SE 1.4

AN INVENTORY OF PRIVATE FORESTS OF SOUTH EAST QUEENSLAND

QUEENSLAND CRA/RFA STEERING COMMITTEE

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FINAL REPORT

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QUEENSLAND CRA/RFA STEERING COMMITTEE

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SUMMARY

This report has been prepared for the joint Commonwealth/State Steering Committee which oversees the Comprehensive Regional Assessment (CRA) of forests in the South East Queensland CRA region.

The Comprehensive Regional Assessment provides the scientific basis on which the State and Commonwealth governments will sign a Regional Forest Agreement (RFA) for the forests of the South East Queensland RFA region. This agreement will determine the future of the region's forests and will define those areas needed to form a comprehensive, adequate and representative (CAR) reserve system and those available for ecologically sustainable commercial use.

This report was undertaken to assess and describe the privately owned native forest resources in South East Queensland, with particular reference to those factors relevant to commercial wood production. It also aims to assess and describe the privately owned commercial wood production plantation resource in South East Queensland.

The methods used for the project included a roadside visual assessment of the private native forest resource, a modelling exercise to predict the potential productivity of private native forests, a review of data relating to private plantations, and a review of landowner attitudes towards the management of private native forests for timber production.

This project found that of the 1.4 million ha of private native forests in South East Queensland, over 80 per cent is carrying less than 2 m^3/ha of standing sawlog volume and can not be considered merchantable. The remaining areas of forest are mainly drier forest types that most frequently carry between 2 and 4.9 m^3/ha. The wetter forest types are generally carrying larger volumes of timber with some sites carrying extremely large volumes. The total standing volume of harvestable timber excluding rainforest species in South East Queensland on private land has been estimated to be around 2.7 million m^3.

There was estimated to be 5,000 ha of high productivity (MAI of >0.8 m^3/ha/yr), 344,000 ha of medium productivity (between 0.1 and 0.8 m^3/ha/yr) and 785 000 ha of low productivity (<0.1m^3/ha/yr) private native hardwood forest in SEQ. There is an additional 65 000 ha of unknown productivity.

The predicted potential yield from these forests is 215,000 m^3/annum, assuming all private native forests are being managed for wood production. It is unclear how much of this area is available and being managed for wood production. However, if only those areas containing merchantable volumes are considered, the predicted annual yield is only 45 000 m^3/annum.

These estimates should be viewed in relation to the 210 000 m^3 harvested annually from private forests within South East Queensland.

Land clearing has been reported from two sources to be occurring at a rate of approximately 0.3 per cent per annum and 0.8 per cent per annum across the SEQ RFA region. The largest area of clearing is occurring in the moist dry and woodland forest types, while the greatest rates of clearing are occurring on the woodland and unproductive forest types. Whilst neither of the clearing rates

consider regrowth of cleared land back to a forested state, they clearly have implications for the long term supply of wood from private native forests.

The private forest owners in South East Queensland were found to possess a wide range of views regarding the native forests existing on their properties. Several issues were identified which are preventing more landholders from actively managing their forests for sustained timber production, including a lack of information regarding silviculture, economics and marketing, as well as an uncertainty about future government decisions regarding harvesting rights.

Three privately owned plantations were identified that were considered large enough to be important to the timber industry. These were all slash pine and covered a total area of 12 450 ha. The predicted annual yield from these plantations is approximately 150 000 m^3.

1. INTRODUCTION

1.1 BACKGROUND

The private native forest resource in South East Queensland currently supplies around 210 000 m^3 per annum (Project Report SE 2.1) which is more than half of the native timber harvested annually in the region. While the Forest Community Mapping Project (EH 1.2) describes the extent of particular forest types across all tenures, there were no existing databases adequately describing the availability or productivity of the approximate 1.4 million hectares of private native forest estate in the region.

The private commercial plantation resource is currently of limited extent in South East Queensland (SEQ). However, the extent of this resource required assessment in order to develop a comprehensive overview of the total wood resources available in SEQ.

The information presented in this report will aid the establishment of industry resource development options, which will form part of the SEQ Regional Forest Agreement (RFA). An understanding of the total resource available to industry is fundamental to identifying industry development options as part of the RFA. Resource inventory is undertaken on a regular and systematic basis in public forests and there is considerable data available for these forests. For private native forests however, due to dis-aggregated ownership of the resource and no central management authority there is currently no consolidated resource information available. The task is made difficult due to the multiple owners and the opportunistic harvest of much of the resource.

The findings of this report have the potential to provide information regarding the future of farm forestry activities in the region. This report provides an indication of the level of landholder involvement in the management of native forests for sustained timber production. The factors considered by landholders when they are making decisions regarding the management of their native forests are also examined to assist in identifying steps that could be taken to encourage greater landholder participation in the sustainable management of native forests.

1.2 OBJECTIVES

- to assess and describe the privately owned native forest and plantation resource
- to assess standing volume, estimate productivity and aim to understand availability of the private native forest resource.

1.3 PROJECT SPECIFICATIONS

A copy of the project specifications appears in Appendix A.

2. METHOD

The project was divided into five components:

1. An assessment of the standing volume of merchantable native timber on private land.
2. A modelling exercise to estimate the productivity of these areas on private land.
3. A review of the impacts of land clearing on the resource.
4. A review of landholder attitudes and intentions regarding areas of native forest on their properties.
5. A description of the private commercial plantation resource.

2.1 ASSESSMENT OF STANDING VOLUME OF MERCHANTABLE TIMBER ON PRIVATE LAND

2.1.1 Resource Stratification

The private native forest resource was stratified according to the following features:

1. Forest/non-forest – only forested areas were considered
2. Land tenure – the properties which were defined as private for this project were those that were either freehold land or leasehold land where the government does not possess timber rights.
3. Property size – only properties greater than 10 ha in size were included in the sample.
4. Forest patch size – only forest patches greater than 10 ha in size were included in the sample.
5. Slope – only slopes less than 25 degrees were considered.
6. Forest type – modelled vegetation types were used as the base stratification unit for forest type.

