ENVIRONMENT & SOCIAL TECHNICAL NOTE

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Indicators of Sustainable Forestry: Prioritising Further Research

Summary

Demonstrating sustainable forestry requires a multifaceted approach to develop the links between scientific knowledge and stakeholder values. A number of research efforts are attempting to contribute to the understanding of this complex combination of technical and social issues.

A survey of district plans found significant variation in the way that the values of plantation forestry were interpreted under the Resource Management Act, which has as its core purpose the sustainable management of the New Zealand environment. Two series of workshops were held across New Zealand to understand what the concept of sustainable forestry signifies to different forest stakeholders. A number of international instruments provide benchmarks for forest sustainability, and highlight international trends toward achieving multiple benefits from forests and for multifunctional forestry. Finally, a risk assessment of one of these international instruments, the Montreal Process (MP), highlights that while the large majority of MP indicators are of lower risk, some show high risk characteristics and may be considered higher priority for future indicator research.

While further work seems advisable to refine the strategy for the research on indicators of sustainable forestry, some priorities are starting to emerge. A proposal for biodiversity indicator research is introduced.

B Hock
Scion

Introduction

Forest owners and managers in New Zealand face a number of challenges in moving towards sustainability. Society is increasingly aware of environmental quality and global and local risk, and requires verification that forestry practices in New Zealand are sustainable. Demonstrating sustainable forestry is achieved through a number of national and international drivers and definitions; the focus of this report is on a number of recent initiatives at Scion to develop the understanding of where further research could be most valuable.

Four investigations are covered in this report:

- a survey of district and council plans;
- a series of workshops with community and forest management stakeholders;
- a review of international drivers; and
- a risk assessment of an international framework for sustainable forests.

District and Council Plans

Within New Zealand, the Resource Management Act (RMA) has been a major factor in the development of sustainable forestry. The RMA has as its primary purpose the sustainable management of natural and physical resources implemented through an effects-based regulatory process (Brown & Swaffield, 2009). Key RMA instruments include the operative plans of the Territorial Local Authorities (TLAs) across New Zealand. Understanding the way that the sustainable management of exotic forest plantations is being interpreted in these plans develops an insight into how sustainable forestry is valued by TLAs.

The district plans of 12 TLAs with significant land areas in exotic plantation forestry were analysed together with interviews of resource planners responsible for forestry in each TLA (Brown, 2009). A summary of this work and its findings is given in the FFR Environment and Social Technical Note by Brown & Swaffield (2009); of note is that significant variation was found in the way that different plans have interpreted the values of plantation forestry in regard to the purpose of the Act. Of relevance to this report is the importance of research for the improved understanding of what constitutes the sustainable management of exotic forests, and support for the development of consistency.

Workshops

Sustainability can have subtly different meanings to different groups of people. In order to demonstrate sustainable forestry, the understanding of what the concept signifies to the different forest stakeholders needs to be developed. Two series of workshops were held mid 2009 in seven locations across New

Zealand. One was undertaken with forest industry and management authorities, the other with forest user groups such as hunters and mountain bikers. The purpose of the workshops was to generate community level input on the indicators of sustainable forestry. The results are being processed and will be published shortly.

International Drivers

New Zealand's activities within the international arena are subjected to international requirements and drivers, whether they are commercially or non-commercially oriented, and whether obligatory or voluntary. These requirements and drivers have the potential to impact on the country's status in international forums and on the ability of its forest sector to access international markets. Table 1 summarises the key international frameworks that currently apply in New Zealand using the classification from McDermott *et al*., (2007).

These frameworks provide the structures by which sustainable forestry claims are critiqued, though they may not specify the particulars of measuring and monitoring. For example, the Montreal Process provides the framework for implementing measures towards sustainable forest management at the national level (MAF, 2009a). An example criteria and indicator set from this framework is (MAF, 2009b):

- Criterion 2: Maintenance of productive capacity of forest ecosystems
- Indicator 2.c: Area, percent, and growing stock of plantations of native and exotic species.

Table 1: Forest-related frameworks currently active in New Zealand

Framework	Description
Global, legally-binding instruments	
Convention on Biodiversity (CBD)	Biodiversity responses
United Nations Framework Convention on Climate Change (UNFCCC) including the Kyoto Protocol	Climate change responses
World Trade Organisation (WTO)	Trade related
Global, non-legally-binding instruments	
United Nations Forum on Forests (UNFF)	Programmes toward sustainable forestry
Food and Agricultural Organisation (FAO) including the Global Forest Resource Assessment (GFRA)	Reporting of forest statistics
International Tropical Timber Organisation (ITTO)	Regulatory e.g. illegal logging
Criteria and indicator processes for forest management	
Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process)	Reporting on sustainability of forests
International forest certification systems	
The Forest Stewardship Council (FSC)	Certification of individual forests as well managed
Green Building Council	Certifies buildings including timber used

A key theme emerging internationally is the growing recognition of the multiple benefits of forests, including sequestration of carbon, supporting well-being and providing conservation and eco-system services, as well as the economic benefits. Multifunctional forestry is considered of fundamental importance (e.g. EU, 2006). International research and development addressing these themes provides the benchmarks for New Zealand's reporting of sustainable forest practices.

