptions. Product legality is a current key issue, timber price may well be another. We also know, through involvement with FSC certification, that there are concerns with management practices used in NZ such as monocultural plantations, clearfelling regimes, and chemical use. Enhanced market knowledge will help identify these issues in more detail, but generally we expect the issues outlined here are likely to be top of mind in our main markets.

Sustainability and Monitoring, Assessment and Reporting (MAR) frameworks relevant to forestry: Forestry is a very quantitative profession and there is a long history of forest assessment and reporting for a variety of reasons – but commonly focussing on sustained yield. Internationally, many countries have National Forest Inventory (NFI) programmes [7] and this information is used for a wide variety of ends – from wood supply forecasting to carbon stock reporting.

In 1992 the Earth Summit in Rio gave rise to a sea change in the way forestry is perceived globally with the adoption of the Forest Principles [8] and a number of sustainability initiatives launched aimed at both reducing deforestation rates and managing forests sustainably for multiple products. One focus was on the definition of sustainable forest management and ways of reporting on progress towards sustainability. Since then definitions have been worked on and the current widely accepted definition developed by the Ministerial Council for the Protection of Forests in Europe (MCPFE) was adopted by the UN FAO in 2011[1].

> *Sustainable Forest Management*
>
> *"The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems."*

International Reporting Frameworks

Criteria and Indicators: In line with the broader view of forestry emerging after Rio the concept of criteria and indicators was developed and has gained widespread acceptance and usage since then. Criteria and Indicators provide a common framework to describe, monitor, assess, and report on forest trends and progress toward sustainable forest management. Criteria cover the essential components of sustainable forest management (Economic, Environment, and Social), and each criterion is underpinned by a set of quantitative and qualitative indicators that, when measured over time, give a picture of trends in conditions.

[1] http://www.fao.org/docrep/003/x6896e/x6896e0e.htm

These criteria provide a common understanding within and between countries of what is meant by sustainable forest management and may be understood to constitute an implicit definition of sustainable forest management at the country level provide has become a key tool for defining, measuring, tracking and reporting on national progress toward sustainable forest management.

The criteria for three major C&I systems plus the FAO's '7 thematic elements' which are equivalent to criteria are in Table 1. Very common themes can be seen across the four columns. Under each Process's Criteria a series of supporting indicators has been developed.

Table 1. Comparison of Criteria across Four Reporting Frameworks

Ministeral Council for the Protection of Forests in Europe (MCPFE)	Montreal Process	International Tropical Timber Organisation (ITTO)	UNFAO (7 thematic elements)
Forest Resources and global carbon cycles	Conservation of Biological Diversity	Enabling conditions for Sustainable Forest Management	Extent of forest resources
Forests biological diversity	Maintenance of Productive Capacity of Forest Ecosystems	Extent and condition of forests	Biological diversity
Forests health and vitality	Maintenance of Forest Health and Vitality	Forest ecosystem health	Forest health and vitality
Productive functions of forests	Conservation and maintenance of soil and water resources	Forest production	Productive functions of forest resources
Protective functins (soil and water)	Maintenance of forest contribution to gobal carbon cycles	Biological diversity	Protective functions of forest resources
Socioeconomic functions	Maintenance and enhancementof long-term socio ecmic benefits to meet the needs of societies	Soil and water protection	Socio-economic functions
Forest Policies, Institutions, nd Instruments	Legal, Institutional and economic framework for forest conservaion and sustanable management	Economic, social and cultural aspects	Legal, policy and institutional framework

Montreal Process framework: The MP C&I comprise 7 Criteria (Table 1 [26]). Underneath these criteria there are 54 individual indicators covering the spectrum of the criteria. MPI have reported on the state of NZ's forests (planted and natural) in 2003 and 2008 so the system is well tested and applied and data already collected by Government.

Forest Certification: In parallel with the emergence of C&I the concept of certifying forest management standards was also developing, driven predominantly by Environment groups concerned at the damage management activities were causing to forests. Two major examples of these systems are the Forest Stewardship Council[2] (FSC) and the Pan European Forest Certification Process (since morphed into the global Programme for Endorsement of Forest Certification - PEFC[3]). These certification systems are structured similarly to C&I systems with Principals, Criteria, Indicators and Verifiers. PEFC mirrors the MCPFE Criteria strongly. However FSC's Principles are clearly more forest management focussed (Table 2).

[2] www.fsc.org
www.pefc.org

Table 2. FSC and PEFC Principals and Criteria.

FSC'S TEN PRINCIPALS	PEFC'S SEVEN CRITERIA
Principle 1: Compliance with Laws	Criterion 1: Maintenance and appropriate enhancement of forest resources and their contribution to the global carbon cycle
Principle 2: Workers' Rights and Employment Conditions	Criterion 2: Maintenance of forest ecosystem health and vitality
Principle 3: Indigenous Peoples' Rights	Criterion 3: Maintenance and encouragement of productive functions of forests (wood and non-wood)
Principle 4: Community Relations	Criterion 4: Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems
Principle 5: Benefits from the Forest	Criterion 5: Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water)
Principle 6: Environmental Values and Impacts	Criterion 6: Maintenance of other socio-economic functions and conditions
Principle 7: Management Planning	Criterion 7: Compliance with legal requirements
Principle 8: Monitoring and Assessment	
Principle 9: High Conservation Values	
Principle 10: Implementation of Management Activities	

Other international forestry related reporting undertaken by New Zealand

United Nations Framework Convention on Climate Change (UNFCCC)
As part of our obligations to the United Nations Framework Convention on Climate Change (the Climate Change Convention) and the Kyoto Protocol New Zealand provides a national communication on progress towards its commitments under the Convention and towards implementation of the Kyoto Protocol. The report covers a wide range of topics, including: policies and measures, trends and projections of greenhouse gas emissions and removals, climate research and observations, financial assistance and technology transfer to developing countries, climate change impacts and adaptation, and public participation and awareness activities. As part of this report NZ provides a GHG Inventory that is an annual account of all human-caused emissions and removals of greenhouse gases in New Zealand. It is produced each year
The inventory reports greenhouse gas emissions from six sectors: energy; industrial processes; solvents; agriculture; land use, land-use change and forestry; and waste. Reporting related to forestry relates predominantly to carbon stocks in the forests and the soils supporting them and also to sectoral industrial emissions.

Global Forest Resource Assessment
The Global Forest Resources Assessments (FRA) are produced by the UN Food and Agriculture Organisation (UN FAO) every five years in an attempt to provide a consistent approach to describing the world's forests and how they are changing. The Assessment is based on two primary sources of data: Country Reports prepared by National Correspondents and remote sensing that is conducted by FAO together with national focal points and regional partners. New Zealand is required to provide national level forestry statistics for a range of predominantly forest resource and economic indicators. For planted forests these statistics are generally collected through the National Exotic Forest Description (NEFD) system.

Convention on Biological Diversity
A core component of New Zealand's CBD reporting is the suite of Natural Heritage Monitoring indicators focussing on plant species. The NHM approach was developed by Allen et al [31] and has been applied across the national LUCAS plot based sampling scheme in both indigenous and planted forests. These indicators are measured every 5 years and can contribute both to CBD and to planted forest reporting for other purposes such as this project.

New Zealand Forestry Related National Reporting Mechanisms

State of the Environment Reporting
Data collected from planted forests through council soil and water monitoring activities will contribute to MfE's national state of the environment reporting through the National Environmental Monitoring Assessment and Reporting (NEMAR) framework. It is therefore necessary that forestry indicators are compatible with the needs of this reporting system, both in terms of indicators sampled and measurement methods.

Treasury's Living Standards Framework
The highest level of reporting in New Zealand is that undertaken by Treasury with a suite of indicators focussed on a living standards framework. Indicators span all aspects relating to living standards and only 2 environmental indicators are included: Nitrogen in rivers (Figure 1), and Greenhouse Gas balance (excluding forestry). So only one indicator will directly reflect forestry conditions.

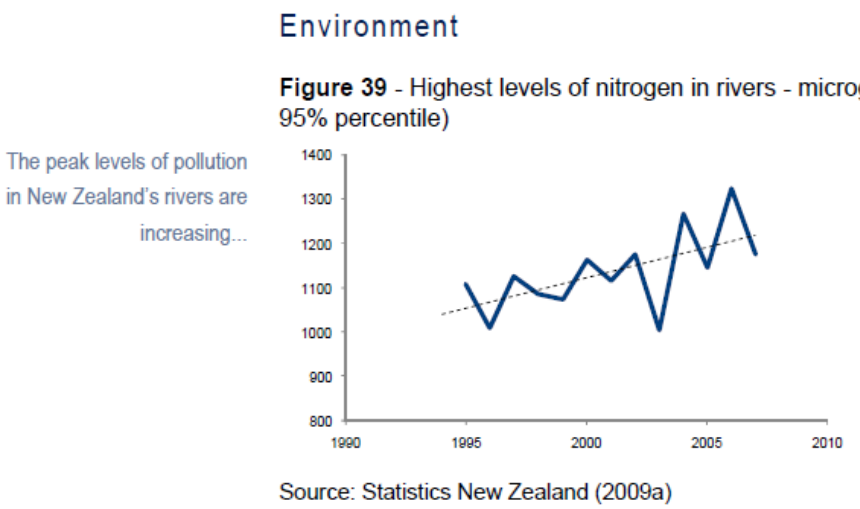


Figure 1. Nitrogen in rivers

National Exotic Forest Description (NEFD)
The NEFD provides resource information annually from a survey of forest owners and managers with >40 hectares of forest to assist in resource and policy planning, and assessing processing opportunities and infrastructural requirements. It provides a national benchmark for characterisation of the forest resource and focusses predominantly on extent, growth and silviculture. It does not collect environmental or social data. Data is presented in an annual report and is utilised in other reports both national (Facts and Figures) and international (GFRA and UNFCCC).

SONZAF (now SOPI)
MPI produces regular 'Situation and Outlook for Primary Industry' reports that call on NEFD and other forestry data to give a picture of trends in production and trade in forestry with projections of future trends.

National Hazardscape reporting
The National Hazardscape Report (DPMC 2007) is a non-statutory document aimed at informing policy makers, hazard managers and their advisors in carrying out hazard and risk management at the national and local level. Only one report has been published in 2007. Information relevant to forests such as landslides and debris flows is only covered at a very general level.

SELECTING AND DEVELOPING INDICATORS FOR NEW ZEALAND'S PLANTED FORESTS

Guiding principles. We recognised when developing the planted forest indicator set that we needed a set of guiding principles. There are five of these:

1. Forestry is an integral part of the New Zealand environment and its primary sector – indicators should be common and translatable for the wider environment where possible.
2. Much data is collected for forestry already – we should make the most of it.
3. Indicators should ideally have the following attributes: non-duplicate, clarity, relevance, practical, sensitive, reliable, understandable, able to be forecast, measurable, valid scientific basis, and cost effective.
4. Indicators need to be very clearly defined in terms of their rationale for use and measurement methods.
5. Data should be measured once and used many times.

We also used the findings from a number of New Zealand values studies [1, 2] and also the Future Forests Research (FFR) Indicators workshop held in 2010 [4], plus signals from ongoing discussions with the NZFOA Resource and Environment Committee, Ministry for Primary Industries (MPI) and Ministry for the Environment (MfE) around national indicator developments to focus the development of the suite of indicators.

Indicator Selection and Development

Suitability of the Montreal Process Indicators for reporting on the state of planted forests.

At the outset we reviewed all international reporting activities to determine where we might be able to use existing mechanisms for our planted forests efforts. After reviewing the various reporting frameworks we concluded that the Montreal Process Principles and Criteria was likely to be the most suitable as the foundation for the development of the NZ planted forest indicators. As well as being appropriate and relevant, its adoption would give us international acceptance and would allow us to link with other international processes such as UN FAO global reporting. We therefore undertook a detailed suitability analysis. Data sources and attributes such as data availability and quality were mapped to the 54 Montreal Process indicators to define which indicators were most appropriate for planted forest reporting. This table is in Appendix 1 and demonstrates the filter approach used.