The forest/non-forest screen used for sampling purposes was from land cover mapping undertaken in Murray–Darling Basin Project M305 (Ritman 1995). This uses a projected crown cover limit of 20 per cent to define woody vegetation. This was the only comprehensive coverage available at the time and was derived from LANDSAT images from 1989 – 1991.

The freehold and leasehold land areas were selected from the digital cadastral database for SEQ. The property and patch sizes were used to limit the sampling to only those properties likely to make a significant contribution to timber resources. This size limit is clearly nominal, and is possibly on the smaller side of properties/patches likely to make a significant contribution.

The slope limit was used to restrict potential forest areas to those considered operationally feasible. The limit in no way reflects environmental suitability.

Modelled vegetation types (as a precursor to field mapped Regional Ecosystems), were used as a surrogate for forest type as they were the only comprehensive coverage of the region available at the time. Twenty modelled vegetation types were identified across the region (see Appendix B). Vegetation type was based on environmental domain modelling using an extensive Department of Primary Industries – Forestry (DPI–F) database detailing dominant species. Unfortunately the modelling was clipped to the former biogeographic regional boundary which left approximately 26 343 ha in the north and north west of the region without coverage. These areas were allocated a new code (2) for sampling purposes.

The modelled vegetation types were sampled at varying intensities, with those considered important to the timber industry sampled at a higher intensity. Appendix B indicates the importance and sampling intensity for the various modelled vegetation types.

Together, these variables defined the area of interest and stratified that area for sampling purposes. Although management history was identified as an important variable affecting standing volume, no information was available on this feature for stratification purposes.

Public roads were then considered in relation to the stratified area of interest using a GIS. Plot locations in each forest type were then randomly selected from within 100 m of the roads. A total of 600 primary sampling points and another 600 secondary sampling points were identified independently across the region. The nearest secondary site was to be assessed only if the primary site could not be accessed.

Due to difficulties in accessing all primary plots and for efficiency purposes, plots were assessed as they were found, regardless of whether it was a primary or secondary plot. As a result of this, the total number of plots assessed was 754. Thirty-three of these were found to be cleared.

2.1.2 Field Sampling Method.

The field sampling was carried out by ‘The Consultancy Bureau’, which employed experienced timber assessors familiar with the forest types being examined. Sample points were located using a combination of Global Positioning System (GPS), topographic and satellite image maps. Where there was no forest present once the sampling point had been located, the assessors would either mark it as a null plot or they would assess an area of similar forest type on private land if it was close by, effectively creating a new plot location.

The visual assessments were made from the roadside by walking along the roadside a short distance and observing the broad ‘picture’ of the forest present. This method did not permit use of a basal area wedge or other measurement methods, as the assessors did not enter the private forest. The forest was assessed for forest type, standing volume and stand structure. Due to the accuracy limitations of the visual assessment method, stands were placed into one of six volume classes. These were <2, 2–4.9, 5–11.9, 12–19.9, 20–40 and >40 m^3/ha. The lowest class (<2 m^3/ha) was established to define those stands considered unviable for logging using conventional techniques. The stand volume was estimated where the stand was in the >40 m^3/ha volume class. Trees were considered to contribute to stand volume if they were greater than 40 cm DBH (diameter at breast height or 1.3 m above the ground). Several other observations were made considering such factors as other products and disturbance. A plot sheet (Appendix C) was completed for each site.

Completed plot sheets were then submitted to DNR staff who transferred the information to a database.

It was attempted to revisit and physically measure at least one plot in each modelled vegetation type, after gaining the approval of the landholder. Whilst this was mostly successful, some types could not be accessed. The focus of the measured plots was on sites where visual estimates indicated standing volume of greater than 2 m^3/ha. Staff of DNR completed these plots with the assistance of the consultants. Plots were relocated using a GPS and the notes made on the plot sheet during the first visit. Plots were marked with coloured tape and the appropriate plot number during the first visit to aid relocation. A minimum of 30 trees or up to four subplots (radius 12.6 m) was assessed according to the plan in Figure 2.1. The total area of the four plots was 0.2 ha.

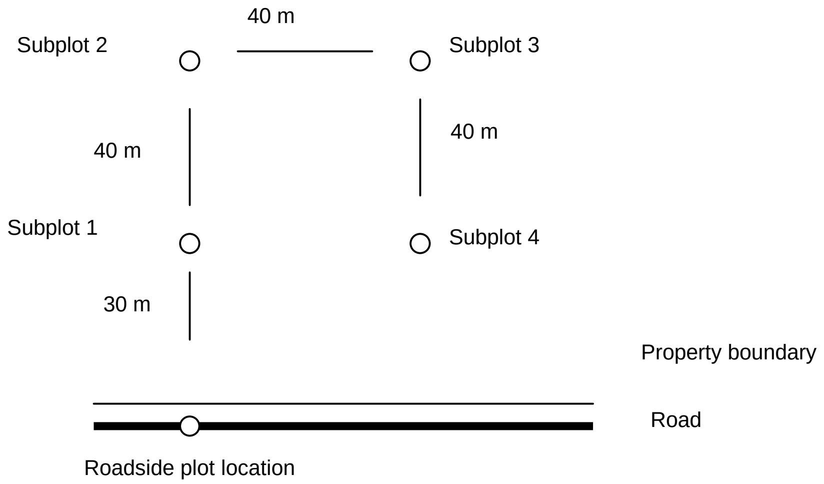


Figure 2.1 Plan of Measured Plots.

All trees over 20 cm DBH were measured and given a sawlog rating and an estimated log length. A plot sheet was completed as per Appendix C. Data collected from these measured plots were entered into the DPIF Area Information System (AIS) which was used to estimate volume. (Refer to *SE 1.1 Sustained Yield Accreditation* for further information on the AIS). The volumes calculated from these measured plots were compared to the visual assessments to obtain a measure of the accuracy of the visual estimates.

2.1.3 Analysis

Preliminary analysis indicated a poor relationship between standing volume and the modelled vegetation types. (See Appendix D). Thus the raw plot data were grouped into five forest types based on the primary and secondary species as observed at the plot. The five broad forest types are rainforest, wet forest, moist dry forests, woodland and unproductive. The main tree species that occur in each are shown in Appendix E.

