Theme

Perspectives on Forests and Climate Change in New Zealand

Tim Payn*, Harley Spence2, Tim Barnard1, Peter Clinton3, Paul Charteris1

Abstract

A series of workshops, interviews and an electronic survey were undertaken to understand the level of awareness and understanding of the NZ plantation forestry sector to the potential impacts of climate change and possible mitigation and adaptation approaches to combat those climate change impacts. Level of awareness and understanding of forests and climate change was good across the sample population, though it was suspected the wider forest sector as a whole could have lower levels of awareness. Climate change impacts of most concern appeared to be related to the negative impacts of increasingly frequent extreme climatic events, impacts on forest productivity of changed temperature and rainfall, and increased pest and disease outbreaks. Global and national policies were also seen to be an impact on forestry as a result of climate change. Current mitigation and adaptation activities in New Zealand are very limited but are expected to increase as greater knowledge on the quantification of impacts and their risks is developed through further research. The dominant mitigation topic identified was forests for carbon sequestration, but it was recognised that uncertainty around policy had slowed the development of new carbon forests to date. Development of fossil fuel replacement technologies or widespread use of forests to mitigate climate impacts on land other than forest were identified but seen as some way in the future. As impacts are more clearly understood there will be a need to translate response to the impacts into an adaptation strategy and this will be a logical step towards changed forestry systems that can minimise adverse effects or take advantage of opportunities such as energy or carbon forestry.

Introduction

In 2007 the Government announced the Sustainable Land Management and Climate Change (SLMACC) Plan of Action. This was an initiative to address climate change impacts, adaptation, and mitigation technologies for the primary sector. Working groups were set up to establish a programme of work to support the plan of action. One of these was the Research, Innovation and Technology Transfer Working Group (RITWG) and as part of this a knowledge and technology transfer strategic plan was developed. This plan identified the need to focus on climate change awareness, understanding, decision making and implementation of new management practices across the primary sector.

As part of the plan we carried out a study within the forestry sector to gauge levels of knowledge and concern about climate change and perspectives on potential impacts and opportunities that may exist from climate change and possible adaptation approaches that could be developed. The findings from the study are being used to develop research and technology transfer activities that address forest sector needs.

A series of workshops and interviews were held in Rotorua, Auckland, and Nelson with stakeholders to explore the topic of Forests and Climate Change. Participants were asked questions based around three main topics: (i) level of awareness and concern with climate change, (ii) current and future impacts of climate change on forests, (iii) practices and technologies available currently and required in the future to adapt to climate change.

To widen the engagement a web based questionnaire was developed and launched through INNOVATEC’s ‘Friday Offcuts’ (www.fridayoffcuts.com) and the New Zealand Institute of Forestry’s (www.nzif.org) weekly electronic newsletters to reach a target audience of around 5500 subscribers. Questions focussed on climate change awareness (current and future impacts), current mitigation and adaptation activities or technologies, and information or knowledge gaps and areas of specific interest from a technology transfer perspective.

Current state of knowledge and awareness

The workshops, questionnaire (166 responses) and other interactions provided a wealth of information to develop an understanding of climate change awareness. Early on in the project it was hard to define what level of understanding there was of climate change and the importance the forest sector attributed to it as a potential factor affecting their forests. Our initial feeling was that the level of importance of climate change was low compared to other more pressing issues such as economic returns and more recently the global financial crisis, but that

1 Scion, Rotorua
2 Coastline Consultants, Rotorua
3 Scion, Christchurch
* tim-payn@scionresearch.com
understanding was reasonable.

Results from the questionnaire indicated this latter point was true with 66% of respondents reporting a ‘good’ or above knowledge level of the potential effects of climate change on our forests (Figure 1). However, our hypothesis of a low level of importance was not the case. Climate change rated highest in terms of priority over other global drivers that can affect forests - energy, the financial crisis, water resources and pollution respectively (Figure 2).

When asked when they thought climate change would affect New Zealand’s forests, 10, 20 or 30 years was a common response, given by 15, 20 and 15% of the survey respondents, respectively (Figure 3). However a large portion (35%) thought that climate change would impact New Zealand’s forests in over 100 years. This response may to some degree reflect the view from a number of the questionnaire respondents who added comments at the end of the survey indicating they believed climate change was not real and makes these responses somewhat hard to interpret. Conversely when asked whether respondents believed climate change was affecting NZ forests now 57% agreed.

