Wood availability forecasting in New Zealand Meeting the challenges

Bruce Manley and Paul Lane

Abstract

Forecasts of wood availability from New Zealand plantations have been undertaken regularly since 1969. The latest round, completed in 2010, differs in approach from previous forecasts in terms of model structure, adjustment to data and constraints. Large-scale owners were differentiated from small-scale owners with the area of the latter reduced by 15 per cent. Yield tables were calibrated using harvest intentions of large-scale owners. Four different yield regulation strategies were modelled including a scenario in which yield was required to be non-declining only for the current rotation. This matches the non-normal age-class distribution of the small-scale owners' forest estate – a consequence of large areas of afforestation in the 1990s. Plans are under way for the next forecasting exercise. A similar approach to the 2010 forecasts is likely to be adopted, but with an effort to verify areas and yields for the small-scale estate. Forecasts are of physical wood availability – a separate analysis of the economic wood availability may be undertaken to complement these forecasts.

Introduction

Wood supply forecasting has been a feature of New Zealand forestry. For example, the 1913 Royal Commission on Forestry, in addressing how future timber demand would be met, forecast the future supply from both existing plantations and assumed afforestation.

Since 1969, forecasts of the potential wood supply from New Zealand's plantation estate have been made on a regular basis. Table 1 lists the national wood supply modelling exercises carried out since the first comprehensive National Forestry Planning Model was prepared for the 1969 Forestry Development Conference. The last forecasts were completed in 2010 (MAF 2010). Forecasts were released on a regional basis between 2006 and 2009 with a national collation released in 2010.

Year	Exercise
1969	National Forestry Planning Model
1972	National Forestry Planning Model
1977	National Forestry Planning Model
1981	National Forestry Planning Model for New Zealand Forestry Conference
1986	National Forestry Planning Model
1991	NZ Forest Industries Council
1992	NEFD National & Regional Wood Supply Forecasts
1996	NEFD National & Regional Wood Supply Forecasts
2000	NEFD National & Regional Wood Supply Forecasts
2010	NEFD National & Regional Wood Availability Forecasts

Table 1: National wood supply modelling exercises carried out in New Zealand

The motivation for these forecasts has been the substantial afforestation rate, at least until 2005, which has resulted in an expanding plantation estate. There has been widespread interest in the potential wood supply that will result from the expansion. Users of the forecasts have included –

- Forest products companies assessing the feasibility of new wood processing plants
- Agencies planning infrastructure development such as ports, railways, roads, energy, labour and harvesting capacity
- The government looking at the probable contribution and effect of forestry on the national economy.

This paper –

- Reviews previous wood availability forecasting exercises in New Zealand
- Outlines some of the challenges faced in national wood availability forecasting, and describes what was done in the last forecasting exercise to deal with these challenges
- Previews the next forecasting exercise scheduled to begin in 2014.

Previous wood availability forecasting exercises

A similar approach was taken for both the 1969 and 1972 National Forestry Planning Models (Familton 1969; Hosking 1972). Area information was obtained by a survey of forest owners with over 400 hectares, yield tables were developed for each region, and management regimes including rotation age known to be current practice were used in simulations of wood production from plantations. These were prepared on a planning district basis and included new land planting of 18,000 hectares a year as a base case, with a variation of 24,000 hectares a year. The 1969 model was based on area as at 31 March 1966 of 361,000 hectares, while the 1972 model used area estimates as at 31 March 1971 of 486,000 hectares.

The 1972 forecasts are higher than the 1969 forecasts as shown in Figure 1. 'Increases in productive resources have been caused not only by new planting but also by a reappraisal of the merchantability of existing stands in the light of developments in industrial processing and trade. Considerable areas of species, particularly in State forests, are now considered productive' (Hosking 1972). Certainly the 1972 forecast proved to be more accurate.

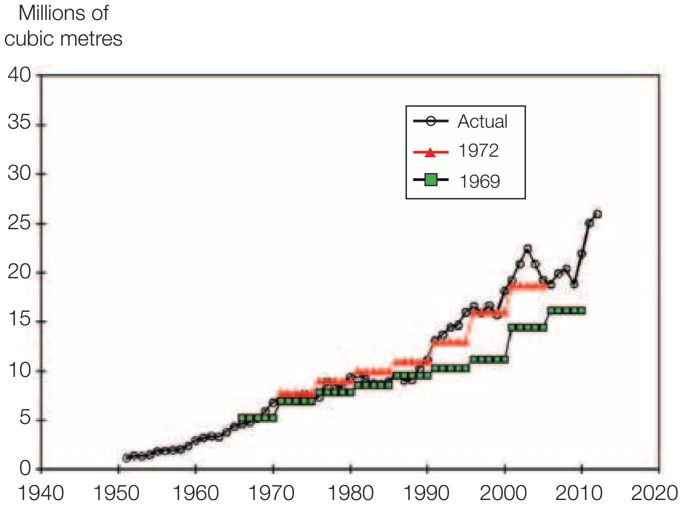

Figure 1: Forecast harvest volumes for all plantation species combined from 1969 and 1972 National Forestry Planning Models compared to actual, i.e. MPI estimated roundwood removals

For the 1977 model (Levack 1979), supply forecasts were prepared for each of 16 planning districts. As for the 1969 and 1972 exercises, all major forest owners were surveyed for their current plantation area and their future intentions for harvesting and new planting. Plantations in each region were subdivided into broad crop-types, each consisting of stands of the same species and ownership, grown with a similar silviculture on sites of similar productivity. A crop-type is an aggregation of stands which may differ in age and time of harvest, but are regarded as identical for the purposes of a particular exercise with respect to silviculture, yields, costs and revenues.

A yield table, giving volume per hectare, was developed for each of the resulting 140 crop-types. From the age-class distribution and yield table a harvest schedule was calculated for each crop-type, generally on the basis of a fixed clear felling age. These crop-type harvest schedules were summed to give regional and national wood supply projections.

Elliott and Levack (1981) note that as the single national supply scenario 'was derived manually using the tabular stand projection of 140 crop-types, it represented a massive effort. The facility to explore alternative supply options was extremely constrained by this limitation'. Elliott (1979) discusses the tedious and time-consuming nature of the manual preparation of cutting plans. He gives the example of one week's calculation being required for a single regional strategy and quotes a planning forester who 'likened the process to building a brick wall without mortar. Each time the wall is finished, someone kicks away the bottom brick and the whole process has to be repeated'.