The mapped regional ecosystems (REs) became available after field assessment, and this was used for subsequent analysis purposes. Mapped REs were classified into the five forest types. The REs in each class are also shown in Appendix E.

For analysis purposes, areas considered include only those forested areas (from Murray–Darling Basin mapping) on freehold or other crown land where the State does not have timber rights, and meeting the slope, lot and patch size criteria as described above.

The area of private forest reported in this report differs from those reported in SE 1.2 (Public Forest Resource Description and Inventory). This arises from the use of the Murray–Darling Project ‘woody’ classification for this project in comparison to the use of mapped remnant vegetation for Project SE 1.2. Using a projected crown cover of greater than 20 per cent to distinguish forests, a significantly greater area of forest is identified for this project than that mapped as ‘remnant vegetation’ in Project EH 1.2 (Forest Ecosystem Mapping and Analysis). This is due to different standards of ‘forest’ being considered, and the minimum polygon size. The forests mapped in EH 1.2 as remnant (and subsequently used in SE 1.2) did not include regrowth vegetation; including only forests where the structure of the woody vegetation was still intact, i.e. there was more than 50 per cent of the normal canopy cover of the community present. However, the forest identified through the LANDSAT classification for this project includes both regrowth forest and forests that have been subject to a high level of disturbance. A high proportion of plots was noted as regrowth forest. In addition, the minimum polygon size for remnant vegetation mapping was 20 ha, whereas the minimum unit used for field timber assessment was 10 ha.

2.2 MODELLED PRODUCTIVITY

Multiple linear regression was used to model the relationship between potential mean annual increment (MAI) and environment. The average environment for each public forest management unit (MUID) was described by 19 climatic or topographic variables and four substrate attributes defined from geological type or stratigraphic units. Substrate attributes represented a mapping resolution of 1:500 000. Climate attributes were defined by indicative BIOCLIM parameters (McMahon *et al.* 1996) using a 100 m digital elevation model (DEM), and the same DEM was used to define a set of topographic attributes.

The projected MAI from public forest was used as a basis for estimating potential yields from private native forests. Native forest management is generally different on these different tenure types. However, the commitment to sustainable forest management of public native forests provides an indication of the potential yields that could be sustainably achieved from private forests. Different silvicultures would clearly result in different yields, however these were not been explored in the project.

MAI for MUIDs was derived from a 100 year projection for the productive forest estate using DPI–Forestry’s yield scheduling system SKED. SKED is described and evaluated in some detail in SE 1.1 *Sustained Yield Accreditation*. Total projected sawlog yield over time plus change in standing merchantable sawlog volume defined increment for each MUID, which was taken over the net area to define MAI.

The predictive model of MAI was subsequently extrapolated to the private native forest estate. Further details of the modelling are provided in Appendix F.

Levels of MAI that reflected high, medium or low productivity forest type were defined as >0.8, >0.1 and ≤0.8, ≤0.1 m^3/ha/yr respectively. The distribution of predicted MAI for private native forests was summarised by the mapped forest ecosystems grouped as wet forest, moist dry forests and woodland. Rainforest was excluded from the analysis because of a lack of growth data relating to this forest type.

Unfortunately, the base data sets used for modelling were clipped to the former SEQ bioregion boundary and a former coverage of rainforest had been clipped from the prediction of MAI. This resulted in 65 000 ha of the 1.2 million ha being of unknown productivity. For computation purposes, this area has been attributed with the average MAI (weighted by area) for the forest type.

2.3 REVIEW OF LAND CLEARING

Data on land clearing was readily available from two sources, these being:

- the Statewide Landcover and Trees Study (SLATS, 1997) analysis of clearing between 1991 and 1995; and
- Queensland Herbarium (unpubl.) analysis of change in remnant vegetation between 1995 and 1997 (using SLATS classification of LANDSAT images from these times).

These were analysed for the area cleared and the Herbarium data were grouped into the five forest types to assess the possible impact on standing volume and potential productivity.

Limitations of this analysis were primarily due to reliance on existing data sources. There was a high degree of variability in the estimate of clearing rates between sources and analysis was limited to those tenures in the source data that approximated private forests used in the remainder of the study, resulting in only approximate results. In addition, regrowth – which can in time contribute to timber yield from private land – could not be evaluated from existing data sources.

2.4 REVIEW OF RESOURCE AVAILABILITY

2.4.1 Review Of Existing Surveys and Consultation.

A review of existing surveys and reports was undertaken to obtain an indication of landholder attitudes towards using their native forest resource for wood production. Field extension officers of DPI–F and DNR were also consulted to obtain their opinion of landowner attitudes. A list of the people consulted appears in Appendix G. It was also sought to gauge landholder attitudes towards the management of private forest for sustained timber production on an ad hoc basis through assessment and CRA contacts.

2.4.2 Sawmill Survey Supplement.

As part of a survey of sawmill managers and owners in SEQ (*SE 2.2 Economic Survey of Log Processing Facilities in SEQ*), questions were asked on the subjects of log supply, log quality and access issues from private forests. A total of 32 sawmills responded to the survey. A copy of this questionnaire is contained in Appendix H. ABARE collected the data for this survey.

2.4.3 Farm Forestry Survey

A survey of landholders derived from a farm forestry database (containing approximately 560 names of parties interested in farm forestry from around SEQ) was undertaken to identify farm forestry issues in relation to the RFA. The survey included questions on the area and type of forests managed and management history. A number of questions when combined provide an indication of the landowner’s management intent. A total of 115 landholders responded to the survey.

2.5 DESCRIPTION OF THE PRIVATE PLANTATION RESOURCE

Details of the private plantation resource were extracted from existing databases, particularly those contributing to the National Plantation Inventory (National Forest Inventory, 1997). Information detailing the location, extent and species composition of plantations has been provided in this report.