Climate Change Impacts and Risks to New Zealand’s forests

When asked “What the major impacts of climate change that could affect New Zealand’s forests?” a number of themes emerged – physical damage, forest establishment difficulties, changes in what forests are used for, changes in biosecurity risk, and economic, political, and policy impacts.

Most noted the negative effects leading to physical damage of forests. Most frequently, an increased number of more extreme storms leading to damage such as wind throw, snow damage, break outs, toppling, erosion and slips. Changes in temperature and rainfall were thought likely to lead to droughts, water shortages and associated increases in the intensity and extent of fire risk and damage.

Some suggested that species establishment and growth rates could be affected by changes in rainfall and temperature. In addition, weed species may increase their growth rate and have a wider distribution. Similar biosecurity risks were seen for pests and diseases that many thought could establish and/or spread at a faster rate in a future warmer climate. As a result, the future location of forests and choice of plantation species may have to change.

There were three key ideas within the responses about how forest use may change in relation to climate change. These were that more planting would occur for erosion control purposes, for carbon sequestration, and for bioenergy and other materials. Respondents suggested that there may also be a change in silviculture to provide a different mix of wood versus carbon and rotations may be lengthened. Respondents also noted that there would be an increase in the research and development of alternative energy and uses for wood and forests and that forests may become

![Figure 1. Knowledge level of potential impacts of climate change on NZ’s forests](image)

![Figure 2. Level of concern of respondents to five global drivers affecting forests (Y axis highest score = highest concern)](image)

![Figure 3. When do you consider climate change will affect New Zealand’s forests? (percent of respondents by time step)](image)
more multiple-use rather than largely monoculture single use as they are now.

The word cloud (www.wordle.com) in Figure 4 shows the most common words contained in transcripts from the interviews and workshops related to climate change impacts. Words used more frequently are in a larger font. These word clouds help to highlight some of the issues that respondents thought were important.

While most concern centred around biophysical impacts of climate change there was a view that policies formulated around climate change at both a national and global scale will affect the NZ forestry industry and NZ landscape in general. Respondents gave a range of potential positive or negative impacts from policies such as the Emissions Trading Scheme (ETS). Respondents noted that the economic buoyancy (or otherwise) of the forestry sector will be influenced by these policies and that carbon credit accounting may stimulate the forestry sector and change the type of investors and investment regimes available.

Mitigation of climate change impacts

Around 15% of respondents thought that New Zealand forests would not play any role in mitigating climate change or would have a minimal role. Some viewed current global warming is part of a natural cycle, while others stated that New Zealand forests are too small on a global scale to have any role. The remaining 85% of respondents provided examples of how they thought our forests could mitigate climate change impacts. Three key themes emerged: carbon storage - sequestration or offsetting; forests as alternatives to fossil fuels and for product substitution; and environmental benefits of forests.

When asked what forest related activities they are involved with or are aware of that are being undertaken to either mitigate or adapt to climate change (Figure 5), the majority cited economic schemes such as carbon forestry and carbon trading to offset atmospheric CO₂ levels. Also cited were changes in planting rationale, including increased tree planting on marginal land and a move away from traditional timber production forestry, towards carbon sequestration. This may include the introduction of longer rotation species such as redwoods and Douglas-fir.

Management practices and decisions to mitigate climate change included maintaining existing forests (indigenous and plantation) acting as carbon sinks as well as expanding planting to increase carbon sequestration potential. Some respondents noted that forests need to be managed and restored to maximize carbon sequestration e.g. carrying out pest control in indigenous forests. Some respondents also noted that management of plantation forests needs to be realistic in that there still needs to be profitable and timely harvest.

Key points related to the second theme were: to reduce the reliance on fossil fuels by developing and using biofuels; to substitute all or part of the components of materials such as plastics with forest fibre and residues; to replace or reduce the use of high energy use materials such as steel and concrete with wood; and to develop the domestic wood industry to both decrease transport emissions (from export), substitute NZ wood for that harvested from old rainforests and to store carbon onshore. One of the issues raised was that the development of technologies particularly for biofuels and alternative materials is in a stage of infancy and there will be a long delay before products become part of the domestic market.