For the 1981 National Forestry Planning Model (Elliott and Levack 1981) an early version of the IFS simulator (Garcia 1981) was used to prepare a supply schedule for each of 24 regions. For this exercise a total of 499 crop-types were used each with an area by age class distribution and a yield table. However, rather than a harvest schedule being prepared independently for each crop-type, IFS was used to develop a schedule simultaneously for all crop-types in a region.

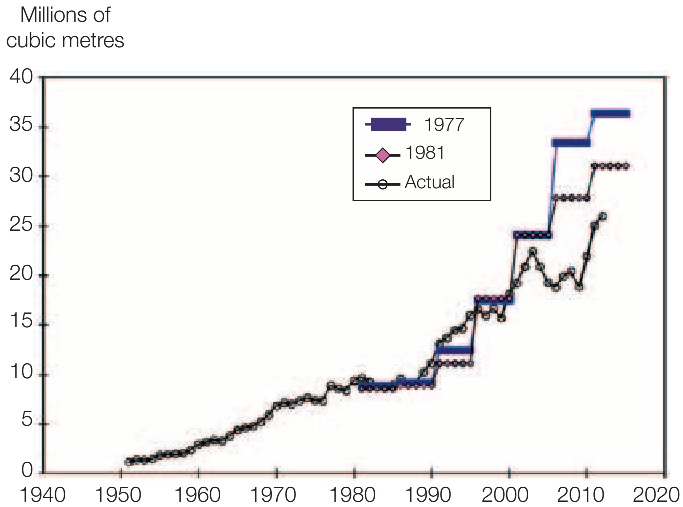

Figure 2: Forecast harvest volumes for all plantation species combined from 1977 and 1981 National Forestry Planning Models compared to actual

The wood supply forecasts for the 1977 and 1981 models are shown in Figure 2. Forecasts closely track the actual harvest until 1990 but under-predict during the 1991 to 1995 period when average rotation ages reduced and were lower than those assumed in the models. As a result, actual wood volumes harvested were higher than forecast. This highlights the fact that the forecasts were not predictions of what would happen. Rather they were scenarios of what could happen under specific assumptions.

This point is touched on by Elliott and Levack (1981) when they note that 'as in previous national planning models, only a single supply option is presented. This has tended to obscure the wide range of supply options that are possible through variation of planting and harvesting rate and silvicultural treatment. In spite of similar warnings in the past we are regularly dismayed by the acceptance of such forecasts as firm plans for harvesting.'

These sentiments were picked up on by Burrows et al. (1987) when they prepared the 1986 National Forestry Planning Model. Rather than presenting a single scenario they presented three scenarios of possible future national forestry development based on different assumptions about new planting.

The 1986 model was the first to use area data from the National Exotic Forest Description (NEFD) survey of forest owners. Burrows et al. (1987) used the 1984 NEFD as a basis for forecasting national wood flows and the socio-economic effects of plantation forestry. They used IFS to model the future wood supply under new-land planting rate scenarios of 0, 20,000 and 50,000 hectares a year.

Figure 3 shows the forecast wood supply under each scenario. The forecasts do not enclose the actual harvest level since 1990 because, although alternative new land planting scenarios were modelled, no account was taken of another major factor – possible alternative rotation ages. Rotation ages were, on average, younger than had been assumed. This was a result of a number of factors including high log prices in 1992/93 which encouraged early harvest. The over-prediction from 2005 is partially a result of some owners reducing harvest to increase forest maturity and future rotation age.

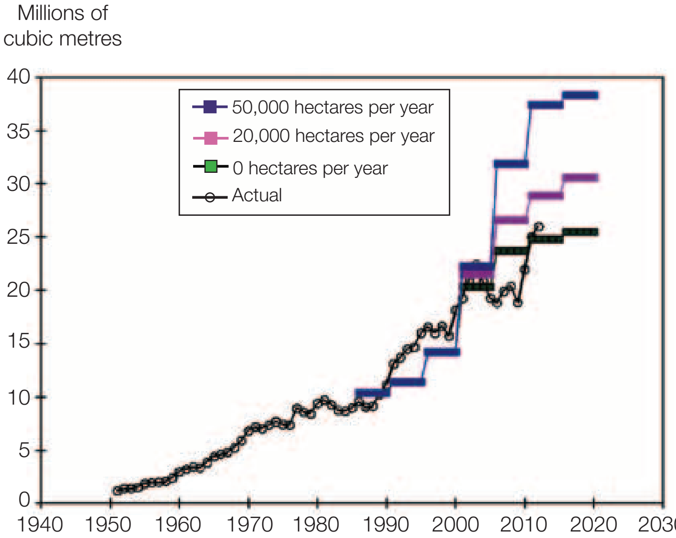

Figure 3: Forecast harvest volumes for all plantation species combined from 1986 National Forestry Planning Model for three different new land planting rates compared to actual

In 1991, as part of the New Zealand Forest Industries Strategy Study (Edgar et al. 1992) regional wood supply was projected through to 2005 using the optimising estate modelling system FOLPI (Garcia 1984). In 1992, the potential sustainable wood supply from New Zealand's plantations was forecast through to the year 2040 (Turland et al. 1993). Projections were based on the 1990 NEFD, updated to 1992 using estimates of actual areas harvested and planted, and associated yield tables. FOLPI was used to forecast the availability of wood for each of 10 wood supply regions by four species categories – radiata pine, Douglas fir, other softwoods and hardwoods. A linear programming based optimiser made it easy to impose non-declining yield constraints.

The five different scenarios evaluated represented different assumptions about target rotation age of radiata pine and new-land planting, as shown in Table 2. Figure 4 shows wood supply projections for the target rotation age variations. A comparison of the forecasts with the actual harvest since 1992 indicates the wisdom of using a range of scenarios in an attempt to describe the envelope of possible future wood supply. The actual harvest through the 1990s tracked somewhere between the base (target rotation 30 years) and early (target rotation 25 years) scenarios reflecting the reduction in average rotation age which was evident in New Zealand during that period.