At the highest level, all MP indicators are relevant for reporting on planted forests. In the 2003 and 2008 reports [20, 21] the overall state of NZs forests has been reported on and this has included planted forests. The relative importance of the MP Indicators for planted forests was assessed through input from the NZFOA Environment Committee members, and categorised into None, Low, Moderate and High. Six indicators relating to NZ forests as a whole were deemed not relevant to planted forests, 20 of Low, 13 Moderate, and 17 of High relevance (Appendix 1). Note that the relevance classification may vary depending on stakeholder group, and the compiled indicator list can be interrogated in different ways to reflect different views.

The New Zealand Montreal Process reports suggested that some indicators were harder to report than others due to data availability, cost or technical difficulties and this led the indicators to be categorised into Low, Medium and High classes. High could be fully reported on, Medium partially and Low could not yet be meaningfully reported on. It is expected with successive reports that the ability to report will undergo continuous improvement as research into these indicators is undertaken.

An analysis of the data quality ('reportability') of the indicators categorised highly relevant showed four indicators classed High, 4 Medium/High, 7 Medium, and 2 Low for 'reportability'. The full analysis is summarised in Appendix 2, as shown in the example below (Table 2).

Table 2. Example of indicator relevance and 'reportability'

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Productive Capacity	**2.a** Area and percent of forest land and net area of forest land available for wood production	High	H
Socio Economic	6.1.a Value and volume of wood and wood products production, including primary and secondary processing	High	H
Socio Economic	6.1.f Value and volume in round wood equivalents of exports and imports of wood products	High	H
Socio Economic	6.3.a Employment in the forest sector	High	H

Gaps in the MP indicator set. We undertook a review of the coverage of the indicators and the needs for NZ reporting. From this, we identified a number of gaps where indicators would be needed. These related to forest operational management. For the most part they related to the need to support certification of forest management practises – for instance chemical usage levels, but there also were instances where more detailed indicators were needed than those provided by the more global MP set. An instance of this would relate to area of forest affected by debris flows. Development of these new indicators was undertaken through the small cluster group and the indicators are listed below (Table 3) (note link to most relevant Montreal Process Indicator through number reference).

Table 3. New Operational Indicators for New Zealand's planted forests

Forest Extent
- 2.d.1 Forest Harvest Coupe size

Chemical Usage
- 3.a.1 Herbicide Usage
- 3.a.2 Pesticide Usage – Insects and Pathogens
- 3.a.3 Pesticide Usage – Mammals
- 3.a.4 Fertiliser Usage

Abiotic Impacts
- 3.b.1 Area and percent of forest damaged by fire
- 3.b.2 Area and percent of forest damaged by wind
- 4.2.b.1 Area of on-site and off-site forest related erosion damage

Good practice and legality
- 7.5.c Area of forest independently certified as well managed
- 4.2.a.1 Number of compliance related visits to the forest
- 4.2.a&b.2 Area of forest affected by prosecutions and abatement and infringement notices [related to soil and water]

Forest Benefits
- 6.4.b.1 Visitor numbers and forest area available to visitors
- 4.1.a.1 Area of riparian reserves
- 1.c.1 Protected areas within the forest
- 6.3.e.1 Forestry's contribution to local economies

The need for indicators in these areas had been identified through forest values workshops (forest access), the FFR indicators workshop (erosion, water and biodiversity) and Forest Stewardship Council (FSC) Cluster Group and NZFOA Environment Committee meetings (chemical usage, clearfell area, reserve areas and riparian zones). Rationales, approaches to measurement, and data sources were defined for each indicator (Appendix 3). Data sources for these indicators will be predominantly forest companies as this data is not routinely collected through any other mechanism.

For the suite of operational indicators outlined here, and presented in Appendix 3, there will be a good ability to report on most of the indicators through utilisation of existing data collection mechanisms plus some new forest company specific data collection for the operational indicators. There is more data potentially available than expected putting the forest sector in a good position to use existing information very effectively. Level of data quality is variable but this is well

understood in national reporting activities of this type. It is to be noted that the depth and breadth of indicator data available for forestry far outweighs that for other sectors.

Overall, we concluded that using the Montreal Process suite of indicators as a foundation set augmented with a set of 16 new operational sub indicators allowed us full coverage of all aspects of the sustainability of New Zealand's planted forests. The full list of all MP indicators plus the new operational indicators is documented in Appendix 1. From the forest sector's perspective there were 32 indicators ranked 'high' in relevance out of the total of 68. These are listed in Table 4.

Table 4. Indicators of High relevance as identified by NZ Forest Owners Environment Committee members and the FFR portal development subgroup[4]

Montreal Process Criterion	Montreal Process Indicator and related national sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)
Biological Diversity	**1.2.a** Number of native forest-associated species	High	LM
Biological Diversity	**1.2.c.1** Protected areas within the forest	High	Not categorised
Productive Capacity	**2.a** Area and percent of forest land and net area of forest land available for wood production	High	H
Productive Capacity	**2.d** Annual harvest of wood products by volume and as a percentage of net growth or sustained yield	High	MH
Productive Capacity	**2.d.1** Forest harvest coupe size	High	Not categorised
Health and Vitality	**3.a** Area and percent of forest affected by biotic processes and agents (e.g. disease, insects, invasive alien species) beyond reference conditions	High	M
Health and Vitality	**3.a.1,2,3&4** Amount of chemicals used within forest management operations (herbicides, pesticides, fertilisers)	High	Not categorised
Health and Vitality	**3.b** Area and percent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions	High	M
Health and Vitality	**3.b.1** Area of forest affected by fire	High	Not categorised
Health and Vitality	**3.b.2** Area of forest affected by wind	High	Not categorised
Soil and Water	4.1.a Area and percent of forest whose designation or land management focus is the protection of soil or water resources	High	L
Soil and Water	**4.1.a.1** Area of riparian reserves	High	Not categorised
Soil and Water	**4.2.a** Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources	High	MH
	4.2.a.1 Number of compliance related visits to the forest	High	Not categorised
Soil and Water	**4.2.b** Area and percent of forest land with significant soil degradation	High	M
Soil and Water	**4.2.b.1** Area of on-site and off-site forest related erosion damage	High	Not categorised
Soil and Water	**4.3.a** Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources	High	M
	4.3.a.1 Number of audit visits, abatement notices, infringement notices and prosecutions related to water and area of forest affected	High	Not categorised
Soil and Water	**4.3.b** Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions	High	L
Carbon Cycles	**5.c** Avoided fossil fuel carbon emissions by using forest biomass for energy	High	M
Socio Economic	**6.1.a** Value and volume of wood and wood products production, including primary and secondary processing	High	H
Socio Economic	**6.1.f** Value and volume in round wood equivalents of exports and imports of wood products	High	H
Socio Economic	**6.1.h** Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption	High	M
Socio Economic	**6.3.a** Employment in the forest sector	High	H
Socio Economic	**6.3.b** Average wage rates, annual average income and annual injury rates in major forest employment categories	High	MH
Socio Economic	**6.3.e.1** Forestry's contribution to local economies	High	Not categorised
Socio Economic	**6.4.a** Area and percent of forests available and/or managed for public recreation and tourism	High	MH
Socio Economic	**6.4.b** Number, type, and geographic distribution of visits attributed to recreation and tourism and related to facilities available	High	M
Socio Economic	**6.4.b.1** Visitor numbers and area of forest available for access	High	Not categorised
Legal and Institutional Frameworks	**7.5.c.1** Area of forest independently certified as well managed	High	Not categorised

INDICATOR DATA SOURCES

The key challenge related to the data sources is its fragmentation. Many different agencies either collect or hold the data and there is no overview of the whole data picture.

Four existing databases were identified as relevant to planted forests – MPI's Montreal Process reporting on the State of New Zealand's forests, MfE's Land Use and Carbon Analysis (LUCAS) system which has had specific focus on planted forests, MPI/NZFOA's National Exotic Forest Description (NEFD) process which provides regular statistics on planted forests, and MfE's State of the Environment monitoring and reporting and regional and local government monitoring programmes also have environmentally related data relevant to planted forests. Other examples of databases identified include FOA's IRIS accident reporting system, Scion's PSP system and forest health databases. The full list of data sources identified as potentially useful are summarised in Table 6.

Montreal Process reporting system: New Zealand has produced two full reports on the state of its forests [20, 21] combining both its indigenous and planted forests. In these reports it has provided commentary on all indicators, but to varying degrees based on data quality and availability. Data was accessed from many sources and compiled to enable production of required statistics. The reports are very valuable resource and present a great deal of synthesised information. Unfortunately the data contributing to the reports was not captured in one central database (A. Reid pers comm 2012) making in difficult to add new information and revise state and trend data without going back to the original data sources.

Land Use and Carbon Assessment System (LUCAS) system: As part of New Zealand's commitment to international carbon accounting and climate change response MfE has developed the LUCAS system that covers all of New Zealand's forest estate, planted and natural plus shrublands. This system is a plot based forest inventory system covering all carbon pools required for international reporting under UNFCCC. The plots are laid on a grid across the forests, 8km for natural forests and 4km for planted. This equates to ~400 plots in the planted forest estate. Data collected that is of relevance to this project includes: tree and tree fern growth, understorey woody plant growth, 0-5cm soil samples, and canopy health measures (needle retention and UMCY/Cyclaneusma/Dothistroma scores)[5]. The data collection cycle is five yearly and is currently in the second round of inventory. Methodologies are summarised in Herries et al 2013 [14]. Data can contribute to reporting on forest production, carbon stocks, soil fertility, understory biodiversity [31], and canopy health [17].

National Exotic Forest Description (NEFD): The NEFD process provides national forestry statistics for government and other stakeholders through a questionnaire approach. The collection and publication of NEFD information is overseen by the NEFD Steering Committee - a forest industry committee with members nominated by the New Zealand Forest Owners' Association and MPI. This resource information is provided annually to assist in resource and policy planning and assessing processing opportunities and infrastructural requirements. Provision of data is a legal requirement under the Forest Act.

Data is collected by owner and collated and reported by wood supply region and nationally. For a full description of the NEFD see one of the annual reports Variables collected include planting and harvest areas, areas by crop type, harvest volumes, ownership type. These data are then used to produce national statistics and generate yield tables. The data is used as base data for a number of reporting exercises – for instance NZs contribution to the Global Forest Resources Assessment (GFRA 2010), Montreal Process reporting, and the annual Forestry Facts and Figures booklet. It will be a major source of data for planted forest reporting.

National and Regional Government monitoring and reporting: Environmental monitoring is a high priority for regional councils and significant data is collected on land, water, and air characteristics.

Soil quality indicators and monitoring methods have been standardised nationally following the 500 soils project [9, 12]. Soil quality indicators recommended cover the biological component (measured by total carbon, total nitrogen and mineralisable nitrogen); the chemical component (measured by soil pH and Olsen P); and the physical component (measured by bulk density and macroporosity). Sampling for planted forests is recommended on a five year cycle as changes do not occur rapidly due to the long term nature of the crop. MfE reports nationally on six of these indicators: total carbon content, total nitrogen content, pH in water, Olsen phosphate, mineralisable nitrogen and macroporosity. In addition to this erosion risk on pastoral erosion prone hill country is monitored and reported by councils. This latter indicator uses analysis of bare soil percentage on a 1 hectare plot located on an aerial photo. The national monitoring design requires a 2km grid of plots. However currently only three regional councils use the system, reducing its usefulness for national reporting.

Water quality indicators are similarly undergoing standardisation through the national water monitoring forum. A fundamental component of water monitoring has been NIWA's National Rivers Water Quality Network that has contributed significantly to reports on New Zealand's overall water quality. However a review by Harrison [35] has noted under representation of planted forest monitoring sites in the system. The NWMF is reviewing and updating the sampling design. Core indicators selected by the NWMF are: Dissolved oxygen, Conductivity, Water temperature, Visual clarity, Suspended sediment, Total nitrogen (N), Nitrate NO_3/oxidised nitrogen, Ammonia/ammonium (NH_3/NH_4), Total phosphorus (P), Dissolved reactive-P (DP), E coli, Periphyton, and Aquatic invertebrates. These indicators will be used for setting minimum standards for the various water characteristics under the Government's on-going water reforms [13, 19]. Reporting of water quality has in the past been done under MfE's State of the Environment reporting e.g. MfE 2007 [18]. This programme was suspended in 2012 however and it is unclear what form a replacement will take. Treasury utilise one water related indicator only in its reporting on New Zealand – nitrate concentration [30].