Key points related to the wider environmental benefits of forests focussed mainly on stabilisation of high risk erosion prone sites by, for example, stabilizing soil, improving surface water run-off and maintaining water quality; and that planting new forests in erodible catchments would provide these benefits thereby retaining carbon in the soil and increasing the carbon store in the trees.
Adaptation

It has been said for agriculture and is also true for forestry that the vast majority of adaptation mechanisms will be business as usual, or good forestry practise. This was reflected in the adaptation mechanisms or technologies identified in the workshops and questionnaire. Nothing really outside the bounds of standard forest practises.

Adaptation mechanisms or technologies identified included: species for new climates, drought tolerant genotypes, silviculture and wind, species and silviculture effect to minimise fire risk and impact, pest and disease resistant genotypes, mechanisation of silvicultural systems, mechanisation – human factors, species selection and breeding, bioenergy systems, silviculture and product quality, silviculture and water yield, human factors, forest establishment, land stewardship, new and diverse forest products (ecosystem services), and forest business systems.

Planning and mitigation for extreme weather events was seen as one of the top priorities for adaptation responses. Responses fell into three themes: that managers consider relocating or not planting production forests in areas likely to be exposed to extreme weather events; that managers are prepared for likely risks such as fire and wind damage; and that the hydrological impacts of weather events be monitored to provide information about best practice for future planting and thinning regimes.

Many respondents thought that management regimes could be improved to include a greater variety of species to meet a range of outcomes including carbon sequestration. These species may be planted in a dual role of carbon sequestration and also for biomaterials/energy production. Some noted that in addition to carbon sequestration, planting native species would help maintain or increase biodiversity in natural areas. Respondents also noted that breeding and planting programs could be improved to make sure the best seedlings are planted in the best sites and that site assessment becomes more influential in planned breeding programs.

A number of respondents commented that forestry in New Zealand needs to move towards continuous canopy forest cover regimes with more selective logging and encouraging greater age distribution and species diversity in an effort to become more sustainable. Respondents had varied views on rotation lengths with some noting that increased rotation times would provide more carbon sequestration and better wood characteristics. Others countered that shorter rotation times may be better for responding to and meeting market demand.

However in addition to these mechanisms a number of respondents raised issues with the way the New Zealand forestry industry and government structures are set up and managed. Frequent comments were made that the forestry industry is focused on short-term financial gain and owned and run largely by investors, many of whom are overseas. There needs to be better and focused leadership and support for New Zealand forestry from government and those forests need to be managed for a range of uses. Some went a step further and recommended an overhaul for the entire industry and government structure for forestry and that this should be directed towards a long term sustainable forest management regime for both plantation and native forests.

The majority of comments noted the need for clear financial incentives or the removal of disincentives to plant forests, or to manage forests differently (i.e. for added value of ecological and social benefit). Respondents stated that the incentives were needed to achieve realistic and practical outcomes on the ground. Some noted the importance of having financial incentives to attract the ‘right’ people into forestry careers and to provide training within the industry about the financial opportunities from the ETS.

Opportunities

When asked what the most important opportunities for forestry are that could result from climate change, the dominant response was new revenue streams via carbon credits which would also lead to other beneficial outcomes such as being able to leave trees standing or plant trees on marginal lands and capture associated ecosystem services. Respondents noted that we may capture a larger slice of international markets for certified, sustainable carbon forests. This focus on carbon was reflected very strongly in the Wordle analysis (Figure 6)

Figure 6: Most frequently used words associated with opportunities for forestry that could result from climate change
Theme

One of the opportunities noted by many respondents was the potential greater demand for wood and wood derived products if governments both internationally and nationally decide to lower emissions associated with climate change and make renewable energy resources a priority. The impact would be to create markets for more sustainable products, substituting for other products such as plastic steel and concrete and in turn increasing sector profitability.