		Target rotation age for radiata pine		
		25 years	30 years	35 years
New land planting	No new planting	X	X	X
	50 000 hectares a year		X	
	100 000 hectares a year		X	

Table 2: Scenarios evaluated in the 1992 national and regional wood supply forecasts

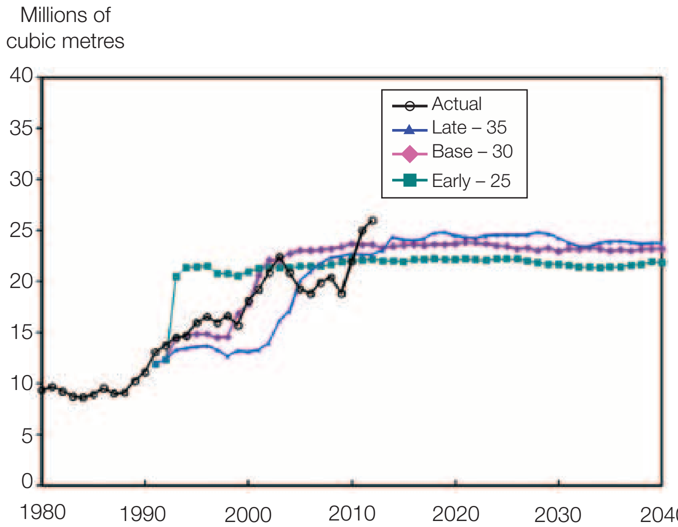

Figure 4: Forecast harvest volumes for all plantation species combined from 1992 NEFD Wood Supply Forecasts for three different target rotation ages compared to actual

A similar philosophy was adopted for the 1996 National and Regional Wood Supply Forecasts (Ministry of Forestry 1996). FOLPI was again used to forecast wood supply under scenarios which varied in target rotation age – base rotation 28 years with variations of 25 and 35 years – and new land planting rate – 0, 40,000, 60,000, and 90,000 hectares a year. Target rotation age scenarios are presented in Figure 5.

The 2000 National and Regional Wood Supply Forecasts (MAF 2000) continued with the same general method. The same target rotation scenarios were used but with a reduced range of new land planting rates of 0, 20,000, 40,000 and 60,000 hectares a year. Figure 6 shows the wood supply forecast for each of the target rotation scenarios.

Both the 1996 and 2000 forecasts over-estimate the volumes harvested since 2005. The national harvest volume was relatively constant between 2005 and 2009 as a result of market conditions as well as the previously mentioned strategy of some large-scale owners to increase forest maturity and rotation age. Another feature of the base forecasts from the 1996 and

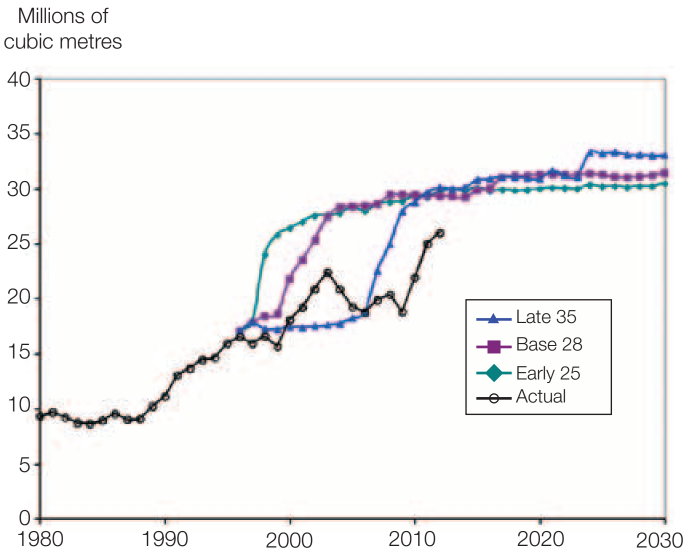

Figure 5: Forecast harvest volumes for all plantation species combined from 1996 NEFD Wood Supply Forecasts for three different target rotation ages compared to actual

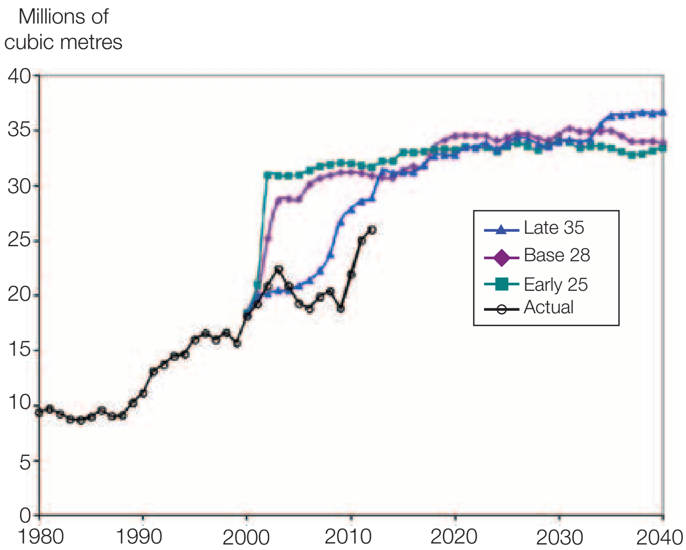

Figure 6: Forecast harvest volumes for all plantation species combined from 2000 NEFD wood supply forecasts for three different target rotation ages compared to actual

2000 exercises is the very steep increase in volume from the year 2000 onwards. These helped to reinforce the perception that New Zealand was facing a wall of wood which has had some negative consequences.

Although national-level results have been presented here, the wood supply modelling was undertaken at a regional level. For example, the 1992, 1996 and 2000 forecasts were based on 10 wood supply regions which represent logical wood supply and processing catchments.

Common features of forecasting exercises

All the forecasting exercises have followed the same general process. Main inputs to the exercises have been –

- Data on forest area by age, species and silviculture
- Yield tables giving the total recoverable volume and volume by aggregate log grade for each potential rotation age
- Management prescriptions including silviculture and target rotation age, together with assumptions about replanting and new planting
- Assumptions about yield regulation, that is, whether yield is regulated using constraints which limit the change from year-to-year or enforce smoothing. Most exercises have used non-declining yield as a target, often with some additional constraints to smooth the increase from year-to-year.