Other data sources: The national permanent sample plot (PSP) database, the national forest nutrition database (FND) and the forest health database (FHD) are all sources of data that could be used to derive trend data related to forest state. The PSP database has been used to develop productivity surfaces for a range of tree species. Updating this periodically would give a spatial indication in overall temporal trends in tree productivity. Similarly the foliage data in the FND has been used to demonstrate spatial distribution of forest nutrition condition and also recently changes with the publication of the new Forest Nutrition Bulletin [3] which updates the 1991 nutritional atlas [11]. The forest health database is a useful source of information on new occurrences of forest health issues but not so useful for developing indicators for the quantum of change in forest health status over time. NZFOA manages the incident reporting information system (IRIS[6]) which collects statistics on workplace incidents. These statistics could contribute to national reporting of the state of the planted forests. Area of forest and scrub and other forest related vegetation types burnt by fire is covered by the Fire Service database[7]. There is an informal wind damage database managed by Scion [25] but this is currently inactive and only updated on an ad hoc basis.

[6] http://nzfoa-iris.com/

Table 6. Databases available to supply data for planted forest indicators. Databases shaded have been identified as core and most important data/information sources.

Database	Indicators	Database Owner[8]	Update frequency	Funding sources	Comments
NEFD	Forest Resource	MPI/NZFOA	yearly	MPI / Forest owners	Core national forest data collection mechanism, currently non spatial
LUCAS	Forest carbon, biodiversity, health, soils	MfE	5 yearly	MfE	4km grid plot system, very detailed measurement methods
ETS	Forest carbon	MPI	Continuous	MPI / participants	Mix of modelled and measured data
Montreal Process	54 Economic, Environmental and Social Indicators	MPI	5 yearly	MPI/DOC	Synthesised data only, variable in quality and quantity
NEMAR[9]	Water quality	Councils/NIWA	yearly	Councils / NIWA	Councils and NIWA have individual databases, supply data to MfE for national picture. Gaps in planted forest coverage
LCDB	Land Cover types	MfE	5-10 yearly	MfE	Irregular updates
IRIS	Health and Safety	NZFOA	Continuous	NZFOA	Dependent on voluntary data supply
PSP	Forest growth and quality	Scion	Continuous	Scion/users	Management and experimental plots
Forest Nutrition	Nutrient chemistry	Scion	yearly	Scion	Based on foliage nutrient analysis – limited soils data
Forest Health	Incidence of disease outbreaks	NZFOA	yearly	NZFOA	Incidence data rather than trend
500 Soils /Erosion	National soil indicators	Councils	5 yearly	Councils	Individual council databases, only 3 monitor erosion, limited plots in planted forests
Operational Indicators	Harvest area, chemical use, erosion impacts, certified area, visitors, regional economic contribution	To be determined	yearly	None as yet	New data, filling important gaps. To be collected by forestry companies in parallel with NEFD survey
Fire	Area damaged by fire	Fire Service	yearly	Fire Service	Covers planted forest vegetation types (forest, scrub, gorse)
Wind	Area damaged by wind	Scion	Ad hoc	Scion	Inactive and currently unsupported

[8] This refers to owner of the database, not necessarily the data contained within it

CREATING A WORKABLE REPORTING FRAMEWORK

Data and Information accessibility: It is clear that very significant amounts of data exist related to planted forests, but that the framework for data collection and storage is fragmented and uncoordinated. In discussion with many people it is clear that a single 'point of contact' for such information will be most helpful.

There are new Zealand examples of 'single points of contact' – for example the 2007 State of the Environment report [18], focusses on a national picture of the state and trends in environmental indicators, the NEFD annual report summarises a segment of NZ's forestry data, and this information is further presented in 'Facts and Figures' in a pocket scale 'easy read'. New Zealand's 2003 and 2008 Montreal Process reports [20, 21] provide an overview of state and trends of NZ's forests, but do not explicitly differentiate between native and planted forests.

There are many examples of 'single points of contact' for forestry information. Internationally a good example would be 'State of the Forest Reports' such as Australia's 2008 initiative which presents data obtained from a wide range of sources, including the public and private sectors. It comprises a full report (hard copy and cd version), stand-alone executive summary and a series of 8 fact sheets on topical forest issues; all available from the Forest Australia website - http://www.daff.gov.au/abares/forestsaustralia. Other examples of reports can be found on the Montreal Process website (http://www.montrealprocess.org/Resources/Publications/index.shtml) or from Europe (http://www.foresteurope.org/state-europes-forests-2011-report) where data, trends and commentary on forests are compiled.

In support of such reports complementary information is useful. This provides background information on how forestry works. Again as with data the sources of such information tend to be fragmented and often hard to find or out of date. (note – it is very important to separate baseline fundamental information from data that can rapidly change). Various sources of information exist for NZ's planted forests e.g. Forestry Insights[10] , Radiata Pine Growers Manual[11], NZFOA Environmental Code of Practice[12], Principles of Plantation Management[13], and the Environmental Effects of Planted Forests in New Zealand [22]. Recently increasing use has been made of video resources, for example a forests and water video[14] (Scion 2012).

Mechanisms for Communicating Information and Data

When considering communication of data and information it is important to understand both how people like to receive information and then to match those requirements with appropriate delivery mechanisms. There are a wide variety of people who potentially have quite a wide range of preferences, and there are also many (and increasing) mechanisms for communication information. Some work (unpublished) done by the Montreal Process Technical Advisory Committee on this topic will be of interest.

An expert group identified both the spectrum of stakeholder groups (or audiences) for, in this case, Montreal Process report information and also the possible communication mechanisms and the level of use of each of these mechanisms for each of the audiences. Sixteen audience categories were identified and 25 communication mechanisms. The level of interaction with these categories and the level of usage of the various mechanism was summarised for 9 of the 12 Montreal Process countries. The most frequent category is shown in the tables 7 and 8.

[10] http://www.insights.co.nz/

[11] http://www.scionresearch.com/general/publications/technical-reports/forest-management/planning-and-resource-evaluation2/radiata-pine-growers-manual

[12] http://www.nzfoa.org.nz/file-libraries-a-resources/cat_view/27-codes-of-practice

[13] http://www.nzfoa.org.nz/images/stories/pdfs/sustainability_principles_brochure_03.pdf

http://www.youtube.com/watch?v=W1ZsLrR03Pg

Table 7. Audience and interaction levels

Audience	Dominant interaction level
Decision makers	
Other professionals and researchers	
Policy Advisers	
Forest Managers	
Investors – senior managers	
Practitioners	
Foresters	
Children	
Press	
High ranking Govt officials dealing with Govt reform	
General public	
ENGOs	
Students – forest science and environment	
Certifiers e.g. FSC auditors	
Politicians	
Wood industry people	
Other (who)	

Table 8. Mechanism of communication and level of use

Mechanism	Dominant Level of Use
Maps	
Dashboards	
Website	
Website – with animation	
Reports	
Journal papers	
State of forest report to parliament	
Workshops	
Field tours	
Issue summaries	
Meetings	
Briefing Notes	
Executive summaries	
Internet forums	
Graphs	
Statistics	
Videos	
Spreadsheets	
Seminars	
Cartoons	
Magazines	
Pictures	
Aggregated Index	
Raw data	
Blogs/Wiki	
Other (what)	

Mechanisms of communication widely used (green) are reports and executive summaries, journal papers, workshops, state of forest reports to parliament, briefing notes, graphs, statistics, and also raw data are also used. Seminars, field tours, magazines were rarely used. Website use was highly variable across countries and new technologies such as videos, internet forums and blogs were hardly used at all.

Moderate levels of interaction (orange) occur with peers – other professionals and researchers, forest managers, policy and decision makers, and forester; and also with ENGOs, students and certifiers. Interestingly there is low level of interaction with politicians, investors, and on the ground practitioners.

It will therefore be important to consider audiences and mechanisms when we design the portal for New Zealand's planted forests. Feedback to date is that rapid access to information in a condensed form is a priority and also having the information in a format where key items such as a graph can be extracted for use outside of the portal (C. Maunder pers. request). The audience for the portal is likely to be forestry professionals looking for information to communicate to third parties; interested third parties such as policy analysts, science groups, and regional authorities using the information for forestry related work; and interested third parties such as Environmental groups with concerns or markets concerned about the sustainability credentials of New Zealand's forestry.

Technology developments are rapid and core to any communication must be the internet and associated technologies such as mobile devices. As noted above – these technologies are rarely used but examples of the use of videography are increasing very rapidly.

WHAT WILL THE PORTAL LOOK LIKE?

The portal. We have established that there is a wealth of information available on New Zealand's planted forests but that it is fragmented and disparate and not easily accessible, so a single point of contact or portal is attractive to ease accessibility. Googling 'New Zealand plantation or 'planted forests' directs the searcher mainly to the NZFOA, MPI, Forestry Facts and Figures (via a third party), the proposed National Environmental Standard for plantation forests, the Environmental Code of Practice and Wikipedia. It reinforces the disparate nature of the distribution of information and the lack of ready accessibility to core information that defines the industry's sustainability profile.

The vision of the portal can be outlined as: *The Planted Forests Monitoring Portal will be developed for national and international communities, industries and governments who are interested in the sustainable management of forests. It is a non-commercial web based software that will allow forestry organisations to capture information on their annual planted forestry operations and have this information displayed on a national and organisational level. Unlike the current state where forestry operational information is inaccessible and decentralised the Planted Forests Monitoring Portal will capture the information in a central database for easy access and have it displayed via the web in a clear and simple format.*

The design for the portal pulls together the disparate streams of data and presents them in one place (Figure 5). The portal should also contain supporting information – for instance topic or issue specific fact sheets or links to other information such as codes of practice.

There should be three main components to the portal – forest related data, forest related information, and useful links.

The portal interface design is important as this will be the first view of the information people will have. There are a number of examples of forestry portals (Table 9). These all have slightly different design criteria and focus and this will be dependent on the overall objectives of those portals.

Table 9 Examples of forestry portals

Portal	Web Address
Euroforest portal	www.forestportal.efi.int/
Forestry Online Directory & *Portal* for the Irish *Forest* & *Timber* Industry	www.forestry.ie
Forestry webinars portal	www.forestrywebinar.net
Forest carbon portal	www.forestcarbonportal.com
Global Forest Information Services portal	www.gfis.com
Texas forest information portal	http://www.texasforestinfo.com/

This New Zealand-based portal will present trend data on important indicators, supported by factual information on the planted forests and their environment. There are two approaches to the interface – present the data in a data-centric way – for instance the list of indicators, or presenting the data in an issues based framework – for instance biodiversity, forests and water, soil impacts. The recommendation is to use the issues based approach as this is generally how people search for information. The data presented will be the same, but clustered differently.

Background, or supporting, information should also be presented within an issues based framework – the list of issues or topics could cover the spectrum of all indicators, however there are likely to be topics of higher interest than others – for instance the pro and cons of monocultures, or clearfell area and ecological function. Identification of priority issues to focus on was determined through electronic survey [27].

Links to other information sources are important and a an effective way to share information rapidly without having to do a lot of work synthesising the information and storing it on the portal. Important links from the portal would include to organisations involved in the forestry sector e.g. NZFOA. NZFFA, CRIs, Tertiary Institutions; key documents such as the Forestry Accord; Montreal Process reports, and other resources such as Forestry Insights..

Databases and data collection and access protocols. Four core databases will form the foundation for the majority of data collection, databasing and data presentation. The NEFD database is housed at MPI, the LUCAS database is housed at MfE, the Montreal Process database is housed at MPI, and the home for the new operational indicators database is yet to be decided.