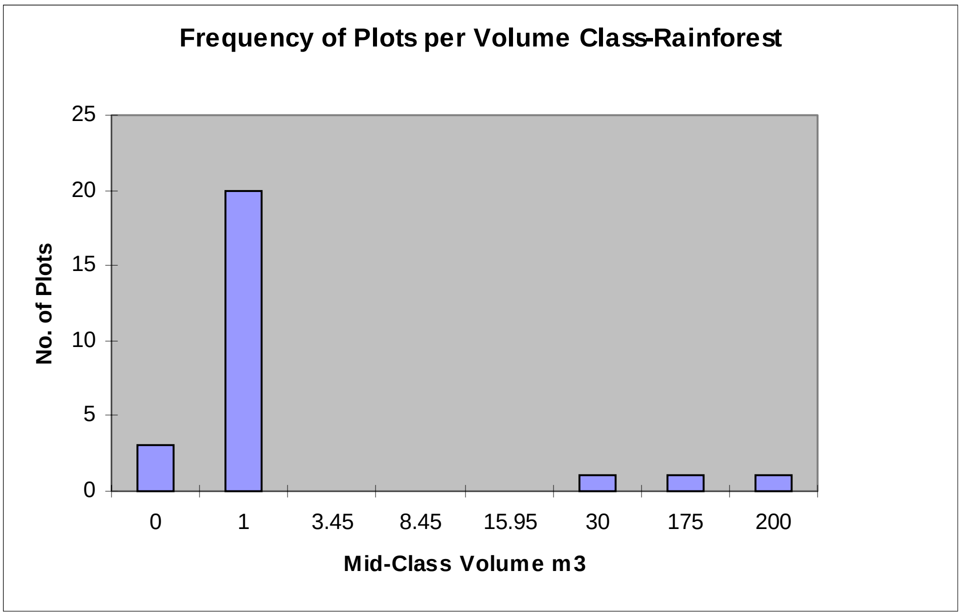
3. RESULTS AND DISCUSSION

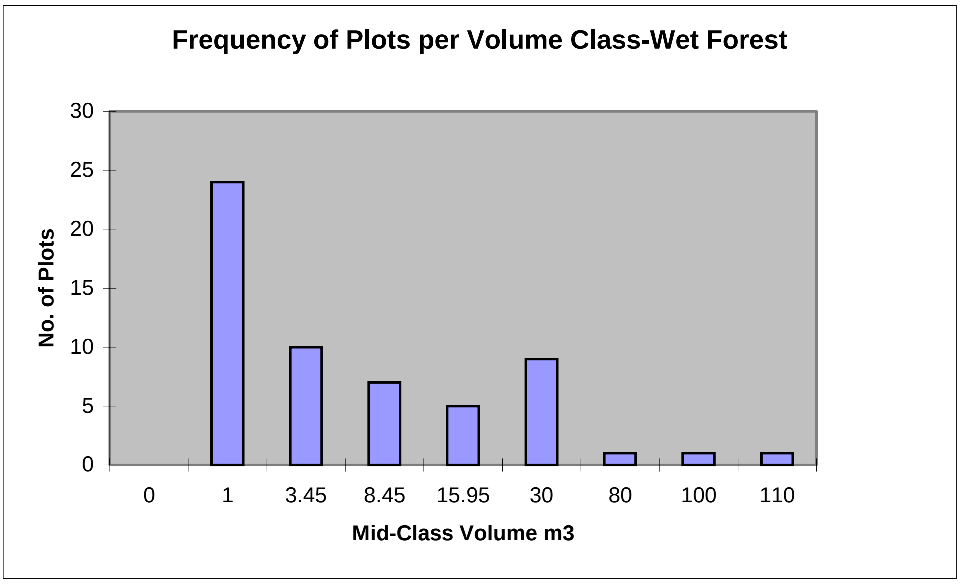
3.1 ASSESSMENT OF THE STANDING VOLUME OF MERCHANTABLE TIMBER ON PRIVATE LAND

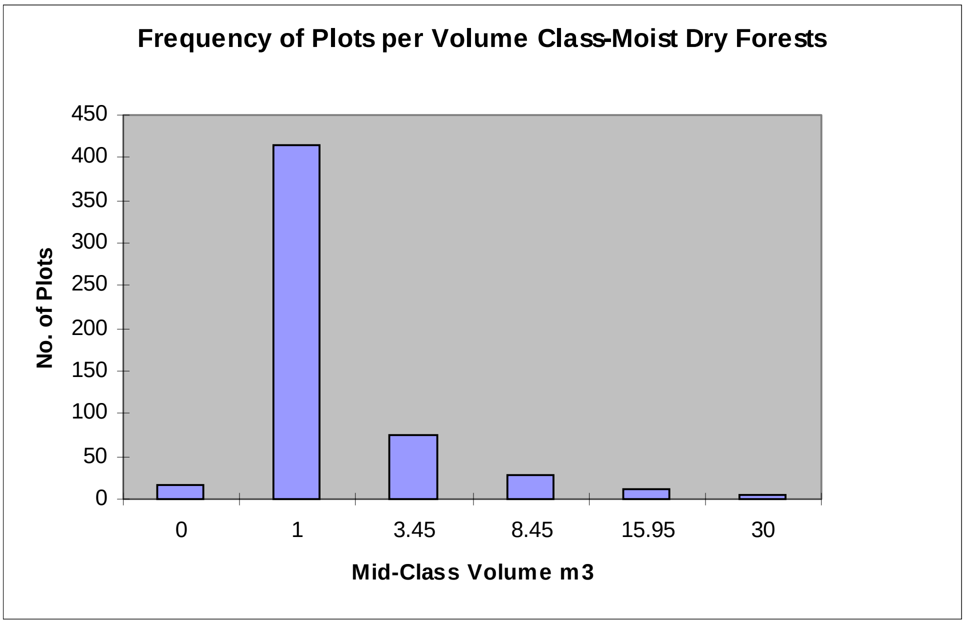
3.1.1 Results.