Forecasts have been of the biological potential of the estate or what is potentially available given the physical resource. 'The forecasts .... are essentially resource-based forecasts of the level of harvest attainable given the assumptions of yields, areas and harvesting constraints. This is not a prediction of how forest owners will manage the cut from their forests, nor is it a prescription for how their cut should be managed' (MAF 2000).

The forecasts make no attempt to model demand. 'It is important to note that the forecasts … are based solely on the available supply of wood. There has been no attempt to match this supply to the international demand for forest products' (MAF 2000). In this, the forecasts differ from the Resources Planning Act (RPA) Assessment process undertaken in the US (see Adams & Haynes 1980).

Challenges in availability forecasting

The overarching difficulty with national or regional wood availability forecasting in a country with a market economy such as New Zealand is that, while there are many interested parties, there is no single decision-maker. Instead there are many owners whose intentions vary and who provide data of varying quality. As a result there are challenges in developing an accurate description of the resource and in specifying scenarios which illustrate the range of the potential wood supply.

The objective of the process is to consider the aggregate effect of the probable decisions which will be made in the future by the many forest growers and log buyers that make up the forest industry in each region. However there are challenges with specifying intentions as well as obtaining relevant data.

Data on area

The problem here is ensuring that area information is accurate. Since 1983, an annual survey of forest area has been undertaken as part of the joint MAF and NZFOA National Exotic Forest Description. Large-scale owners of over 1000 hectares are surveyed annually while small-scale owners are surveyed less frequently – every two or three years for owners with 40 to 999 hectares, and from nursery surveys or a one-off survey in 2004 for owners with less than 40 hectares.

According to MAF (2009) 'the quality of the data provided by owners with less than 1000 hectares is likely to be more variable in nature. For instance, some owners may report the total land area originally taken out of pasture and put into forest without mapping out unstocked gaps. The difference between "gross" forest area and "net stocked" area is generally of the order of 10 to 20 per cent.' Therefore, for the 2010 forecasts, the NEFD area for small-scale owners was reduced by 15 per cent.

Another concern is that the NEFD contains some old stands which are unlikely to be harvested. In each region the area of radiata pine in age classes older than 30 years was reviewed. The original NEFD data was checked to ensure that the stands still existed and, if they did, that they were merchantable. Although the area removed was not large it was considered important to do so, otherwise it can contribute, particularly when an optimising model is used with non-declining yield constraints, to a rapid increase in the allowable cut that is forecast as being immediately available.

The age class distribution of the New Zealand radiata pine estate as at 2008, after adjustment, is shown in Figure 7. The total area of radiata pine, after the adjustments reported above, is 1,487,000 hectares.

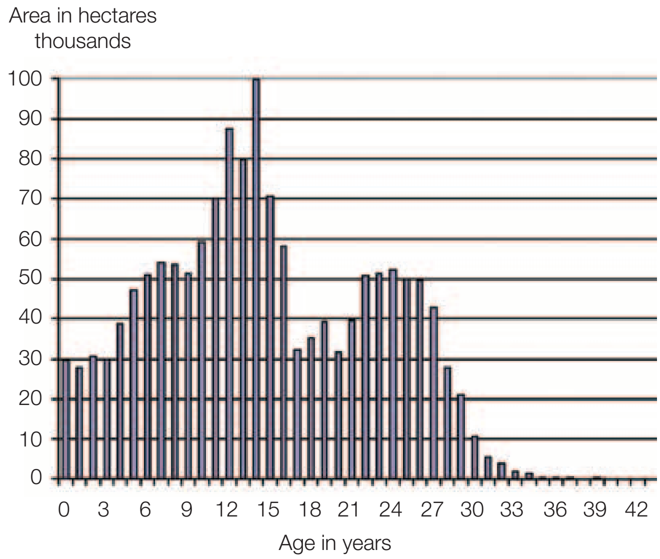

Figure 7: Area by age class for the New Zealand radiata pine estate, at 31 March 2008, was used in the wood availability forecasts

Data on yields

The challenge here is how to aggregate yield data from a number of companies and still end up with a yield table that accurately estimates the average yield for each region. A yield table is required for each crop-type. For wood supply modelling crop-types are primarily defined by species – radiata pine, Douglas fir, other softwoods and hardwoods. The radiata pine resource is also differentiated on whether or not it is pruned.

However the planting year is also used as a basis for crop-typing to act as a surrogate for changes in average site quality, planting stock, establishment practices and tending regimes. For example, the crop-types used in the 1996 and 2000 exercises separated stands planted after 1975 from those planted before 1976 in some regions. In the 2010 exercise, radiata pine stands planted before 1990 were assigned to a different crop-type from stands planted after 1989.

For previous wood supply exercises, regional yield tables were developed by large-scale owners to represent the area in each crop-type which they own. These company yield tables were averaged, on an area weighted basis, to give a regional average yield table. One of the challenges is that companies were asked to provide an average yield table that represented their stands. This aggregate yield table is not relevant to company planning where more detail is required. Often companies have a unique yield table for each stand, at least for older stands. As companies were asked to provide a yield table for which they had no use, it was sometimes generated automatically without adequate verification.

A related problem is the variation in approach to yield table development by different companies, in the choice of growth and yield models and in the reliance placed on inventory as opposed to models to generate yield tables. Figure 8 shows the company yield tables for one regional crop-type. The wide range is a result of the variation between companies in inherent site quality as well as different approaches to yield table development.