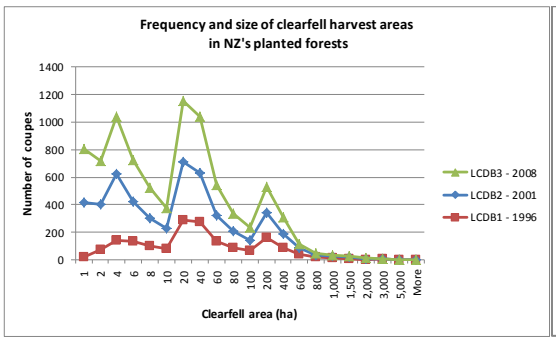
Data collection protocols, timing and storage will be controlled by each of those database managers and will be designed to meet their requirements. Access protocols would need to be agreed with each of the database owners to enable use of the data in the portal. Based on discussions to date agreeing access protocols is likely to be feasible for all these databases.

- NEFD is currently undergoing a redesign and there is a good opportunity to align the portal projects objectives with those of the NEFD. Discussions at MPI have raised the possibility of aligning the new operational indicator database and questionnaire survey with the NEFD data gathering process. Access would be required annually.
- Nigel Searles of MfE is most enthusiastic about wider use of the LUCAS database by the forestry sector – key issue around access would be agreement by the forestry companies upon whose land the LUCAS plots lie to make the data available. Access would be required five yearly.
- The location of past data from the 2003 and 2008 Montreal Process reports is unclear at present. This activity was a stand-alone MPI (then MAF) project that was done by a small team to generate both reports. The data and information compiled is archived, but not in a single database (A. Reid, J. Novis pers. comm 2012) as the information would have been a mix of quantitative and qualitative data and also a number of case studies where data sources were most limited. MPI plan to prepare the third Montreal Process report either in 2013 or 2014 so are likely to consolidate the information to enable updating. An MPI team with CRI support are likely to be responsible for the update. Access would be required five yearly.
- The operational indicator database prototype for data capture has been developed and would be able to be hosted and managed in a number of locations. Access protocols would have to be agreed for both wood supply and national level summary data. Confidentiality functions are included in the design to ensure individual company data is only available to the owner.

Access to other data contained in other databases or generated by other organisations would have to be arranged on a case by case basis. This could include Council databases or NIWA's rivers and water databases, or MfE's synthesised environmental data.

Data Presentation, Visualisation and Interpretation

The indicator spreadsheet identifies possible mechanisms for data display (Appendix 1). There are numerous possible approaches from tabular information, graphs (e.g. harvest area, understory species – Figures 1 and 2), to maps or visualisations of data trends over time (e.g. UMCY spread). Preferences will be individual, and maybe there will be benefit from having different display options for different users. One specific need identified is the ability to export the information for subsequent usage. There will need to be discussion as to whether this is the data or the derived means of data presentation or visualisation.



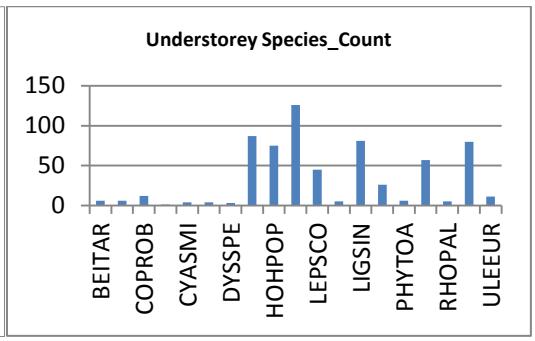


Figure 1. Frequency and size of harvest area

Figure 2. Understory species composition

Visualisation of the overall state of the forests is an important concept to promote, and there are numerous approaches to presenting such summary visualisations from a smiley face or green tick through to more complex representations such as cobweb diagrams (Figure 3) from the USA (www.ssfindex.com) or criterion specific representations as derived from New Zealand's 2008 Montreal Process report (Figure 4).

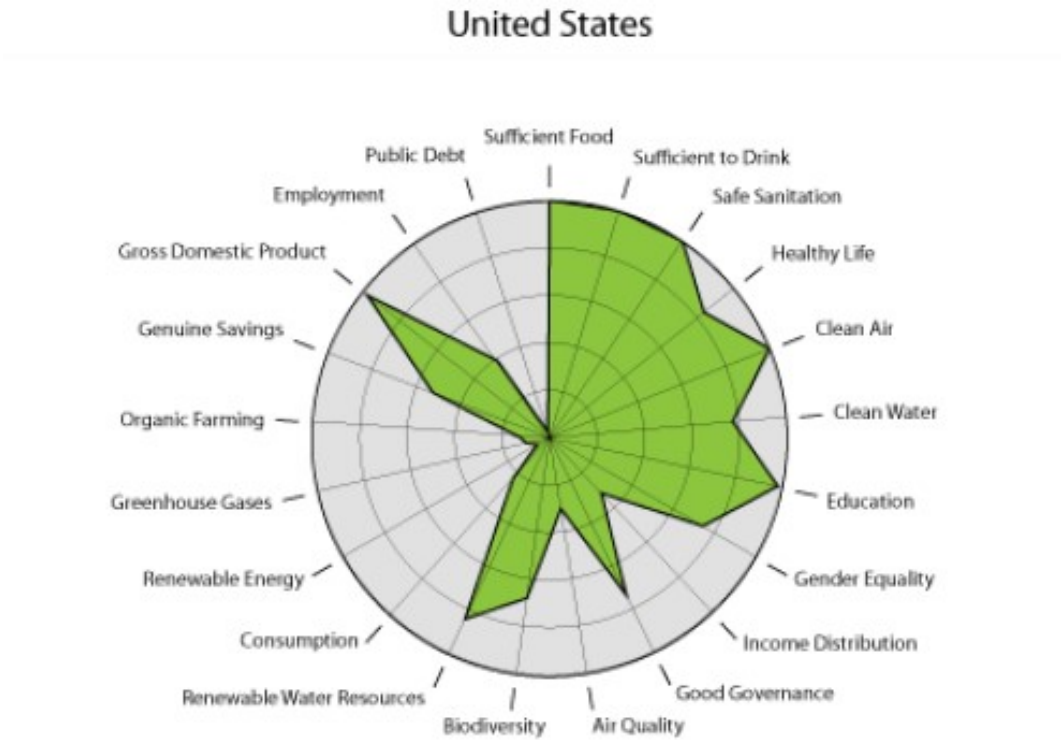


Figure 3. Sustainability performance for key criteria, USA

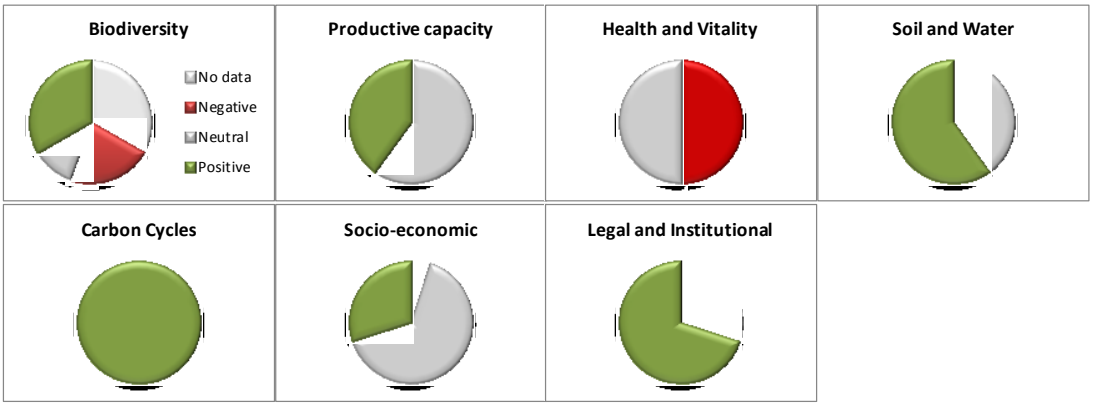


Figure 4. Data trends for 7 Criteria for New Zealand's Forests (green – positive, grey - neutral, red - negative, white – no data)

Interpretation of the data can be fraught with challenges. It is necessary to present factual commentary around the data and let the user provide the value judgements on the data presented if the portal is to be a provider of unbiased information and to be seen as a credible source of information.

Supporting information. There is a great deal of supporting information available that may be included on the portal if wanted. There is also a lot of information that could be included as web links on the portal to save effort in rewriting and updating or duplicating information. What will actually be a priority for inclusion in the portal is the subject of a questionnaire survey (currently being developed) to enable the portal developers to get a good view of where effort is best spent. Examples of supporting information could include fact sheets or posters e.g. related to forests and climate change[15]; recorded webinars such as one on wind risk[16]; or videos such as the example on forests and water[17]. Reports and published information e.g. Maclaren 1996 [22], or bibliographies on specific topics are also options. Links to other resources will also be important – for instance Forestry Insights, the NZFOA Environmental Code of Practise, or the rare and endangered species web site.

Development of the Prototype Portal

A prototype portal for demonstration of the overall concept has been developed. The scope of the prototype includes a database for operational indicator data capture and storage and a web based display portal that demonstrates the structure and conceptual approach. The database, data capture and storage mechanism was first developed and trialled by the cluster group followed by focus on display of information and the user needs through the portal interface. The portal interface was developed following a simple Survey Monkey questionnaire that was used to canvas preferences for the portal interface and interactions with it (Appendix 4).

Operational indicator database development

Once the operational indicators had been defined by the sub group a database design and software requirements were developed [15]. This design was then developed into a testable prototype by Scion's ATLAS software engineering team. Members of the subgroup were requested to provide feedback and this was collated for reference and use when the full database is developed in the implementation phase of this project.

In brief, the database allows individual company input of operational indicator data for their forests and by wood supply region. The data is to be entered on an annual basis and data is stored by year. Individual companies can view their own data, but not other companies so confidentiality is assured. Data from all companies is compiled and summarised to present national summaries for each indicator for use in the portal. This will also enable individual companies to compare their data with national averages.

The prototype data base can be accessed at:

Public: http://webapps.scionresearch.com/ForestIndicatorsPublic
Forest Company: http://webapps.scionresearch.com/ForestIndicatorsEntry

The 'Public' site shows how summary data is presented and is accessible without a password, the 'Forest Company' site (please input user name 'test' and password 'test') shows how data can be entered.

[15] http://www.scionresearch.com/research/forest-science/climate-change/modeling-and-adaptation#gsc.tab=0
[16] http://www.youtube.com/watch?v=0QuhV7fd6_4&list=PL49392A4D17B5774C&index=1
http://www.youtube.com/watch?v=W1ZsLrR03Pg

Feedback from the small group was positive and focussed mainly on modifications to indicator units, rather than anything major and these suggestions will feed into the development of the full database at the implementation phase of the project.

Web based display portal development

A web based survey was undertaken to determine how people would like to interact with the portal, what they would like to be able to do on it, and what they would like to see in it. There were 97 respondents to the survey from across the forest sector (corporate and farm forestry) central and local government and academia. Results showed in brief that users wanted the portal to be issues based (e.g. forests and water, safety); to contain accessible, summarised and downloadable indicator data; to contain supporting factual information in readily digestible and useable form – fact sheets were most commonly preferred; and to have links to other information of interest. They identified that there were many sources of information but that environmental and social information was lacking. Full detail of the survey responses are contained in Payn 2013 [27].

Using the results of the survey a portal design and software specifications were developed by Scion's ATLAS software engineering group [16] and a limited functionality prototype developed by Cucumber, a web development company based in Tauranga. The prototype can be accessed at: http://site223618.webydo.com/

The prototype home page is shown in Figure 5 and the hierarchical structure of home, theme, and indicator pages and the indicator index shown in Figure 6. Feedback on the portal prototype was sought from the FFR subgroup, and other stakeholders at MPI, Councils, within Scion, and also from international colleagues within the Montreal Process Technical Advisory Committee.