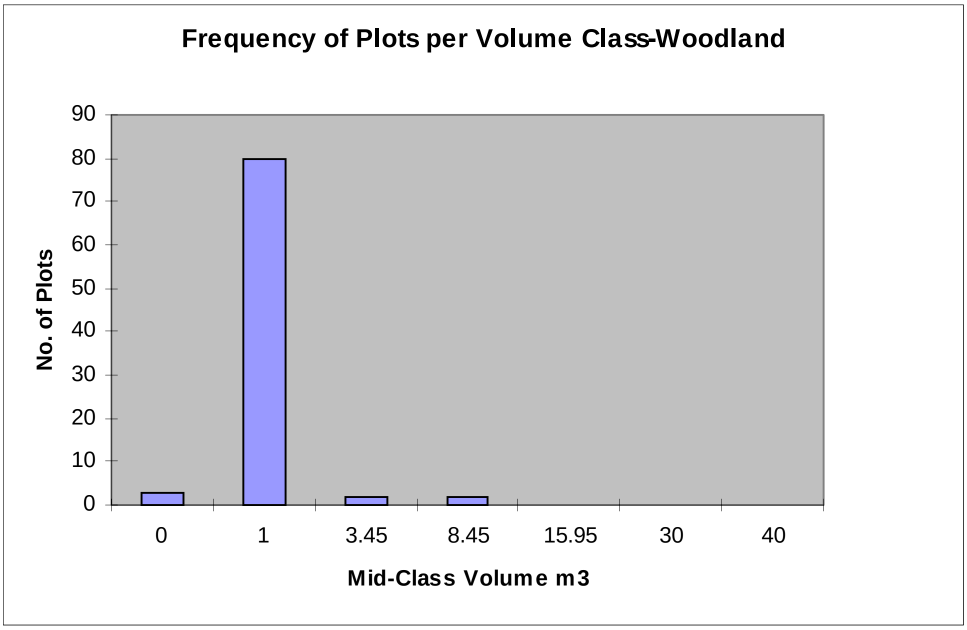
Map 1 displays the location of the five forest types into which the results and analysis have been grouped. Figure 3.1 displays the frequency of plots in each volume class by the four productive forest types.

Figure 3.1 Frequency Distribution Graphs of Visual Assessment Data.




Frequency of Plots per Volume Class-Wet Forest
No. of Plots
30
25
20
15
10
5
0
0
1
3.45
8.45
15.95
30
80
100
110
Mid-Class Volume m3


Frequency of Plots per Volume Class-Moist Dry Forests
No. of Plots
450
400
350
300
250
200
150
100
50
0
0
1
3.45
8.45
15.95
30
Mid-Class Volume m3


Frequency of Plots per Volume Class-Woodland
No. of Plots
90
80
70
60
50
40
30
20
10
0
0
1
3.45
8.45
15.95
30
40
Mid-Class Volume m3

The statistics that were calculated for each forest type included the mean and 95 per cent confidence interval, the median and the mode. As can be seen from Figure 3.1, the data is not normally distributed. In addition, even when individual forest types are grouped there is a large amount of variation within some of the forest groups leading several of the means to have quite large confidence intervals. Where this is the case the median and the mode may provide better estimates of the average.

The volume data collected during the project can be considered in two ways. The first includes the plots with less than 2 m^3/ha of timber present, that being the total standing volume. The second includes only those plots which had more than 2 m^3/ha, those being areas that are considered to contain merchantable volumes based on current harvesting practices.

Of the total number of plots assessed, 80 per cent fell into the less than 2 m^3/ha class which would indicate that the majority of the private native forest could not be considered to have a merchantable standing sawlog volume at this point in time.

The data displayed in Table 3.1 indicates that the median and mode for most of the forest types occurs in the less than 2 m^3/ha range for the standing volume of the total area. The rainforest and wet forest each had some plots with large volumes of timber and this increased their means and resulted in broader confidence intervals.

Table 3.1 Statistics for Standing Volume (m^3/ha) for Forest Types Grouped into Four Classes (Total Area).

Forest type	No. of plots	Mean	95% C.I.	Mode	Median
Rainforest	26	16.35	20.54	1	1
Wet forest	58	13.06	5.89	1	3.45
Moist dry	550	2.21	0.30	1	1
Woodland	87	1.19	0.26	1	1

The data displayed in Table 3.2 only shows the statistics for those plots which had standing volumes greater than 2 m^3/ha. The mode value for each of the forest types for this data set all fell in the 2–4.9 m^3/ha class, except for rainforest which only had three plots with greater than 2 m^3/ha, one in the 20–40 m^3/ha class and others in the greater than 40 m^3/ha class. The mean values were higher, but again they had broad confidence intervals. These large confidence intervals are a result of the data distributions not being normal, the fact that there are large variations in volumes present within the forest types, and because of the small number of plots in some of the forest types.

Table 3.2 Statistics for Standing Volume (m^3/ha) for Forest Types Grouped into Four Classes (Merchantable Area).

Forest type	No. of plots	Mean	95% C.I.	Mode	Median
Rainforest	3	135	228.03	> 40	175
Wet Forest	34	21.57	9.15	3.45	12.20
Moist Dry	119	6.74	1.07	3.45	3.45
Woodland	4	5.95	4.59	3.45, 8.45	5.95

The proportion of merchantable plots varies between forest types, with the highest proportion of merchantable plots found in the wet forest type and the lowest proportion found in woodland. The proportions are presented in Table 3.3 by percentage and area.

Table 3.3 Total and merchantable area by forest type (ha).

Forest type	Total area	Merchantable area	% Merchantable
Rainforest	104 694	12 080	12
Wet forest	38 229	22 410	59
Moist dry forest	833 732	180 389	22
Woodland	327 696	15 066	5
Non productive	55 153	0	0
Total	**1 359 503**	**229 946**	**17**

Volume by forest type is estimated by multiplying the plot statistics by area. These are presented in Tables 3.4 and 3.5. Volume estimates for the rainforest type should be used with caution for a number of reasons:

- the small sample size
- the large projected area of this forest type (the remnant vegetation mapping mapped only 70 000 ha of this forest type on these tenures)
- the current harvesting of rainforest species is limited. From sawmill returns it is estimated that rainforest comprises only seven per cent of the total cut from private native forests in Queensland.

As a result, totals in tables 3.4 and 3.5 have also been reported with Rainforest excluded.