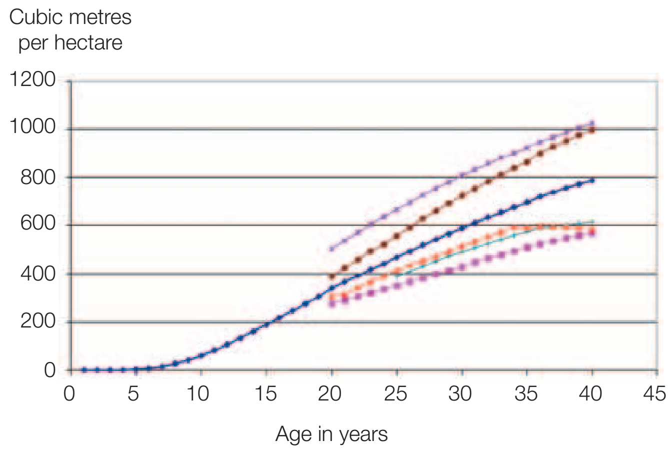

Figure 8: Yield tables provided for the 2010 Wood Availability Forecasts by five large-scale owners for a radiata pine in one region compared to the area weighted regional average yield table

For the 2010 exercise an additional step was applied. Large-scale owners were surveyed in 2006 and asked for their annual harvest intentions through to 2015, both the volumes that they intended harvesting and the area to be harvested to achieve this volume. The information was used to calibrate the regional yield tables. The underlying assumption is that the harvest intentions, being mainly based on inventory, provide the best indication of the actual yields that will be achieved in the short term.

The calibrated yield tables for pre-1990 stands of large-scale owners were also applied to the pre-1990 stands of small-scale owners. Adjustment to yield tables for post-1989 stands was subsequently carried out in consultation with resource foresters in each region. In some regions the same adjustments were made as for pre-1990 stands while in other regions no adjustment was made.

Intentions

The challenge is how to show the range of potential wood availability. The actual wood supply which will arise will be the aggregate result of decisions that will be made by many forest owners. Given the inherent uncertainty about the future, the general approach taken was to present a number of different scenarios in which constraints and target rotation ages were varied. However the question was what scenarios to model and which to present in reports.

Target rotation age

The 1992 exercise used a base rotation age of 30 years for radiata pine, whereas the 1996 and 2000 exercises used 28 years. Since 1995, the annual NEFD survey obtains information on the average clear fell age of radiata pine in the previous year. Over the period 1995 to 2010 the average has been 27.8 years. There has been an increasing trend, since a low of 26.8 years in 2000 through to 28.4 years in 2010, as owners have sought to increase the maturity of the estate and improve log quality. For the 2010 exercise a base rotation age of 30 years was adopted with variations of 28 and 32 years also evaluated.

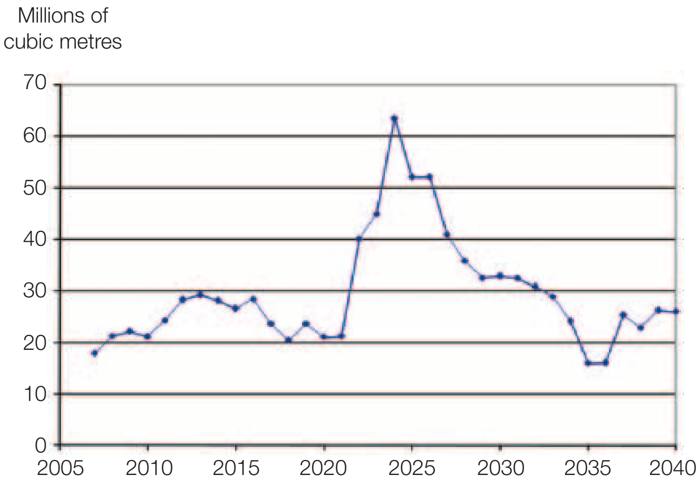

Figure 9 Radiata pine wood availability from New Zealand plantations if all stands are harvested at age 30 years (Scenario 1 in 2010 Wood Availabilty Forecasts)

An initial scenario was run for each region in which all areas were harvested at 30 years. The objective was to indicate the pure unconstrained availability of wood. Figure 9 is the mirror image of the age-class distribution shown in Figure 7. It shows the effect of the large areas of afforestation which took place in the 1990s. The change in annual harvest volumes, particularly those after 2021, would be impractical.

Yield regulation constraints

Three general patterns are evident in historical radiata pine log volume production by region, as shown in Figure 10. In some regions harvest volumes have been relatively steady while in other regions there has been an increase. Some regions in the latter group have volume reaching a plateau after an initial increase. For all groups there has been substantial fluctuation between years. Despite these fluctuations the overall trends in the long-term have generally been non-declining.

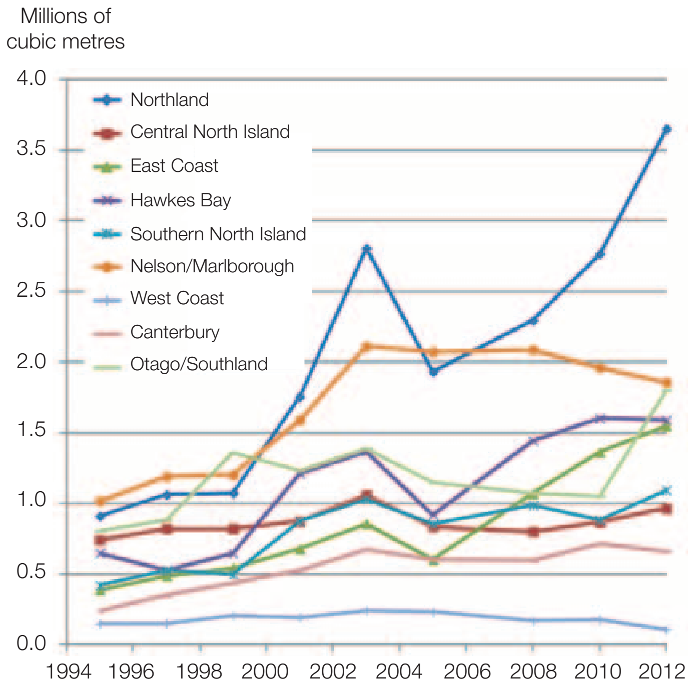

Figure 10: Radiata pine harvest volumes by region from NEFD surveys. Central North Island volumes have been divided by a factor of 10 to put them on a comparable scale

The issue is whether it makes sense to impose non-declining yield constraints on a forest that does not have a normal or even-age class distribution. The key to developing more realistic scenarios was to differentiate the large-scale owners from the small-scale owners. The combined estate of large-scale owners, while not normal, does have at least 20,000 hectares in each age class from zero, area awaiting replanting, to 28 years as shown in Figure 11. The general approach taken was to use harvest intentions to determine the harvest through to 2015. Then non-declining yield constraints were imposed.