Figure 5. Prototype home page for New Zealand Planted Forest Portal (see demonstration at *http://site223618.webydo.com/*)

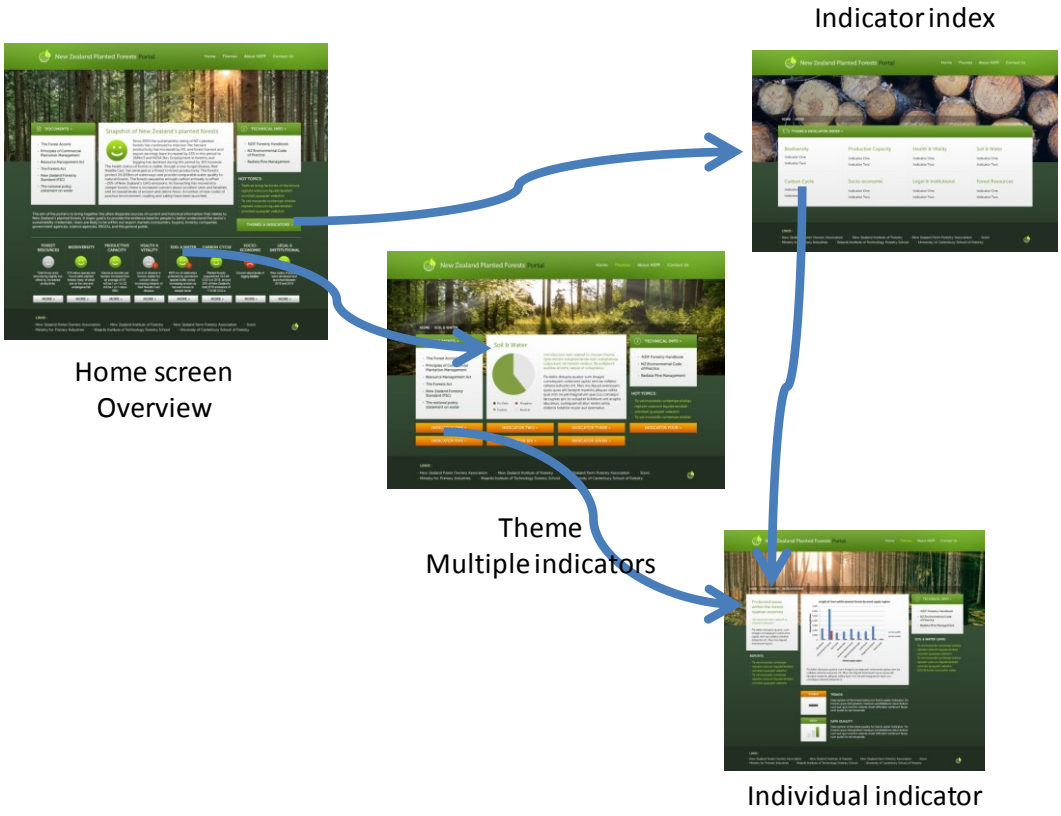


Figure 6. Portal hierarchical structure

Feedback has been positive on the prototype – nice general layout, and easy to navigate. Suggestions focussed on keeping the portal as clear and 'unwordy' as possible; visuals (smiley faces or similar such as arrows) are favoured; and having a very clear statement of the aim of the portal. The portal should focus on the evidence or data rather than value judgements on the information presented as this will be subject to varying interpretation by different parties. There were some comments about potential duplication with other information sources, and questions as to who the actual users will be. These comments will be factored into the final design for the portal during the implementation phase of the project.

IMPLEMENTATION

Implementation of the portal will require coordination and cooperation between a range of stakeholders. Support from NZFOA, MPI, MfE and NZ Wood will be critical to the success of this initiative as they will need to champion the project and also provide data access and/or funding support.

A portal implementation and management committee to plan the prototype is a critical first step. This committee would be responsible for agreeing on the implementation plan which should include the portal 'business model', system development, data protocols, confidentiality aspects, management protocols, detailed costings and funding streams. Common committee members with the NEFD steering group, FFR portal cluster group, and the Scion research team are recommended.

Once implemented, the portal will need to be managed and maintained. New functionality or expansion of indicators should be done on a three-yearly review and update cycle, with the oversight of the implementation and management committee. The portal should be designed to enable such future developments. For efficiency and cost effectiveness, such developments must be tightly planned and implemented

WHAT WILL THE COSTS BE AND WHO WILL PAY THEM?

Principles: The project was undertaken under the expectation that development of a portal would have to be cost neutral as there is little appetite for increased expenditure. So a key focus of the study has been to identify potential cost savings that might be made that may be able to offset the price of any new developments.

Summary of current costs: Costs associated with the NEFD, Montreal Process and other International reporting, production of Forestry Facts and Figures, and sampling costs associated with the LUCAS grid and other systems such as water monitoring frameworks have been gathered with an understanding that they should remain confidential at this time. If the concept outlined in this report is accepted in principle by the forest industry then it is expected we could move to a cost benefit analysis of the proposal. Costs are currently the responsibility of MPI, MfE, NZFOA, individual forest companies, and other agencies such as regional councils.

Operational costs: These would be associated with any new data gathering– such as the operational indicators, additional water sampling sites [35], development and implementation of the portal, and on-going management costs of new developments associated with the portal.

A coordinated approach to data sharing and costs: The agencies already gather data as part of their statutory roles. Being able to represent the data to fulfil wider policy objectives such as State of the Environment or Montreal Process reporting, or marketing purposes could potentially justify data and cost sharing.

Cost savings: There are a number of identified savings opportunities. These include:

- Alignment of the national reporting efforts.
- Savings attributable to coordination of data collection through the aligned NEFD/Operational indicators system.
- Efficiencies related to linking the Forestry Facts and Figures with the portal.

RECOMMENDATIONS AND CONCLUSIONS

- **Planted Forests Portal**
  - That a Planted Forests Portal is established that collects organises and disseminates data and information.
  - That additional data on biodiversity, forest condition, and soils is collected on the LUCAS grid of plots.
  - That the density of water quality monitoring sites is increased in line with the recommendations of Harrison [35]
  - That the portal data collection for new operational indicators is aligned with the revised NEFD – leading to cost efficiencies and broader coverage than running separately.
  - That the portal is aligned/merged with Forestry Facts and Figures – giving enhanced coverage and cost efficiencies
- **State of New Zealand's Planted Forests Report**
  - That New Zealand produce a 'State of New Zealand's Planted Forests' report in 2015 as part of the overall State of the Forests report produced by MPI using the Montreal Process framework. And that this is repeated five-yearly. This information would be available on the portal.
- **National Reporting Efficiencies**
  - Align the reporting cycles of the Global Forest Resource Assessment, Convention on Biological Diversity, and Montreal Process and harmonise indicators leading to cost efficiencies for national government reporting activities through MPI, MfE, and DOC.

Overall benefits of implementing these recommendations should be lower central government reporting costs, lower company related data collection and analysis costs, enhanced ability of the forestry sector to respond to challenges about their data from better information, enhanced visibility of forestry information, and ultimately better understanding of forestry by the wider community.

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APPENDICES

Appendix 1: Indicators, Data Sources

New Zealand Planted Forests – Sustainability Indicator Set

Montreal Process Criterion	Montreal Process Indicator and related national (operational) sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)	Data Source and approach to reporting	Comments
Biological Diversity	**1.1.a** Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure	No	LM	5 yearly Montreal Process reporting	
Biological Diversity	**1.1.b** Area and percent of forest in protected areas by forest ecosystem type, and by age class or successional stage	No	M	5 yearly Montreal Process reporting	
Biological Diversity	**1.1.c** Fragmentation of forests	Low	M	LCDB, 5 yearly Montreal Process reporting	
Biological Diversity	**1.2.a** Number of native forest-associated species	High	LM	5 yearly LUCAS survey MfE	Use DOC Natural Heritage Monitoring Indicator set
Biological Diversity	**1.2.b** Number and status of native forest-associated species at risk, as determined by legislation or scientific assessment	No	LM	5 yearly Montreal Process reporting	
Biological Diversity	**1.2.c** Status of on site and off site efforts focused on conservation of species diversity	Moderate	LM	5 yearly Montreal Process reporting	
Biological Diversity	**1.2.c.1** Protected areas within the forest	High	Not categorised	Annual Forest sector questionnaire	may split out riparians from other protected areas
Biological Diversity	**1.3.a** Number and geographic distribution of forest-associated species at risk of losing genetic variation and locally adapted genotypes	No	LM	5 yearly LUCAS survey MfE	
Biological Diversity	**1.3.b** Population levels of selected representative forest-associated species to describe genetic diversity	No	LM	5 yearly LUCAS survey MfE	
Biological Diversity	**1.3.c** Status of on site and off site efforts focused on conservation of genetic diversity	No	LH	5 yearly Montreal Process reporting	
Productive Capacity	**2.a** Area and percent of forest land and net area of forest land available for wood production	High	H	Annual NEFD survey	
Productive Capacity	**2.a.1** Area of forest	High	Not categorised	Annual NEFD survey	Base information needed to derive other indicators
Productive Capacity	**2.a.2** Net stocked area	High	Not categorised	Annual NEFD survey	Base information needed to derive other indicators
Productive Capacity	**2.a.3** Area of forest established or re-established	High	Not categorised	Annual NEFD survey	Base information needed to derive other indicators
Productive Capacity	**2.b** Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production	Moderate	MH	Annual NEFD survey	

Montreal Process Criterion	Montreal Process Indicator and related national (operational) sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)	Data Source and approach to reporting	Comments
Productive Capacity	**2.c** Area, percent, and growing stock of plantations of native and exotic species	Low	LH	Annual NEFD survey	
Productive Capacity	**2.d** Annual harvest of wood products by volume and as a percentage of net growth or sustained yield	High	MH	Annual NEFD survey	
Productive Capacity	**2.d.1** Forest harvest coupe size	High	Not categorised	Annual Forest sector questionnaire	To inform markets concerned about clearfells and size thereof. High level LCDB analysis also possible
Productive Capacity	**2.e** Annual harvest of non-wood forest products	Low	LM	5 yearly Montreal Process reporting	Need to define what products these are e.g. sphagnum, ginseng, venison
Health and Vitality	**3.a** Area and percent of forest affected by biotic processes and agents (e.g. disease, insects, invasive alien species) beyond reference conditions	High	M	5 yearly LUCAS survey MfE	Forest Health Surveillance as developed by FBRC/FHRC probably does not meet the requirement to track changes over space and time. Need to look in detail regarding plot based methods adopted as international standards. Adopting Marshall et al 2011 method in LUCAS recommended
Health and Vitality	**3.a.1,2,3&4** Amount of chemicals used within forest management operations (herbicides, pesticides, fertilisers)	High	Not categorised	Annual Forest sector questionnaire	Have to do this through a questionnaire approach. FOA used to compile fertiliser usage numbers in the 1980s. FSC chemicals group could generate list of active ingredients and NEFD survey could have fields to fill in. Sub indicators - herbicides, pesticides - insect and disease, pesticides - mammals, fertilisers
Health and Vitality	**3.b** Area and percent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions	High	M	LCDB - land cover change, 5 yearly Montreal Process reporting	Fire and widn covered below, land use change not. Depends on frequency of update of LCDB
Health and Vitality	**3.b.1** Area of forest affected by fire	High	Not categorised	Companies and NZ Fire Service	Should be able to import direct from Fire Service
Health and Vitality	**3.b.2** Area of forest affected by wind	High	Not categorised	Annual Forest sector questionnaire	Could be by tabular reporting or more complicatedly with spatial reporting. If latter need a spatial database and data capture system a la ETS or MyLand. Split into severe (needs salvage logging) and low level.
Soil and Water	**4.1.a** Area and percent of forest whose designation or land management focus is the protection of soil or water resources	High	L	5 yearly Montreal Process reporting	

Montreal Process Criterion	Montreal Process Indicator and related national (operational) sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)	Data Source and approach to reporting	Comments
Soil and Water	**4.1.a.1** Area of riparian reserves	High	Not categorised	Annual Forest sector questionnaire	Local data capture more precise than national level analysis using REC and other databases (Hock and Payn 2013), but if local data not available use LCDB
Soil and Water	**4.2.a** Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources	High	MH	5 yearly Montreal Process reporting	informed by 4.2.a.1
Soil and Water	**4.2.a.1** Number of audit visits, abatement notices, infringement notices and prosecutions related to soil, and area of forest affected			Annual Forest sector questionnaire	Council sources are very hard to get the information and untangle for planted forests - often land use is not recorded. Council criteria for prosecution/identification of breaches may vary. Note this indirect indicator avoids highly intensive soil monitoring with attendant costs and utilises operation RC system. Could merge with water one. Portal questionnaire likely to be most effective way fo collecting data
Soil and Water	**4.2.a.2** Number of compliance related visits to the forest	High	Not categorised	Forest sector questionnaire	
Soil and Water	**4.2.b** Area and percent of forest land with significant soil degradation	High	M	Forest sector questionnaire	Use Council core indicator set and methods - Total Carbon, Total Nitrogen, Olsen P, Bulk density, macro-porosity, and pH. Long term trend analysis possible and then comparison against degradation thresholds
Soil and Water	**4.2.b.1** Area of on-site and off-site forest related erosion damage	High	Not categorised	Annual Forest sector questionnaire	Council aerial photo and plot based approach could also be utilised. Currently a number of councils using 2km grid based photogrammetric approach. Worthwhile analysing intensity of points in planted forests from LCDB3 and grid . Data on slips on cutover would need to be collected by companies. Potentially use modified council photogrammetric methodology.
Soil and Water	**4.3.a** Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources	High	M	5 yearly Montreal Process reporting	