Table 3.4 Total standing volume in each forest type using a range of statistics (m^3).

Forest type	Area	Mean	*Minimum*	*Maximum*	Mode	Median
Rainforest	104,694	1,711,739	0	3,862,143	104,694	104,694
Wet forest	38,229	499,268	274,101	724,436	38,229	131,889
Moist dry forests	833,732	1,842,547	1,592,427	2,092,666	833,732	833,732
Woodland	327,696	389,959	304,758	475,160	327,696	327,696
Non productive	55,153	na	na	Na	na	na
Total	**1,359,503**	**4,443,513**	**2,171,286**	**7,154,405**	**1,304,350**	**1,398,011**
Tot without RF	*1,254,809*	*2,731,774*	*2,171,286*	*3,292,262*	*1,199,657*	*1,293,317*

Table 3.5 Merchantable volume (containing only areas with volumes > $2m^3$/ha) in each forest type using a range of statistics (m^3).

Forest type	Area	Mean	*Minimum*	*Maximum*	Mode	Median
Rainforest	12,080	1,630,803	0	4,385,409	na	2,114,003
Wet forest	22,410	483,384	278,332	688,435	77,314	273,402
Moist dry	180,389	1,215,823	1,022,807	1,408,840	622,343	622,343
Woodland	15,066	89,646	20,490	158,801	na	89,646
Total	**284,106**	**3,419,655**	**1,321,629**	**6,641,485**	**na**	**3,099,394**
Tot without RF	*217,866*	*1,788,853*	*1,321,629*	*2,256,076*	*na*	*985,390*

Most of the forest assessed had been logged recently (greater than 10 but less than 40 years ago) or very recently (less than 10 years ago). This supports the observation that about half of the forests assessed is composed of regrowth and half of mature trees, with a small proportion made up of old growth.

A table listing the volumes, which were calculated from the measured plots and the corresponding visual assessment estimates, appears in Appendix I. The Wilcoxon's test for matched pairs was carried out on the data and it was found that there was a significant difference between the median volume of the two samples (calculated T=67, tabulated T>170, at $P<0.05$). For the physically measured plots, the average measured volume was about 60 per cent greater than that of the visually estimated volume.

3.1.2 Discussion

In summarising the standing private native forest resource, it is recommended that only those stands with merchantable volumes be considered. However, it should be noted that some mills might consider harvesting areas with less than 2 m^3/ha and trees smaller than 40 cm DBH. These calculations are thought to provide a conservative estimate of total merchantable volume. In addition, the estimates of rainforest volumes are considered unreliable and are not recommended for use.

The results indicate that over 80 per cent of the study area does not contain viable volumes of sawlogs. Of the 17 per cent that contained volumes greater than 2 m^3/ha, the majority consisted of moist dry forests. The volume in merchantable stands shows that these forests contained small standing volumes of timber per unit area, with most plots falling in the 2–4.9 m^3/ha class. These drier forest types would have been logged quite heavily as they contain species such as spotted gum and white mahogany, which are favoured species by the timber industry. As these forests are drier they are also slower growing which would lead them to have lower standing volumes depending on the time since logged. Wet forest had a higher proportion of plots that contained larger volumes of standing timber per unit area. This forest type also had a large standard error, indicating that there is a large variation in the standing volumes. This variation would in part be attributed to the differences in logging and management history which exist for each site and because of the higher potential volume that could be standing in this forest type.

A significant difference between the visually assessed and measured plots was confirmed by the Wilcoxon's test for matched pairs, with the measurements estimating on average 60 per cent more volume than the visual estimate. There would be several reasons to account for this difference. The visual assessments were completed looking at the forest as a whole; that is the vista that was presented to the assessors at the plot. The size of the area sampled during the measured assessments in comparison is quite small (0.2 of a hectare). This could lead to one or two large trees being included in the measured plots, which may have been unusual for that area of forest as a whole. This would then produce an overestimate of the volume of timber present. Turner (1997), reported that volumes that are actually harvested are consistently less than those assessed using DPI–F methods (which were also used in this project). This may be related to difficulties in estimating the merchantability of standing trees or due to modelling methods. Another explanation for the difference between visual and measured estimates would be that the assessors would instinctively be conservative in their estimates. In most cases the visual assessor would err on the side of caution and underestimate the volume of timber present rather than overestimate. This discrepancy indicates that the standing volume may be significantly underestimated. However, the major point to note is that the volume estimates should be used with caution.

There are some assumptions in the method used for this project that need to be considered when using these results. These include the accuracy of roadside assessments to estimate the volume of native forest on private land. It is possible that the native forest which occurs near the roadside is not representative of the forest which occurs over the whole of the property. It is possible that roadsides would tend to be more heavily harvested, due to accessibility, slopes (roads tend to avoid very steep country) and visibility (more people are likely to know about a resource located near a road). The method did not allow for this difference to be assessed.

The assessment did not take into account the conservation status of the various ecosystems present on private land. Although currently available for logging, ideally ecosystems such as rainforest and those that are ‘endangered’ or ‘of concern’ would be excluded from harvesting. In SEQ the total area of ‘endangered’ ecosystems outside national parks and State forests is 64 000 ha and the area of ‘of concern’ ecosystems is 220 000 ha. High proportions of these areas are found on the tenures assessed.

There was also a total of approximately 6000 ha of land dedicated to nature refuges at the end of 1997 which would similarly be unavailable for harvesting. When carrying out the measurements at one of the plots it was found from talking to the landowner that the property had a nature refuge declaration over it.

Access to private property, time and cost constraints were the major reasons for proceeding with a method based predominantly on visual assessment. As the assessment was of privately owned native forest, permission was required before assessors could access private property. Given the number of plots that needed to be assessed, the logistics involved in gaining permission from hundreds of landholders meant that roadside assessments were the only realistic option for gathering the data required. The method was considered consistent with the data quality likely to be achieved without an order of magnitude increase in resources.

The consultants submitted a summary of observations made while carrying out the project which highlights many features of private native forests and some of the problems they faced when carrying out the assessment. They found that many areas of private native forests exist on small rural subdivisions which are either unlikely to be logged or likely to be cleared. Five percent of assessed plots contained comments referring to the fact that the plot was located on a subdivision. The consultants had trouble accessing many of the sample points because of locked gates across gazetted roads or ‘keep out’ signs.