The small-scale owners' estate is far from normal, with over 30,000 hectares in each of ages 11 to 16 years planted in 1992 to 1997, and much less area in other age classes, as shown in Figure 12. The main concern is how to forecast the wood availability. In particular, will the large area planted in the 1990s be harvested –

- At a fixed rotation age
- Spread over many years
- Spread over an intermediate number of years.

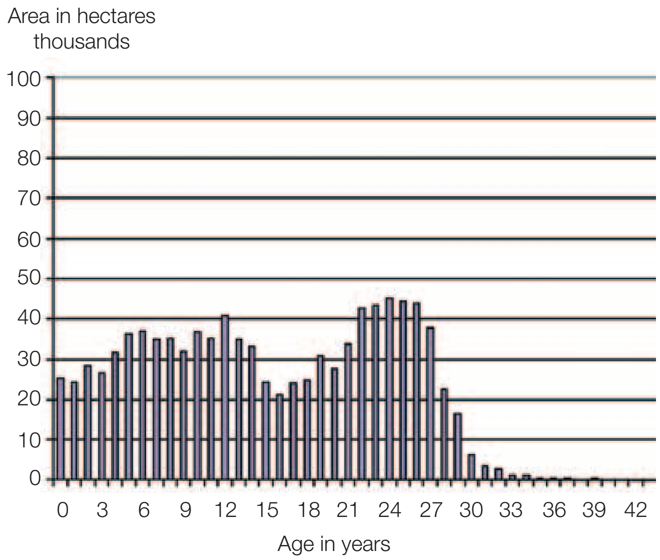

Figure 11: Area by age class for radiata pine of large-scale owners at 31 March 2008

Scenario 2 shown in Figure 13 assumes that the small-scale forests are harvested at age 30. As was the case with the first scenario this is impractical. Scenario 3 in Figure 14 assumes that the total harvest volume of all owners combined will be non-declining. There is also a smoothing constraint which restricts the annual increase in harvest volume to no more than 10 per cent. In Scenario 3 the small-scale owners' estate is harvested to complement the large-scale owners' estate. A result of spreading out the harvest of the small-scale owners' estate is that the average clear fell age becomes markedly different from 30, in fact it gets as high as 40 years.

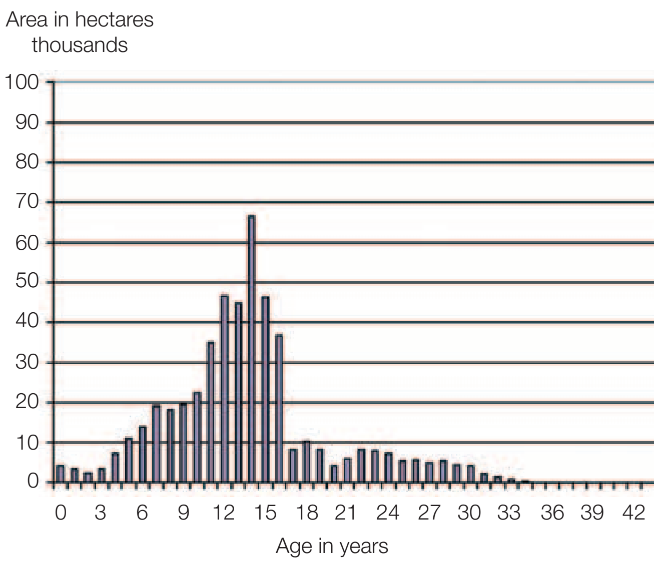

Figure 12: Area by age class for small-scale owners' radiata pine estate at 31 March 2008

An intermediate option would be to require non-declining yield for the current rotation and then to allow a reduction by up to 10 per cent a year for three years before requiring non-declining yield for the subsequent rotation, as shown in Figure 15. Scenario 4 was designed to allow harvest volumes to reflect the

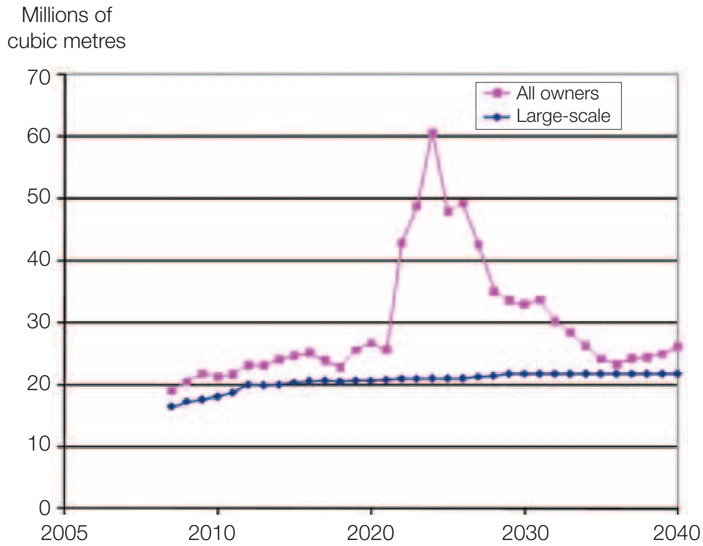

Figure 13: Radiata pine wood availability from New Zealand plantations if large-scale owners harvest volumes are based on intentions and all small-scale owners harvest at age 30 years (Scenario 2 in 2010 Wood Availability Forecasts)

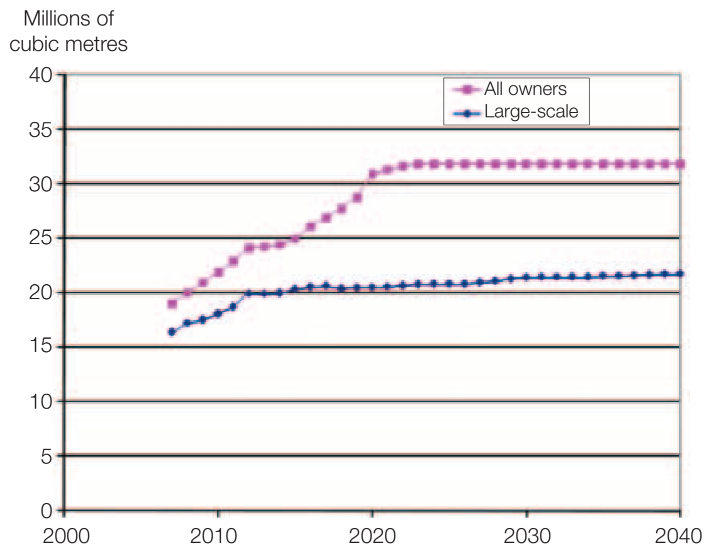

Figure 14: Radiata pine wood availability from New Zealand plantations if large-scale owners harvest volumes are based on intentions and combined harvest is non-declining (Scenario 3 in 2010 Wood Availability Forecasts)

age-class distribution. As with all scenarios, no further afforestation is assumed. Should substantial new land planting again occur then the reduction in volumes forecast would be mitigated.