Montreal Process Criterion	Montreal Process Indicator and related national (operational) sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)	Data Source and approach to reporting	Comments
Soil and Water	**4.3.a.1** Number of audit visits, abatement notices, infringement notices and prosecutions related to water and area of forest affected	High	Not categorised	Annual Forest sector questionnaire	Hard to get the information and untangle for planted forests. Council criteria for prosecution/identification of breaches may vary. Could merge with soil one. Company questionaire through portal
Soil and Water	**4.3.b** Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions	High	L	National FWENZ network, operational reference monitoring sites, council reports	Use 14 national core indicators adopted by national water quality monitoring network (Brenda Baillie representative on national working group). Suspended sediment, pH, conductivity, water temperature, visual clarity, turbidity, coloured DOM, Total N, Nitrate/oxidised N, ammonia/ammonium, Total P, Dissolved reactive P, E coli, Periphyton, chlorophyll a, aquatic invertebrates, fish. Indicator set indentified as optimum for forestry likely to be adopted nationally by NeMAR (BB pers comm)
Carbon Cycles	**5.a** Total forest ecosystem carbon pools and fluxes	Moderate	M	UNFCC report	Currently undertaken by MfE
Carbon Cycles	**5.b** Total forest product carbon pools and fluxes	Moderate	H	UNFCCC report	Currently undertaken by MfE
Carbon Cycles	**5.c** Avoided fossil fuel carbon emissions by using forest biomass for energy	High	M	Not currently routinely collected	May not be UNFCC criterion therefore may need to use NEFD or similar approach
Socio Economic	**6.1.a** Value and volume of wood and wood products production, including primary and secondary processing	High	H	Annual NEFD survey	
Socio Economic	**6.1.b** Value of non-wood forest products produced or collected	Moderate	L	5 yearly Montreal Process reporting	Need to define what products these are e.g. sphagnum, ginseng, venison
Socio Economic	**6.1.c** Revenue from forest based environmental services	Low	LM	5 yearly Montreal Process reporting	Probably best based on a one off desk study
Socio Economic	**6.1.d** Total and *per capita* consumption of wood and wood products in round wood equivalents	Low	MH	5 yearly Montreal Process reporting	
Socio Economic	**6.1.e** Total and *per capita* consumption of non-wood products	Low	L	5 yearly Montreal Process reporting	
Socio Economic	**6.1.f** Value and volume in round wood equivalents of exports and imports of wood products	High	H	Annual NEFD survey	
Socio Economic	**6.1.g** Value of exports and imports of non-wood forest products	Low	LM	5 yearly Montreal Process reporting	

Montreal Process Criterion	Montreal Process Indicator and related national (operational) sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)	Data Source and approach to reporting	Comments
Socio Economic	**6.1.h** Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption	High	M	5 yearly Montreal Process reporting	
Socio Economic	**6.1.i** Recovery or recycling of forest products as a percent of total forest products consumption	Low	M	5 yearly Montreal Process reporting	
Socio Economic	**6.2.a** Value of capital investment and annual expenditure in forest management, wood and non-wood forest product industries, forest-based environmental services, recreation and tourism	Moderate	LM	5 yearly Montreal Process reporting	
Socio Economic	**6.2.b** Annual investment and expenditure in forest-related research, extension and development, and education	Moderate	LM	5 yearly Montreal Process reporting	
Socio Economic	**6.3.a** Employment in the forest sector	High	H	Dept Statistics, MBIE	Fairly easily accessible
Socio Economic	**6.3.b** Average wage rates, annual average income and annual injury rates in major forest employment categories	High	MH	MBIE, NZFOA IRIS database	
Socio Economic	**6.3.c** Resilience of forest-dependent communities	Low	LM	5 yearly Montreal Process reporting	
Socio Economic	**6.3.d** Area and percent of forests used for subsistence purposes	Low	L	5 yearly Montreal Process reporting	
Socio Economic	**6.3.e** Distribution of revenues derived from forest management	Moderate	L	5 yearly Montreal Process reporting	
Socio Economic	**6.3.e.1** Forestry's contribution to local economies	High	Not categorised	Annual Forest sector questionnaire	MPI and other statistics lump forestry and agriculture together so need questionnaire
Socio Economic	**6.4.a** Area and percent of forests available and/or managed for public recreation and tourism	High	MH	5 yearly Montreal Process reporting	informed by 6.4.b.1
Socio Economic	**6.4.b** Number, type, and geographic distribution of visits attributed to recreation and tourism and related to facilities available	High	M	5 yearly Montreal Process reporting	
Socio Economic	**6.4.b.1** Visitor numbers and area of forest available for access	High	Not categorised	Annual Forest sector questionnaire	
Socio Economic	**6.5.a** Area and percent of forests managed primarily to protect the range of cultural, social and spiritual needs and values	Low	M	5 yearly Montreal Process reporting	
Socio Economic	**6.5.a** The importance of forests to people	Low	M	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.1.a** Legislation and policies supporting the sustainable management of forests	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.1.b** Cross sectoral policy and programme coordination	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	

Montreal Process Criterion	Montreal Process Indicator and related national (operational) sub indicators (right justified)	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	MPI 'Reportability' (Quality of information, Low, Medium, High and intergrades - 2008)	Data Source and approach to reporting	Comments
Legal and Institutional Frameworks	**7.2.a** Taxation and other economic strategies that affect the sustainable management of forests	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.3.a** Clarity and security of land and resource tenure and property rights	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.3.b** Enforcement of laws related to forests	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.4.a** Programmes, services and other resources supporting the sustainable management of forests	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.4.b** Development and application of research and technologies for the sustainable management of forests	Moderate	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.5.a** Partnerships to support the sustainable management of forests	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.5.b** Public participation and conflict resolution in forest-related decision making	Low	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.5.c** Monitoring, assessment and reporting on progress towards sustainable management of forests	Moderate	Not categorised, indicators changed since 2008	5 yearly Montreal Process reporting	
Legal and Institutional Frameworks	**7.5.c.1** Area of forest independently certified as well managed	High	Not categorised	Annual Forest sector questionnaire	Can also rerieve from FSC or other audit scheme websites

Appendix 2: Indicators ranked by Relevance and 'reportability'

a. Indicators of high relevance to planted forests categorised by 'reportability'

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Productive Capacity	**2.a** Area and percent of forest land and net area of forest land available for wood production	High	H
Socio Economic	6.1.a Value and volume of wood and wood products production, including primary and secondary processing	High	H
Socio Economic	6.1.f Value and volume in round wood equivalents of exports and imports of wood products	High	H
Socio Economic	6.3.a Employment in the forest sector	High	H

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Productive Capacity	**2.d** Annual harvest of wood products by volume and as a percentage of net growth or sustained yield	High	MH
Soil and Water	**4.2.a** Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources	High	MH
Socio Economic	6.3.b Average wage rates, annual average income and annual injury rates in major forest employment categories	High	MH
Socio Economic	6.4.a Area and percent of forests available and/or managed for public recreation and tourism	High	MH

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Health and Vitality	**3.a** Area and percent of forest affected by biotic processes and agents (e.g. disease, insects, invasive alien species) beyond reference conditions	High	M
Health and Vitality	**3.b** Area and percent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions	High	M
Soil and Water	**4.2.b** Area and percent of forest land with significant soil degradation	High	M
Soil and Water	**4.3.a** Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources	High	M
Carbon Cycles	**5.c** Avoided fossil fuel carbon emissions by using forest biomass for energy	High	M
Socio Economic	**6.1.h** Exports as a share of wood and wood products production and imports as a share of wood and wood products consumption	High	M
Socio Economic	6.4.b Number, type, and geographic distribution of visits attributed to recreation and tourism and related to facilities available	High	M

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Soil and Water	4.1.a Area and percent of forest whose designation or land management focus is the protection of soil or water resources	High	L
Soil and Water	**4.3.b** Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions	High	L

b. Indicators of Moderate Relevance by 'reportability'

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Carbon Cycles	**5.b** Total forest product carbon pools and fluxes	Moderate	H

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Productive Capacity	**2.b** Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production	Moderate	MH

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Carbon Cycles	**5.a** Total forest ecosystem carbon pools and fluxes	Moderate	M

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Biological Diversity	**1.2.a** Number of native forest-associated species	Moderate	LM
Biological Diversity	1.2.c Status of on site and off site efforts focused on conservation of species diversity	Moderate	LM
Socio Economic	6.2.a Value of capital investment and annual expenditure in forest management, wood and non-wood forest product industries, forest-based environmental services, recreation and tourism	Moderate	LM
Socio Economic	6.2.b Annual investment and expenditure in forest-related research, extension and development, and education	Moderate	LM

MP Criterion	MP Indicator	Relevance specifically for planted forests reporting (No, Low, Moderate, High)	Reportability' (Quality of information, Low, Medium, High and intergrades - 2008
Socio Economic	6.1.b Value of non-wood forest products produced or collected	Moderate	L
Socio Economic	6.3.e Distribution of revenues derived from forest management	Moderate	L

Appendix 3. New Operational Indicator rationales, definitions, approaches to measurement

LIST OF OPERATIONAL INDICATORS (note numbers are a cross reference to Montreal Process Indicator numbers)

Forest Extent
- 2.d.1 Forest Harvest Coupe size

Chemical Usage
- 3.a.1 Herbicide Usage
- 3.a.2 Pesticide Usage – Insects and Pathogens
- 3.a.3 Pesticide Usage – Mammals
- 3.a.4 Fertiliser Usage

Abiotic Impacts
- 3.b.1 Area and percent of forest damaged by fire
- 3.b.2 Area and percent of forest damaged by wind
- 4.2.b.1 Area of on-site and off-site forest related erosion damage

Good practice and legality
- 7.5.c Area of forest independently certified as well managed
- 4.2.a.1 Number of compliance related visits to the forest
- 4.2.a&b.2 Area of forest affected by prosecutions and abatement and infringement notices [related to soil and water]

Forest Benefits
- 6.4.b.1 Visitor numbers and forest area available to visitors
- 4.1.a.1 Area of riparian reserves
- 1.c.1 Protected areas within the forest
- 6.3.e.1 Forestry's contribution to local economies

Background: Operational indicators are those indicators identified and agreed upon by the forest sector Indicators Cluster Group as important to assess and report on for a variety of reasons. These are indicators that do not currently exist in the Montreal Process suite, or where they do, are not at the appropriate scale. All indicators do link to the core Montreal Process indicators suite and these operational indicators are effectively NZ specific sub-indicators under the Montréal Process framework. There are also very close links to the NEFD survey indicators for base data.
The indicators support FSC certification activity (chemicals, visitor access) and also respond to local issues such as concerns about environmental impacts of forestry e.g. erosion from harvested areas, compliance with environmental regulations. They will provide information that is currently not available nationally and support responses to questions on these topics, hopefully enhancing license to operate.
These indicators will supplement both the NEFD and Montreal Process suite and other indicators collected and presented through the NZFOA/MPI Forestry Facts and Figures.