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Risk Assessment

Indicators of sustainability attempt to measure a range of complex ecological and socio-economic functions based on current knowledge and capacity. Hence the quality of information is variable, ranging from high through to low (MAF, 2009b). This poses a risk to factors affected by sustainability and its reporting, for example to international trading, and the wellbeing of communities and tourism. An example of risk in international reporting was the estimated carbon emissions and sequestrations profit of $1,100 million at the time New Zealand decided to enter the Kyoto Protocol. Later calculations revealed that New Zealand had a potential deficit of up to $482 million[1] – a significant impact.

Assessing risk is a systematic approach for examining the potential of problematic or unexpected results. Such assessments help focus on where the significant risks are most likely to be found.

A risk assessment considers the combination of the likelihood of errors in the indicators, and the impact that such errors could have (NSP, 2008). Both likelihood and impact often cannot be estimated from historical data because of issues such as the lack of comparable data, the inability to quantify what data exists, or the unreliability of historical data. In these cases, expert knowledge becomes an important source of information.

Method

Contributors to New Zealand's Montreal Process reports were surveyed to determine the likely error level of each of the 64 indicators of the Montreal Process and the potential seriousness of such an error (the impact). The error levels explored were 1%, 10%, 25%, 50% and 100%, while the potential impact was categorised as negligible, small, substantial, serious or very serious. Given the very different data sources available for the indigenous and planted forests within New Zealand, responses were allowed to be specific to a particular forest type.

Results

The fully interpreted results of the survey are shown in Figure 1. Most indicators can be seen to be in the low to mid range, i.e., it was considered that there is a potential for a low to moderate error, but the detection of such an error is not considered disastrous. Twelve indicators (Table 2) were considered to be high risk, with only three at the highest risk level, though this was not consistent across all respondents, and some respondents had no high risks identified.

Also of interest is that even the risk of a low error in an indicator is considered to have the potential for a high impact, for example indicator 5.b, "Total forest product carbon pools and fluxes". Conversely for some indicators, even a high error is considered to have the potential of only a very low impact, as for indicator 6.4.b "Number, type, and geographic distribution of visits attributed to recreation and tourism and related to facilities available".

Discussion

Risk assessments help with prioritising where further research efforts are likely to have the highest value. Developing better measurements for an indicator assists in reducing the likelihood of a substantial error, and the expectation is that, aligned with an error reduction, there will also be a reduction in the potential impact.

The high risk indicators were considered to have the highest priority for further consideration, followed by those with the potential of high impact even at low error levels.

[1] http://theyworkforyou.co.nz/portfolios/climate_change/2008/may/15/kyoto_protocol

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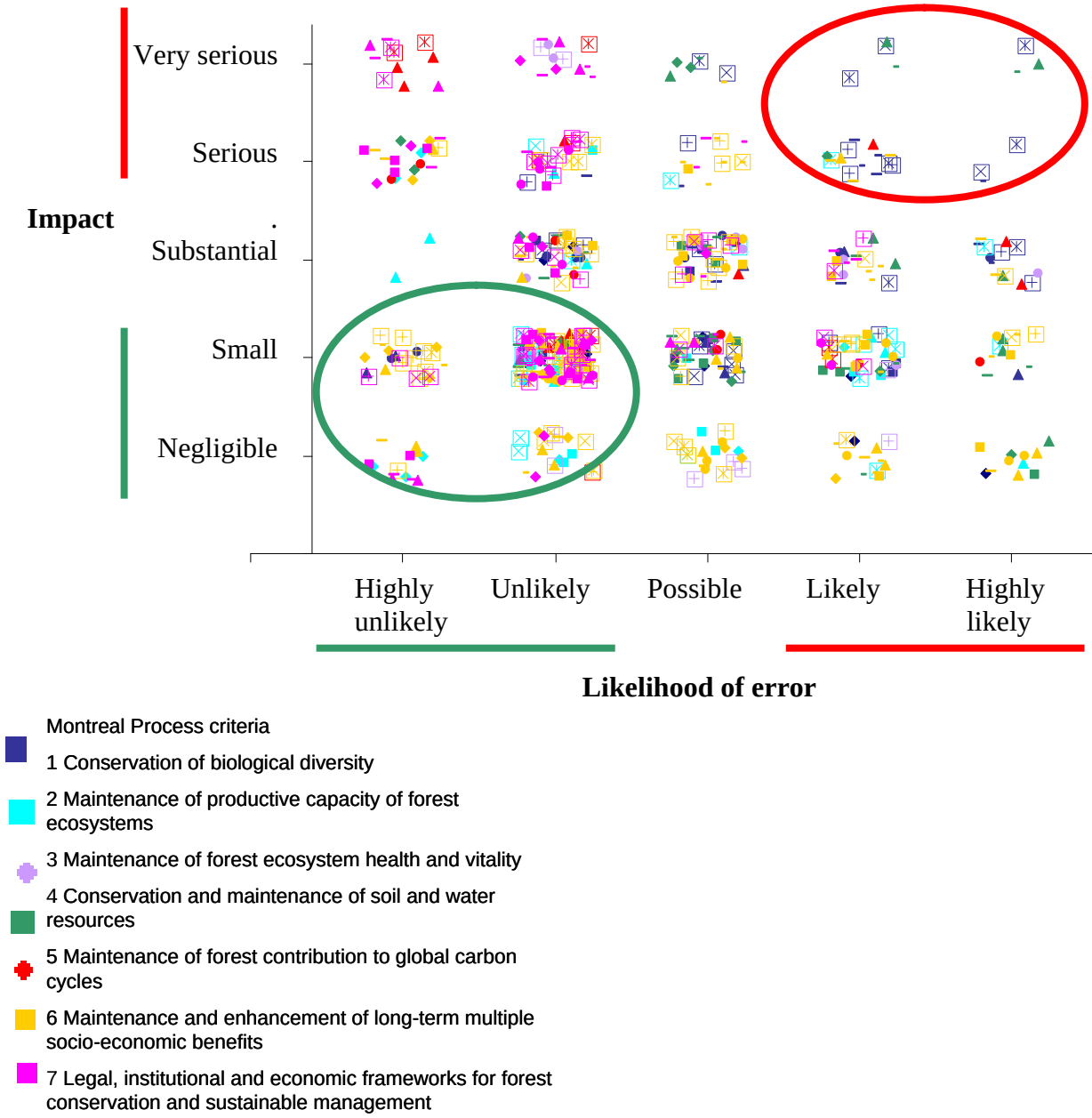