Interpretation of results

The challenge is to encourage users to understand that results are forecasts of what will happen under given assumptions. What will actually happen will depend on the interaction of many participants in the log market. Reports produced in the 2010 exercise emphasised that fluctuations in harvest volumes occur in response to market conditions because of factors such as log and lumber prices, shipping costs and exchange rates.

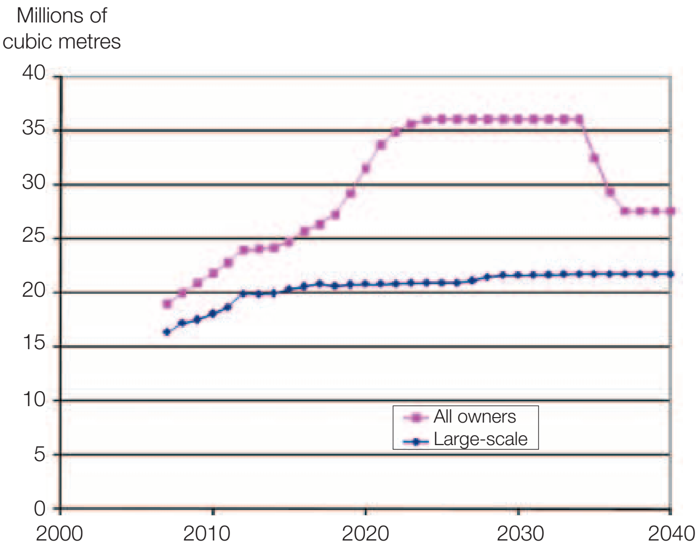

Figure 15: Radiata pine wood availability from New Zealand plantations if large-scale owners' harvest volumes are based on intentions and the combined harvest is non-declining for the current rotation and then allowed to reduce (Scenario 4 in 2010 Wood Availability Forecasts).

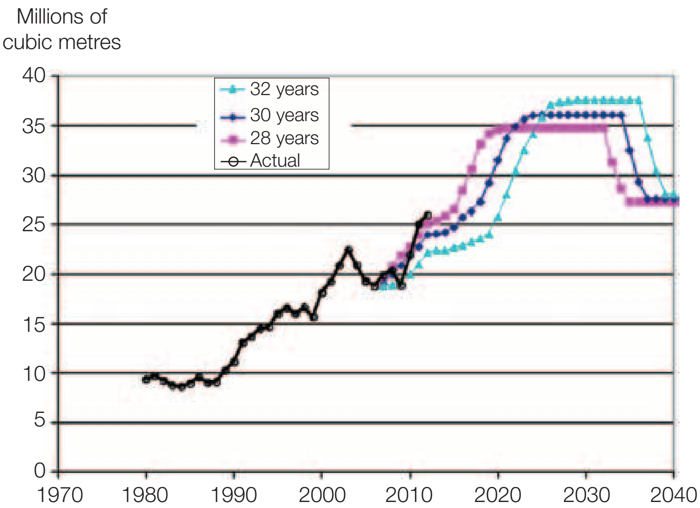

Figure 16: Radiata pine wood availability from New Zealand plantations under different target rotation ages (Scenario 5 in 2010 Wood Availabilty Forecast). The actual volumes are MPI estimated roundwood removals for all species.

No attempt has been made to model log supply and demand. Instead, the wood availability forecasts have been based on quantifiable physical characteristics of New Zealand's plantations. In order to make this clear, the results of the 2010 exercise were called Wood Availability Forecasts rather than wood supply forecasts.

The full range of scenarios has been presented in reports to show that there are many ways that the forest estate may be harvested. As well as to the different yield regulation scenarios, an additional scenario with alternative target rotation ages was presented which shows the effect of varying rotation length, as shown in Figure 16.

Consultation with forest owners

A key feature of the 2010 exercise was getting collective ownership of the process and results by forest owners. This was achieved by discussion of the proposed process at its outset with the Forest Owners Association as well as regional industry groups, and presenting draft results to stakeholders in each region. These review meetings provided valuable feedback and led to a revision of assumptions as well as the provision of additional data by companies and consultants.

The decision to treat large-scale owners and small-scale owners as different entities in the process was strongly supported by forestry companies because –

- Large-scale owners provided yield information and harvest intentions
- The description of the large-scale owners' resource is generally more accurate
- They are usually going concerns with annual log production from plantations which have a wide age-class distribution.

This differentiation helped identify that –

- The increase in potential wood availability in the short-term form 2009 to 2012 was coming mainly from large-scale owners.
- The increase from 2015 to 2020 onward will come largely from small-scale owners.

The differentiation helped focus attention on the key issue of the potential effect on future wood availability of the large area of plantation established in the 1990s.

At the outset of the exercise there was concern expressed by some forest owners about presenting another wall of wood. In fact, the current forecast is for a much slower rate of increase than forecast in the 1996 and 2000 forecasts. The reasons for this are –

- Use of harvest intentions for large-scale owners.
- Imposing a 10 per cent limit on the annual increase in volume
- Removal of area not expected to be harvested in old age classes.

Other feedback from forest owners at the beginning of the project was to present a band of results rather than a single forecast. The relevance of presenting a range of results is already evident. Scenario 3 – non-declining yield from the total estate – was not deemed realistic for traditional forestry with revenues only from logs because of the excessive rotation ages which result. However, it became more realistic with the implementation of the Emissions Trading Scheme in New Zealand. In an environment where forest growers can earn revenues from carbon as well as logs, optimum rotation ages increase (Maclaren et al. 2008).