1. Forestry Base Information

Background: This base data enables calculation of a range of derived variables for operational indicators – for example percentage of forest affected by fire or other impacts, percentage of forest in reserves

Title: Area of Forest
Rationale (why do we need it):
• Fundamental unit of description of a forest estate
Definition (tight and mutually agreed):
• As defined in the National Exotic Forest Description (NEFD)
Approaches to measurement (details of units etc):
Units: Hectares
Comments:
• The forest base data should use the same variables as the NEFD questionnaire to ensure derived data is based on company and nationally acceptable figures. • If the Operational Indicator Survey can be linked to the NEFD questionnaire approach this variable would be called from the NEFD survey section and this would decrease time taken to collect data.
References/links:
• Source NEFD Question A6 • Montreal Process 2.a, 2.c
Software/Systems comments:

Title: Net stocked area
Rationale (why do we need it):
• The net stocked area is the area of forest available for production of the rage of forest products. This base data enables calculation of a range or derived variables for operational indicators – for example percentage of net stocked area affected by fire or other impacts
Definition (tight and mutually agreed):
• The planted production forest area occupied by trees excluding mappable gaps such as landings, roads and other unstocked areas. (National Exotic Forest Description glossary)
Approaches to measurement (details of units etc):
• Units: Hectares
Comments:
• The forest base data should use the same variables as the NEFD questionnaire to ensure derived data is based on company and nationally acceptable figures. • If the Operational Indicator Survey can be linked to the NEFD questionnaire approach this variable would be called from the NEFD survey section and this would decrease time taken to collect data.
References/links:
• Source NEFD Question B8 • NEFD Glossary • Montreal Process 2.a

Title: Area of forest harvested
Rationale (why do we need it):
• This provides base data to enable to computation of indicators related to forest harvesting scale (such as coupe size) or environmental impacts such as area affected by erosion.
Definition (tight and mutually agreed):
• The area of forest harvested in any one year period
Approaches to measurement (details of units etc):
• Units: Hectares • Period same as for NEFD, year ending March 31st
Comments:
• Can extract this base data from the NEFD questionnaire
References/links:
• Source NEFD Question C6
Software/Systems comments:

Title: Forest Harvest Coupe size
Rationale (why do we need it):
• The international planted forests debate focusses on a number of perceived issues or drawbacks to planted forests. One such issue is the harvesting of uniform age stands or coupes at one time – called clear-felling. The size of these clear-felled coupes is often cited as a concern for a range of forest attributes such as sediment supply to rivers, biodiversity, or aesthetics. Whether the concerns are valid or not, to support the debate, clear data on clearfell area is required. Currently there is no source of data in New Zealand that can be accessed to demonstrate coupe size or trends over time.
Definition (tight and mutually agreed):
• The average area of all coupes or management units felled as in a year
Approaches to measurement (details of units etc):
• Units: hectares • Simple average: Divide the area harvested (obtained from NEFD question C6 or from questionnaire) by number of coupes recorded.
Comments:
• Coupes are individual harvesting operations which are referred to variously e.g. coupe, OpID, sale area. The aim is to identify areas that are individually considered. These may end up adjacent to others leading to an overall larger contiguous unstocked area but the aim is to report average unit size of harvest. • There are also remote sensing approaches to this indicator that could be used e.g LCDB harvest class analysis [6] or use of rapideye imagery (Watt et al 2012). However both of these are likely to be less precise.
References/links:
• NEFD Question C6. • Clear-felling - removal of all the trees in a stand of timber (http://www.merriam-webster.com/dictionary/clear-cutting?show=0&t=1359684389) • Watt P, Watt M.S. 2012. Forest planning applications using high resolution satellite data. New Zealand Journal od Forestry. 57(1) pp32-40
Software/Systems comments:

Title: Area of forest planted
Rationale (why do we need it):
• This provides base data for deriving values for indicators related to chemical use
Definition (tight and mutually agreed):
• Area of forest planted (either new planting or re-establishment) in one year
Approaches to measurement (details of units etc):
• Units: Hectares • Year ending 31st December as in NEFD
Comments:
• Area includes both areas of new forest established on non-forest land and re-established on cutover • May be an issue with reporting time in order to capture herbicide use associated with the same areas but which occurs at different times of the year to planting. • May also be an issue with second and third applications to sites planted in previous years
References/links:
• Source NEFD Question C3
Software/Systems comments:

2. Chemical Use

Background

Under FSC Principles planted forest managers must work to minimise chemical use in their forests. There are three main uses of chemicals – vegetation management, pest and disease management, and nutrition management.

Title: Herbicide Usage
Rationale (why do we need it):
• Under FSC Principles forest companies must commit to reduce chemical usage across their forests if they are interested in becoming or maintaining certified status. Currently interactions with FSC are on a company specific basis and no overview of national information exists. Significant efficiencies could be gained by capturing the national picture in terms of ability to argue the case for derogations for certain chemicals used for instance.
Definition (tight and mutually agreed):
• The amount of active ingredient (kg) used within the forest in any one year and the total area (ha) treated for all major herbicides (Hexazinone, Terbuthylazine, Metasulphuron, Glyphosate, Haloxyfop) used by the forest sector.
Approaches to measurement (details of units etc):
• Units: Kg (active), hectares • As in the definition.
Comments:
• Use a drop down menu with current NZ forestry chemicals for each year, would need to make it as easy to input as possible • Companies collect and report both Kg active ingredient used and also area treated.
References/links:
• list in the AGPRO manual 2012 – that includes all herbicides registered to forestry and recommended weed spectrum, crop stage, weed stage and rate/ha – the actual industry application and use might differ slightly... we would need to add the active ingredient to the table • MP indicator 3.a
Software/Systems comments:
• If there are difficulties reporting active ingredient then maybe we develop a multiple approach input table that will automatically convert product used to active ingredient applied

Title: Pesticide Usage – insects and pathogens
Rationale (why do we need it):
• Under FSC Principles forest companies must commit to reduce chemical usage across their forests if they are interested in becoming or maintaining certified status. Currently interactions with FSC are on a company specific basis and no overview of national information exists. Significant efficiencies could be gained by capturing the national picture in terms of ability to argue the case for derogations for certain chemicals used for instance.
Definition (tight and mutually agreed):
• The amount of active ingredient (kg) used within the forest in any one year and the total area (ha) treated for all major pesticides (copper oxychloride) used by the forest sector to treat insect and pathogen outbreaks.
Approaches to measurement (details of units etc):
• Units: Kg (active), hectares • As in the definition.
Comments:
•
References/links:
• list in the AGPRO manual 2012 • MP indicator 3.a
Software/Systems comments:
• If there are difficulties reporting active ingredient then maybe we develop a multiple approach input table that will automatically convert product used to active ingredient applied

Title: Pesticide Usage - Mammals
Rationale (why do we need it):
• Possums, deer, pigs and other mammals such as mustelids are a problem in both planted and native forests. By far the largest issue for control are possums as they both affect native forests and are also carriers of TB and so can have an adverse impact on the pastoral sector with requirements for control imposed by the Animal Health Board. This indicator therefore focusses specifically on possums. Control options include both chemical poisoning, trapping and shooting. Given FSC interest in chemical minimisation this indicator focusses on that aspect.
Definition (tight and mutually agreed):
• The amount of active ingredient (kg) used within the forest in any one year and the total area (ha) treated for all major pesticides (1080, Broadificum, Potassium Cyanide) used by the forest sector to control possum numbers.
Approaches to measurement (details of units etc):
• Units: Kg (active), hectares
Comments:
•
References/links:
• http://www.doc.govt.nz/documents/conservation/threats-and-impacts/animal-pests/wanganui/national-possum-control-agencies-questions-and-answers-on-1080.pdf • http://www.pce.parliament.nz/publications/all-publications/evaluating-the-use-of-1080-predators-poisons-and-silent-forests • MP indicator 3.a
Software/Systems comments:
• If there are difficulties reporting active ingredient then maybe we develop a multiple approach input table that will automatically convert product used to active ingredient applied

Title: Fertiliser Usage
Rationale (why do we need it):
• A number of the planted forests in New Zealand are entering their fourth rotation. Apart from forests that were severely deficient in nutrients and where establishment was problematic there has been little application of fertiliser in our forests. It has been estimated that ~$1bn worth of nutrients are removed through harvest each year (P Clinton pers comm). Currently we have no data on how much of that is replaced annually. Surveys of fertiliser use are only rarely done. • With increased emphasis on intensification and increased productivity it is likely that fertiliser usage will increase across the forest estate, to enable discussion on potential issues such as environmental impacts data on the amount applied and area fertilised each year will be required.
Definition (tight and mutually agreed):
• Tonnes of nutrient applied to forest in any one year and hectares covered.
Approaches to measurement (details of units etc):
• Units: Tonnes elemental, hectares • Data to be captured by nutrient (N, P, K, Mg, and B)
Comments:
• This data will also be useful in relating any increases in productivity across the forest estate to past applications of nutrients
References/links:
• Payn T.W., Clinton P.W., 2005. The environmental footprint of New Zealand's plantation forests: nutrient balances. New Zealand Journal of Forestry. 50, 17-22. • Payn, T.W., Skinner, M.F., Clinton, P.W., 1998. Future nutrient requirements of New Zealand plantation forests. In: *Long term nutrient needs for New Zealand's primary industries: Global supply, production requirements and environmental constraints* (Eds L D Currie and P Loganathan). Occasional report No. 11. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand. pp
Software/Systems comments:
• If there are difficulties reporting elemental applications then maybe we develop a multiple approach input table that will automatically convert product used (e.g. Urea) to element applied

3. Abiotic Impacts

Background: Physical damage to forests from abiotic risks such as wind, fire, and storms are clearly recognised risks and are actively managed for by forestry companies. With the increasing impact of climate change it is likely these risks will increase and adaptation and mitigation mechanisms will be required. Good data on extent and impact will be needed for these risks. Currently there are major gaps in data, especially related to storm impacts on slopes and erosion.

Title: Area and percent of forest damaged by wind
Rationale (why do we need it):
• Wind damage can have a significant and catastrophic impact on forest production through large scale extreme blow downs such as cyclone Bola, it can also have less severe or chronic impact on stands where damage does not require salvage logging and re-establishment but overall crop productivity is affected due to canopy damage.
Definition (tight and mutually agreed):
• This indicator is split into two categories: (a) area of wind damaged forest requiring salvage logging; (b) area of forest with minor damage that may affect productivity.
Approaches to measurement (details of units etc):
• Units: hectares • Area affected in both categories will be recorded in hectares, it will also then be possible to compute and present percent of forest area affected in both categories
Comments:
•
References/links:
• http://www.mpi.govt.nz/news-resources/publications.aspx?title=Sustainable%20management%20of%20New%20Zealand%27s%20forests • MP indicator 3.b

Title: Area of on-site and off-site forest related erosion damage

Rationale (why do we need it):

- Soil erosion within a forest can have significant and adverse effects on forest productivity, additionally soil erosion can have significant impacts on land neighbouring the forest if the soil and debris flows cross the forest boundary.
- Soil erosion within forests occurs naturally, but risk is exacerbated during the harvesting/re-establishment window and this is the focus of this indicator
- Currently there is no data on frequency of occurrence in forests or on the actual area affected within forests and outside the forest boundary. This makes it very difficult to respond to comments on the scale of the impacts from the wider community.

Definition (tight and mutually agreed):

- Number of individual occurrences and area of forest (ha) affected by mass movement of soil, and number and area of off-site debris flows

Approaches to measurement (details of units etc):

- In forest:
  - The approach is to delineate and accumulate all areas identified in the forest as having suffered a mass movement event to get total area affected. Minimum area for an individual occurrence should be > 20*20m
  - The number of individual occurrences >20*20m should be recorded
  - This assessment could be done from field observations or aerial photography.
  - Present results as both total area affected and percent of forest (or harvest area?) affected
- Outside forest:
  - Document the number of debris flows leaving the forest boundary, the area (ha) of adjacent land affected by each and the average depth (m) of the debris flow
  - Present data as number of events and total and average unit area affected

Comments:

- Overall baseline of erosion rates: Councils undertake aerial photo based assessments of bare ground cover (see e.g.Waikato RC) on a five yearly basis of 1ha samples on a fixed 2km grid. This is not erosion *per se* but closely related. This is not likely to be a fine enough scale to get trends within a specific forest, but could be used to develop a national baseline. Would be worthwhile overlaying the 2km grid with LCDB3 to determine how many plots fall within forests nationally. Reece Hill has supplied shape file to enable this. Reece Hill noted that focus on what actually occurs on cutover would be very valuable data.
- Companies are developing incident reporting systems for extreme weather event impacts (e.g. Hancocks) that are beginning to collect this data.