Constraints

Survey respondents were asked to identify the most important constraints for forestry production that could result from climate change. Three themes emerged: political, environmental, and economic constraints. Most issues revolved around land use, constraints imposed by the carbon economy, and Government legislation. There were a number of issues raised with respect to the ETS. Namely, uncertainty, discouraging or over-complex policy, more regulation, more paper work, lack of encouragement (i.e. ‘rewards’ for forestry investment such as a proposed cap on carbon credits) and funding (e.g. for research about potential impacts).

Many respondents noted that the impacts of climate change would mean that land use may change with some areas being less suitable for forestry and planting or harvesting operations in some areas may be further constrained by legislation.

A wide and detailed range of comments were made about the impacts and implication of national and international policy. Themes related to uncertainty for the industry, lack of equity between industries (particularly agriculture), the impact of energy price rises and changes to ownership rights for production forests. In addition, the respondents recognised the potential political implications of the public perception of the industry.

Implications for the Forestry Sector

Overall we now have a clearer view of the state of knowledge and level of concern within the forest sector in New Zealand and some good indications of needs for adaptation strategies. Generally the level of understanding of the potential impacts of climate change and the opportunities to use forests for mitigation is good, though it must be noted the number of respondents to the questionnaire was low and the workshop/interview participants were probably at the more knowledgeable end of the spectrum. With this in mind we had also canvassed participants on their need for more information on a range of identified topics. All respondents identified the need for more information – the topics of most interest were forests for bioenergy, forest productivity, carbon forestry and pests and diseases (Figure 7). A number of studies have been done under MAF’s Plan of Action since 2008 (MAF 2012a) for example on potential forest impacts (Watt et al, 2008), and on carbon tools (Meason et al. 2011) and MAF have developed some fact sheets and case studies (MAF 2012b) on forests and climate change. However information flow must be an ongoing effort, as part of a forests and climate change technology transfer strategy (Payn et al 2009). Since this project was completed Scion has launched a webinar series on forests and climate change covering most of the topics identified in Figure 7 (http://www.youtube.com/playlist?list=PL49392A4D17B5774C&feature=plcp) and is developing resources to aid understanding of the impacts of climate on forests (e.g. http://www.scionresearch.com/_data/assets/pdf_file/0020/37343/Climate-Change-poster-March2012.pdf).

There is currently little activity relating to mitigation of climate change impacts either through the use of forests for mitigation, or mitigation activities to reduce the sector’s own emissions profile. This is probably due to the great uncertainties surrounding the ETS in recent years and it is likely that as this uncertainty decreases the amount of carbon forestry will increase. Similarly as the sector better understands its carbon footprint mitigation responses will be developed. Some work has been done on forest sector footprinting that can act as a foundation for this (McCallum 2009).

Currently there is no adaptation strategy in place for the forest sector, though the Technology Transfer Working Group coordinated by MAF has made recommendations that such strategies be developed for the primary sectors to reduce risks from climate change (R. Dale pers comm. 2010). Current activity reflects the position of the sector in MAF’s identified continuum of activities (climate change awareness, understanding, decision making, and implementation of changed behaviours) with reasonable awareness,
increasing understanding and knowledge but as yet limited responses. Development of a set of adaptation strategies for forestry based on current knowledge and potential climate scenarios is currently underway.

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About the Author

Tim Payn has a first degree in soil science and chemistry from Bangor in Wales and a Ph.D in Forestry from Canterbury on the magnesium nutrition of Pinus radiata. His Ph.D was sponsored by Tasman Forestry, FRI, the New Zealand Forest Site Management Cooperative, and the University of Canterbury. Since completing his Ph.D he has worked at Scion, where he is currently a Principal Scientist. He has worked on a wide range of research projects such as developing nutrition decision support systems, spatial modelling of forest productivity as related to the environment, the development of criteria and indicators of sustainable forest management, and helped establish FSC certification activities within New Zealand. He has developed and led a number of environmental forestry related research programmes over the years and since 2008 has been closely involved with climate change related activities in New Zealand. He is a member of MAF’s Research Innovation and Technology Transfer Working Group, and is a committee member of the New Zealand Climate Change Centre. In 2009 with colleagues from France, Portugal, the UK, and Australia he established a four year collaborative programme ‘TRANZFOR – forests and climate change’ to encourage science exchanges between Europe and New Zealand and Australia. To date more than 50 exchanges have occurred. He is a full member of the NZIF and has been involved since he was a student.