The objective of the exercise was to indicate harvest volumes potentially available from the New Zealand plantations. The scenarios show the consequences of different sets of assumptions. One comment received was that presenting the results of the scenarios will ensure that they do not occur. Forest owners, together with log buyers and wood processors, are likely to respond to the forecasts in ways that best suit them.

As pointed out in the regional reports 'forests are managed to maximise the benefits to the enterprise that owns them. Each enterprise has its own harvest strategy based on the owners' objectives, market conditions and the forest estate that it owns or manages. Any change in harvesting strategies by forest owners affects the age-structure and maturity of the forests they own. This in turn feeds back directly into future wood availability.'

Plans for the next forecasting exercise

In April 2013 the Ministry for Primary Industries completed *A User Needs Review of the National Exotic Forest Description Survey.* Feedback from users, including the forest industry, was that the Wood Availability Forecasts was the most used output from the NEFD. As a result there are plans by the Ministry for Primary Industries to begin another forecasting exercise in 2014. While details have yet to be confirmed it is likely that the general approach will follow that of the 2010 exercise –

- Separation of large-scale and small-scale estates
- Yields for the large-scale owner estate to be calibrated by harvest intentions
- Presentation of a range of scenarios.

Aspects that are under review include –

- Area of small-scale estate
- Yields for small-scale estate
- Economics of harvesting.

In the 2010 forecasts the area of the small-scale estate was reduced by 15 per cent to allow for the reduction from gross reported area to net stocked area. This assumption warrants review.

The general approach adopted for the 2010 forecasts was that yields for the small-scale estate were the same as those for the large-scale estate in the region. Again this assumption warrants review. As part of the Land Use and Carbon Analysis System, a national network of plots has been established on a four kilometre grid for post-1989 forests and an eight kilometre grid for pre-1990 forests. These provide the possibility of comparing, at a high level, the stocking and productivity of the small-scale and large-scale estates.

A proportion of the small-scale forests have been planted on steep and remote land which may not be economic to harvest. For example, Park et al (2012) found that between five and 10 per cent of the small-scale forests in the Wanganui District were not economically viable to harvest at age 30 years given average log prices. In other words they had negative stumpage values.

Further analysis is being considered to help users interpret wood availability forecasts. It is anticipated that the wood availability forecasts will continue to be estimates of the wood available physically rather than economically. Any economic analysis would be produced separately from the wood availability forecasts.

References

Adams, D. and Haynes, R. 1980. The 1980 Softwood Timber Assessment Market Model: Structure, Projections and Policy Simulations. *Forest Science Monograph*, 22.

Burrows, G.D., Levack, H.H. and Novis, J.D. 1987. A National Forestry Planning Model for New Zealand. In Roche, M.M. and Hodder, R. (Eds.). Social and Economic Perspectives on Forestry and Agroforestry. *Proc. Forestry Section 56th ANZAAS Congress*. Palmerston North, NZ: Massey University; Wellington, NZ: NZ Forest Service, 231-236.

Edgar, M.J., Lee, D. and Quinn, B.P. 1992. *New Zealand Forest Industries Strategy* Study. Wellington, NZ: New Zealand Forest Industries Council.

Elliott, D.A. 1979. Plantation Mensuration Practice in Australia and New Zealand. In Elliott, D.A. (Comp.). Mensuration for Management Planning of Exotic Forest Plantations. *FRI Symposium No. 20.* Wellington, NZ: New Zealand Forest Service, 17-39.

Elliott, D.A. and Levack, H.H. 1981. New Zealand's Plantation Resource. First Lead Paper: Areas, Locations and Quantities. *Proceedings of 1981 New Zealand Forestry Conference,* (1).

Familton, A.K. 1969. The 1969 National Forestry Planning Model. *Production Forestry Working Report for the Forestry Development Conference*. Wellington, NZ: New Zealand Forest Service.

Garcia, O. 1981. IFS: An Interactive Forest Simulator for Long Range Planning. *New Zealand Journal of Forestry Science,* 11(1): 8-22.

Garcia, O., 1984. FOLPI: A Forestry-Oriented Linear Programming Interpreter. In Nagumo, H. et al. (Eds.) *Proceedings IUFRO Symposium on Forest Management Planning and Managerial Economics*. University of Tokyo, Japan, 293-305.

Hosking, M.R. 1972. *The 1972 National Forestry Planning Model: A Report for the Targets Working Party.* Wellington, NZ: Forestry Development Council.

Levack, H.H. 1979. Future National Wood Supply. *New Zealand Journal of Forestry,* 24(2): 159-171.

Maclaren, P., Manley, B. and Final Year School of Forestry Students. 2008. Impact of the New Zealand Emissions Trading Scheme on Forest Management. *New Zealand Journal of Forestry*, 53(3): 33-39.

Ministry of Agriculture and Forestry. 2000. *National and Regional Wood Supply Forecasts 2000*. MAF, Wellington, NZ: MAF.

Ministry of Agriculture and Forestry. 2009. *National Exotic Forest Description as at 1 April 2009*. Wellington, NZ: MAF.

Ministry of Agriculture and Forestry. 2010. *New Zealand Wood Availability Forecasts 2010-2040*. Wellington, NZ: MAF.

Ministry of Forestry. 1996. *National Exotic Forest Description: National and Regional Wood Supply Forecasts 1996*. Wellington, NZ: Ministry of Forestry.

Park, D., Manley, B., Morgenroth, J. and Visser, R. 2012. What Proportion of the Forest of Small-Scale Owners is Likely to be Harvested – A Whanganui Case Study. *New Zealand Journal of Forestry*, 57(3): 4-11.

Turland, J., Wakelin, S. and Lane, P. 1993. *1992 National and Regional Wood Supply Forecasts*. Wellington, NZ: Ministry of Forestry.

Bruce Manley is Head of the New Zealand School of Forestry based in Christchurch. Paul Lane is a Principal Advisor at the Forestry and Plant Sector of the Ministry for Primary Industries based in Wellington.