References/links:

- http://www.waikatoregion.govt.nz/Environment/Environmental-information/Environmental-indicators/Land-and-soil/Soil/Soil-stability-techninfo/
- Land Monitoring Forum. 2009. Land and Soil Monitoring: A guide for SoE and regional council reporting http://www.envirolink.govt.nz/PageFiles/31/Land%20and%20soil%20monitoring__A_guide_for_SoE%20and%20regional%20council%20reporting.PDF
- MP indicator 3.b, 4.2.b

Software/Systems comments:

Title: Area and percent of forest damaged by fire

Rationale (why do we need it):

- Fire can have a severe effect on forest productivity and also on the wider environment and fire is one of the major risks forest companies manage. Data on the area of forest affected can be used to assess the effectiveness of investment in fire management activities as well as providing estimates of the loss of productivity from the estate.

Definition (tight and mutually agreed):

- Area of forest (ha) damaged by wildfire

Approaches to measurement (details of units etc):

- Unit of measure is hectares, and approaches to measurement should align with Rural Fire Authority assessment and reporting

Comments:

- May be able to get data directly from Rural Fire Authorities/Fire Service for the national picture
- Note wildfire category only, does not include controlled burning

References/links:

- http://www.mpi.govt.nz/news-resources/publications.aspx?title=Sustainable%20management%20of%20New%20Zealand%27s%20forests
- MP indicator 3.b

Software/Systems comments:

4. Good practice and legality

Background: Increasingly for market access and forestry's license to operate there is a need to demonstrate legality and compliance with national and local regulation. Third party audited certification schemes covering all aspects of forest management enable demonstration of legality and compliance so is a useful integrative indicator. Environmental impacts from forestry operations are also another major concern of stakeholders. Issues such as soil intactness and erosion impacts from harvesting can be indirectly monitored by reviewing compliance with environmental regulation. This is far cheaper than developing and implementing intensive soil monitoring schemes across the forest estate and was the approach adopted in the 2009 revision of the soil and water indicators under criterion 4 of the Montreal Process (http://www.montrealprocess.org/documents/publications/techreports/2009p_2.pdf)

Title: Area of forest independently certified as well managed
Rationale (why do we need it):
• The sum area and proportion of all forests with FSC forest management certificates gives an indication of the quality of forest management practised. This includes all aspects of management and includes interactionism with the wider community. The suite of principles and criteria cover economic, environmental, social and cultural indicators.
Definition (tight and mutually agreed):
• Area of forest with independently audited third party certificates of good forest management
Approaches to measurement (details of units etc):
• Could probably get data from FSC's website directly, therefore may not need to collect in questionnaire
Comments:
• This indicator is potentially problematic as currently small growers are not well catered to with certification systems and so the national coverage is likely to remain at ~50% of forests until cheap and effective systems for small growers are developed. This means interpretation is difficult and could be open to mis-representation • If other certification schemes became available these would also need to be interrogated
References/links:
• https://ic.fsc.org/about-us.1.htm
Software/Systems comments:

Title: Number of compliance related visits to the forest
Rationale (why do we need it):
• Forest managers are subject to oversight from both regulatory bodies and bodies related to voluntary third party certification of their management standards. Regulations and involvement in 3rd party audit schemes vary widely across New Zealand. • This indicator provides base information that shows how tightly the oversight of forest practises are and then allows interpretation of both certification status and compliance with regulations in the following indicator
Definition (tight and mutually agreed):
• Number of individual visits to the forest by council or other regulatory staff, and staff of 3rd party certification bodies
Approaches to measurement (details of units etc):
• Record number and duration of visits and purpose (regulatory compliance, 3rd party certification audit) and area affected
Comments:
• This replaces an indicator related to number of resource consents
References/links:
•
Software/Systems comments:

Title: Area of forest affected by prosecutions and abatement and infringement notices related to soil and water
Rationale (why do we need it):
• Similarly to the area certified indicator these indicators give a perspective on the environmental impacts of forestry operations. Using compliance with environmental regulations as an indirect indicator for such variables as soil degradation through erosion. Legality of forest operations is a crucial market access issue globally and also for achievement of certified status under FSC. • It is a cheaper way to get an indication of quality of environmental management than by intensively monitoring soils in forests – a very expensive undertaking • Local understanding of the environmental impact of forestry is poor and this is an easily understandable and explainable statistic for communities
Definition (tight and mutually agreed):
• The number (n) and area affected by: 1. prosecutions, 2. abatement and 3. infringement notices
Approaches to measurement (details of units etc):
• Number of prosecutions and the area covered by those prosecutions • Number of abatement notices issued to the company and area affected by the notice • Number of infringement notices issued to the company and area affected by the notice • Number of third party regulatory compliance based inspections and audits hosted by the company [and area inspected/audited?]
Comments:
• To be able to put the results in context of the total area of forest it is necessary to record the area affected by the various prosecutions or notices • Use of indirect indicators such as regulatory compliance are far cheaper than soil based ones, and in 2009 Montreal Process Indicators were changed to reflect the difficulty and cost of gathering intensive soils data that might be the cause of a prosecution. • This data is not available from another source as council records of prosecutions etc. do not differentiate by land use type so it is not possible to extract forest related information.
References/links:
• MP indicator 4.2.a
Software/Systems comments:

5. Forest Benefits

Background: Forests provide much more than just timber in terms of goods and services. Examples include, clean water, greenhouse gas mitigation, biodiversity, recreation, understorey crops. Forest access is very important to NZ society and currently there are no national statistics available on public use of planted forests. Visitor activity is therefore a priority selected indicator. Biodiversity and clean water are covered by riparian and protected or reserve areas. There are other possible operational biodiversity indicators but still in development stage (e.g. Pawson LiDar metrics).

Title: Visitor numbers and forest area available to visitors
Rationale (why do we need it):
• Public access to forests is very important to New Zealanders and is a contentious issue with stakeholders who have a long memory of when our planted forests were publicly owned and access was a right. • Recreation and other public usage of forests has a large potential value (normally unrealised by forest managers). This indicator will give a perspective on the amount of visitor usage in forests which could contribute to evaluation of the non-timber values of the forests. The ability to demonstrate this value could have benefits.
Definition (tight and mutually agreed):
• The number of visitors to the forest per annum and area of forest the public can access
Approaches to measurement (details of units etc):
• There are a number of ways the number of visitors could be represented and it will be left up to companies to estimate numbers from their data in their own way. • Area of forest accessible to visitors in hectares • The area of forest available for visitor use (hectares) can then be used to calculate percentage area of forest 'open'
Comments:
• This is a difficult indicator to get numbers for – some companies use a permit system others do not, sometimes permits are per vehicle and not per person etc. Sometimes one off surveys are undertaken. Companies will have to make a best estimate based on their knowledge and specify their approach
References/links:
• MP indicator 6.4.a, 6.4.b
Software/Systems comments:

Title: Area of riparian reserves
Rationale (why do we need it):
• Water quality is one of the biggest environmental issues in NZ and maintenance of quality is a Government priority • Forests provide high quality water, but if riparian areas are mismanaged during harvest water quality can be adversely affected • The public do not understand the scale of environmental benefits planted forests provide for water quality.
Definition (tight and mutually agreed):
• Area of forest (ha) within protected buffers adjacent to perennial streams and water bodies
Approaches to measurement (details of units etc):
• If stream lengths (in km) are known then riparian area can easily be calculated for a standard 5m buffer. It is 1ha per km of stream.
Comments:
• NZFOA Environmental Code of Practise states riparians should be at least 5m for all perennial streams. • The calculation can be done nationally for average riparian widths using the LCDB3 national coverage, NIWAs REC layer and a GIS system. • As the national forest area is stable the area is unlikely to show large year to year shifts so frequency of collection of this indicator may not need to be annual. • The estimate of riparian area from LCDB is likely to be an underestimate as often buffer areas are defined by changes in land units. An evaluation of the potential under reporting will be investigated through case studies.
References/links:
• NZ FOA ECoP. (http://www.nzfoa.org.nz/file-libraries-a-resources/cat_view/27-codes-of-practice)
Software/Systems comments:

Title: Forestry's contribution to local economies
Rationale (why do we need it):
• Forestry's community benefit is often unknown and unrecognised and there is no source of information on the contribution of forestry to local economies apart from national employment statistics. • Forestry contributes to local economies in a variety of ways – direct and indirect employment, expenditure through local businesses, investment in local infrastructure such as public roads
Definition (tight and mutually agreed): Will need more development
• Annual expenditure on direct and indirect employment, expenditure through local businesses, capital investment in infrastructure.
Approaches to measurement (details of units etc):
• Dollars by category
Comments:
• This could be quite a broad and far reaching indicator or series of sub indicators. Needs more thinking to refine the definition.
References/links:
• MP indicator 6.3.e •
Software/Systems comments:

Appendix 4. Portal interface design questionnaire

Preamble:

We are undertaking a project to design a web based information portal for New Zealand's planted forests.

The idea is to develop a one stop shop for information that gives a clear view of all aspects of our planted forests – covering a wide range of economic, environmental and social indicators.

Information will be drawn from a wide range of sources and the idea of the portal is to present it in easy-to-understand form that is useable by a wide range of interested parties.

Currently our concept is for a portal that presents regularly updated trend data on forestry indicators, with supporting information on topical issues related to our planted forests and a range of links to other sources of information.

The following questionnaire will help us in the design of the interface and the content of the portal.

Questions:

1. Information sources: where do you currently go for information on New Zealand's planted forests?
    a. 5 Free form boxes
    and comment

2. Do these sources meet your needs?
    a. Comment

3. Portal Interface: What would you like on the portal?
    a. Trend data for indicators
    b. Background supporting information
    c. Relevant web links
    d. A summary statement of current state of the planted forests
    e. Other – please suggest

4. Portal Interface: How would you like the portal laid out
    a. Theme specific entry points (e.g. biodiversity, economics, safety)
    b. Indicator/data specific entry points (e.g. area of forest affected by fire)

5. Portal interaction: How would you like to interact with the portal
    a. Download raw data
    b. Download trend data
    c. Download graphs or other summary information
    d. Upload information yourself
    e. Use it as a discussion site
    f. Other – please suggest

6. Background supporting information. What format would you like?
    a. Concise fact sheets
    b. In depth reports
    c. Scientific journal references
    d. Videos
    e. Web links to relevant topics
    f. Other - please suggest

7. Supporting information on planted forests – what topics should be covered?
    a. Impact of forestry on water
    b. Effect of tree crops on soil nutrients
    c. Forestry and communities
    d. Environmental impacts of harvesting
    e. Biodiversity in planted forests
    f. Forest productivity
    g. Effects of climate change on planted forests
    h. Environmental impacts of chemicals used in forests
    i. Monocultures

k. Silvicultural regimes
l. Safety in forestry
m. Carbon forestry
n. Other – please suggest

8. Supporting information. What web links would you like
    a. NZ Forestry Facts and Figures pdf
    b. Forestry Insights
    c. Environmental Code of Practise
    d. Principles of Sustainable Forest Management
    e. The Forestry Accord (Original and Climate Change)
    f. Radiata Pine Growers manual
    g. NZFOA roading manual
    h. Rare and Endangered species web site
    i. Forest Stewardship Council
    j. Convention on Biological Diversity
    k. Montreal Process
    l. Global Forest Resource Assessment
    m. Other – please suggest

9. A bit about you: What is your professional affiliation
    a. Forestry sector
    b. Regional Government Agency
    c. Territorial Authority
    d. National Policy Agency
    e. Environmental Non-Government Organisation
    f. Education and Training sector
    g. Research Institution, University or Polytechnic
    h. Other – please identify

10. A bit about you: where are you located?
    a. Country drop down box

11. Any other comments
    a. Free form box

12. Would you like to trial our portal prototype? If so please enter your email address
    a.

Mail to:
NZIF news, Friday Offcuts, FFR members, NZARM, MPI, MfE, MBIE, NZTE, FSC Bonn, NZFOA members, NZFFA, encourage forwarding