Figure 1: Risk assessment for Montreal Process indicators (green circle and line highlights indicate low risk while red ones indicate high risk; the indicator risks within the graph are coloured to match their respective Montreal Process criteria).

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Table 2: Indicators considered high risk by at least one respondent

MP id	Indicator	Contributory cause
	Forest ecosystem / Biodiversity	
1.2.a	Number of native forest-associated species	Monitoring is not extensive and exhaustive; many introduced pests threaten native species
1.2.b	Number and status of native forest-associated species at risk, as determined by legislation or scientific assessment	As for 1.2.a
1.3.a	Number and geographic distribution of forest-associated species at risk of losing genetic variation and locally adapted genotypes	Much unknown regarding the genetics of native vegetation
1.3.b	Population levels of selected representative forest-associated species to describe genetic diversity	Many unknowns regarding the genetic variation of native vegetation
	Maintaining productive capacity	
2.e	Annual harvest of non-wood forest products	Knowledge intermittent; diverse stakeholders affected if not sustainable
	Soil and water resources	
4.1.a	Area and percent of forest whose designation or land management focus is the protection of soil or water resources	This is not a formal definition in NZ, hence subject to interpretation
4.2.a	Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources	Statutory soil management is activity-focused, e.g., harvesting; soil indicators are under development within NZ
4.2.b	Area and percent of forest land with significant soil degradation	No systematic inventory; monitoring occurs for specific actions such as harvest only. See also 4.2.a
4.3.a	Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water-related resources	National level data are under development
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	Reference conditions not known, subject to interpretation and knowledge development; lack of systematic national sampling
	Socio-economic well-being	
6.1.c	Revenue from forest-based environmental services	The eco-system service market is still novel in NZ; the development is still under the influence of many drivers
6.3.d	Area and percent of forests used for subsistence purposes	Little or no data known

Conclusion

Demonstrating sustainable forestry is a complex theme that marries scientific knowledge on measurements with concepts and values, while being both internationally defendable and locally (regionally) relevant. Within New Zealand there is a growing understanding of the science of measuring sustainability (e.g., Jones *et al*., 2009), and of sustainability concepts (e.g., MAF, 2009b) and values (e.g., the workshops described above). However much work is still required on the development of the links between these themes. The additional research planned includes a workshop on forestry indicators. This will be open to key stakeholders, especially the forest industry.

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These investigations will also be useful for further refining indicator research priorities. Meanwhile, results to date include support for developing a better understanding of the presence and importance of biodiversity in plantations.

Biodiversity Indicator Research (by Steve Pawson)

Habitat or structural-based indicators are common and more feasible than taxonomically exhaustive species-based indicators for biodiversity. Structural indicators can be further separated on spatial scale, with at one end the stand scale, for example species mixtures, stand ages, stocking, pruning, coarse woody debris; and, at the other, the preservation of biological legacies such as big, old, live or dead trees within stands. These indicators can also be used at the landscape scale, for example the spatial arrangement of stand ages, and the proximity to and proportion of native forest within the landscape (Brockerhoff *et al*., 2008). A key characteristic of structural-based indicators is that they need to be validated against solid biodiversity data (Humphrey *et al*., 1999).

An interesting development internationally relates stand and understorey structure to insect diversity (e.g. Gollan *et al*., 2008). Developing a correlation between, for example, LiDAR parameters of tree and understorey structure and associated biodiversity, allows stand and landscape level structural indicators to act as surrogates for biodiversity. Planning is under way to have LiDAR flown on Kyoto plantation plots, presenting a favourable opportunity for investigating the structural indicator approach at greatly reduced costs. Further enquiries regarding this possibility are being pursued.

Acknowledgements

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