They observed that there was a lot of evidence of current and very recent logging in the Murgon, Gayndah and Maryborough areas, with very little recent logging in the south and not many areas being logged in the northern areas. The consultants identified some excellent stands of forest red gum in the north; a forest type considered ‘of concern’. They also found spotted gum areas which had excellent regeneration following clearing, and other areas which had been selectively cleared, retaining stands of high value poles. It was also mentioned that there was a lot of timber in the 20–40 cm DBH class. This timber was not included in the visual assessment and is not currently within the DPI–F specifications for sawlogs, but it may be harvested as sawlogs by some timber mills. With suitable management, the timber in this size class could grow to become a valuable source of timber in the future. After referring to the plot sheets it was found that almost half of the plots contained minor forest products, some of which may grow into sawlogs.

The measured plots were not completed and analysed until all the visual assessment plots had been completed. It would have been better if the measured plots had been completed at the same time as the visual assessments or near the start of the project. This would have enabled the assessors to gauge how accurate their visual estimates were early in the project and provide them with feedback regarding the accuracy of their assessments as the project progressed.

3.2 MODELLED PRODUCTIVITY

The results indicate that a significant relationship exists between the estimates for MAI for each MUID and its environmental descriptors. Of the 45 candidate variables and variance-covariates, 26 were significant for at least their highest order polynomials. These included three substrate attributes, 15 climatic or topographic factors, and eight covariates. Polynomial combinations were also significant for some of these variables. These factors and covariates explain about 69 per cent of the variance for the relationship between MAI and the environment of MUIDS. This provides a relatively high level of confidence in the sustained yield estimates in comparison with the standing volume estimates. Further analysis of the modelling is presented in Appendix F.

Table 3.6 displays the results of the spatial modelling, with these multiplied out to estimate potential annual volume. The areas of each forest type predicted to have high, medium, low and unknown productivity are presented in Map 2.

Table 3.6: Total area, modelled MAI and potential annual volume for Each Forest Type in Each Productivity Class.

Forest type	High	Medium	Low	Unknown *	Total
a. Total area (ha)					
Wet forest	232	28,388	3,099	6,509	38,229
Moist dry forest	2,982	246,149	551,564	33,037	833,732
Woodland	2,112	69,097	230,572	25,915	327,696
Total area	5,326	343,634	785,235	65,462	1,199,657
b. Modelled average MAI (m^3/ha/ann)					
Wet forest	1.25	0.48	0.04	0.44	
Moist dry forest	1.26	0.45	0.05	0.18	
Woodland	1.27	0.45	0.05	0.15	
c. Total potential annual volume (m^3/ann)					
Wet forest	289	13,577	133	2,873	16,872
Moist dry forest	3,753	111,822	27,578	5,907	149,060
Woodland	2,685	31,428	11,529	3,919	49,561
Total volume	**6,728**	**156,827**	**39,240**	**12,699**	**215,493**

* MAI for area of 'Unknown' productivity taken as the average MAI (weighted by area) for that forest type.

The predicted potential annual yield assumes that all available private native forests are grown for timber production. This assumes that the forests are managed in a similar manner to those on State forests. The predicted annual yield for Wet Forests was estimated to be around 17 000 m^3, for moist dry forests 149 000 m^3 and for Woodland, 50 000 m^3. This gives a total predicted annual yield from private native forests in SEQ of 216 000 m^3, excluding rainforest areas.

The actual area that is likely to attain such potential is somewhat less than the total area. The total area would be reduced by areas that landowners do not wish to harvest, and areas that are retained in an unproductive state for wood production (e.g. to optimise grazing potential). It would also be reduced by environmental considerations and desirably by forest types of conservation significance. If one assumes that 50 per cent of the total private forest area were to grow at the predicted rates and be available for timber harvesting, this would result in an average annual yield of around 108,000 m^3. If only areas that currently contain merchantable volumes are assumed to contribute to the sustainable yield, predicted annual yield would fall to around 45 000 m^3.

The reported cut from private native forests in SEQ is 210 182 m^3 for 1995–96 (Project Report SE 2.1). This figure includes some volume that comes from outside the SEQ region.

Recognising the limitations of the modelling, the current levels of harvest from private native forests clearly appear to be unsustainable in the long term. Given the current importance of the private native forest resource to the timber industry, and its potentially greater importance in the future, there is an obvious need for considerable effort to ensure it is managed in a productive and sustainable manner. As a result of greater landowner input and fewer environmental restrictions, the private resource offers opportunities for more intensive management than State forests. This may provide opportunities for increasing yields beyond those predicted. However, an immediate reduction in the level of harvest of private forests is essential to avoid the imminent exhaustion of the private native forest resource.

3.3 REVIEW OF LAND CLEARING

The SLATS (1987) analysis identified clearing within the SEQ RFA region as occurring at a rate of approximately 8170 ha/ann. This included all forest types (i.e. native, regrowth and exotic etc.) on all tenures. Pine salvage operations after the November 1994 wildfires that occurred to the west of Bribie Island led to a large area of State forest being cleared in this period. With State forest excluded, an average of 5780 ha was cleared per annum. This represents a rate of approximately 0.3 per cent per annum.

The Queensland Herbarium (unpubl.) identified clearing of approximately 26 000 ha of remnant vegetation over a two year period (i.e. 13 000 ha/ann) across all tenures. Remnant vegetation includes only native forest, and does not include heavily disturbed or regrowth forests. The area of remnant forest on freehold and all leasehold land (i.e. with and without Crown timber rights) was approximately 1.47 million ha in 1995 (from SE 1.2 *Public Forest Resource Description and Inventory*). Approximately 23 000 ha of clearing occurred over the two years on freehold land with a further 500 ha of clearing on leasehold land. Together this represents a clearing rate of approximately 0.8 per cent per annum.

The clearing rates between 1991–1995 and 1995–1997 are substantially different, with a much higher rate over the last two years (≈ 12 000 ha/ann) than in the previous four years (≈ 6,000 ha/ann). In addition, since the clearing rate for the last two years includes only remnant vegetation, the difference between the two rates is likely to be even greater.

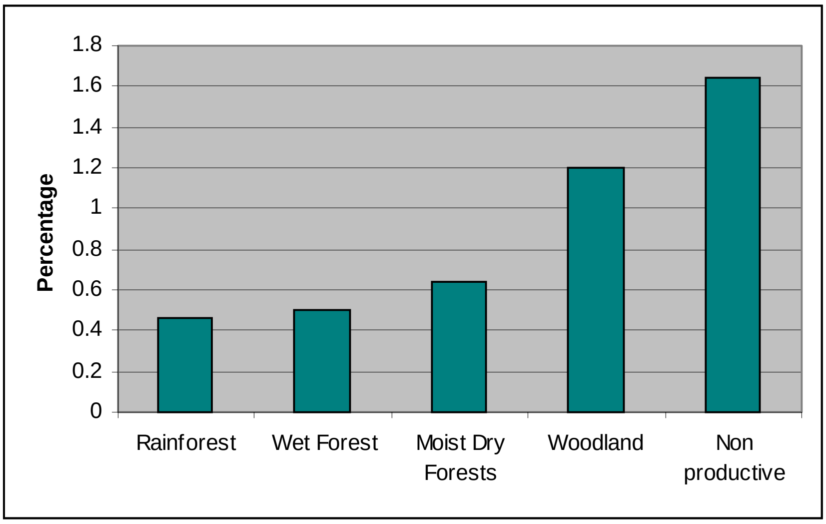
Table 3.7 presents the results of analysis of clearing rates over the last two years on freehold and all leasehold land classified into the five broad forest types used in other parts of the report. The majority of clearing is occurring in the moist dry forest type that occurs over approximately 60 per cent of the region and contributes the greatest standing merchantable volume; and the woodland forest type which occurs over approximately 25 per cent of the region. However, the rate of clearing is actually highest in the least productive forest types of woodland and unproductive (Figure 3.2).

Table 3.7 Analysis of annual clearing of remnant vegetation on freehold and all leasehold lands in SEQ by broad forest type and estimated impact on standing merchantable and potential annual volumes.

Forest type	Area cleared (ha)	Approximate* rate of clearing	Estimated** standing merchantable volume	Estimated** potential annual volume
Rainforest	523	0.46	*8,139****	Na
Wet forest	208	0.50	2,626	92
Moist dry	5,790	0.64	8,444	1,035
Woodland	4,248	1.20	1,162	642
Unproductive	978	1.65	0	0
Total	**11,747**	**0.80**	**12,232****	**1,769**

* Clearing rate is approximate only. Total area of remnant vegetation (1.47 million ha) for these tenures was derived from SE 1.2 and distributed across forest types according to proportions in Table 3.4.
** Volumes calculate using mean standing merchantable volume (derived from Table 3.5) and mean MAI (derived from Table 3.6) by forest type.
*** Estimated standing volume for rainforest considered unreliable and not included in total.

Figure 3.2 Approximate rate of clearing by forest type on freehold and all leasehold land.



Extrapolation of the 1995 – 1997 clearing rates for even 20 years would see the area of remnant vegetation fall by 16 per cent. The clearing data reported from both sources represent only the shift from forested to cleared land over the periods and do not consider recruitment of regrowth forests. SLATS (1997) reports that *"…analysis of central Queensland [LANDSAT] scenes indicate that regrowth may be occurring at a rate of approximately 43 % of the clearing rate, although the estimate has a high degree of uncertainty*". Whilst central Queensland data may have limited relevance to SEQ, it does indicate that cleared land frequently returns to a forested state. This is supported by observations during the field assessment of standing volume that a large proportion of plots fell within regrowth forest. The extent of regrowth in SEQ has not been analysed.

3.4 REVIEW OF RESOURCE AVAILABILITY

The availability of native forest resources from private sources to the timber industry depends greatly on landholder perceptions of the commercial value of their resource and their attitudes towards harvesting. This was assessed using a number of information sources.

Appendix G details the range of people consulted to obtain their understanding of landholders intentions towards the private native forest on their properties. In the course of field surveys, several landholders were questioned about their intentions towards their native forest. A report titled *Survey of Trees on Australian Farms: 1993–94* (ABARE 1995) provided some information relating to the proportion of land holders who were planning to clear native forest which they had on their land. The results of the sawmill survey supplement were analysed and summarised. This summary appears in Appendix H.

The landholders of SEQ are reported to have many different views towards the native forest on their properties. Some of the commonly held views are that native forest:

- is a hindrance to other potential land uses
- is a resource which can be capitalised on while clearing their land for other agricultural purposes
- should be retained for conservation and wildlife habitat purposes
- is a resource that can be used to supply on-site timber needs
- is a resource which can be sustainably managed for timber production.

The farm forestry survey indicated that of the 96 landholders that responded, 60 had native forests on their property. Fifty two percent of these manage at least part of their forest for ongoing wood production. The forest areas managed by the respondents were evenly distributed between less than 10 ha, 10 to 50 ha and greater than 50 ha classes. Of the 60 respondents with native forests, 25 per cent have sold wood in the last five years. A total of 52 per cent indicated some intention to sell in the future, however these were not necessarily the same respondents managing for ongoing wood production. Some respondents indicated that they used the native forest products on their properties.

It was thought by most of those consulted that there is great potential for landholders to successfully manage their native forests for sustained timber production. By doing this they would be able to supplement their farm incomes with timber sales and provide themselves with some form of income diversification. There seem to be many factors though that are discouraging landholders from taking up the management of their native forests for sustained timber production.

A number of extension officers reported that one of the main reasons is a lack of information. Landholders require silvicultural, market and economic information before they can make informed decisions regarding the management of their native forests for sustained timber production. As was noted during the assessment of standing timber, there was a large proportion of potential resource that fell into the 20–40 cm DBH category. These areas could be managed more actively for wood production through better selection of retained trees or even the application of silvicultural practices such as thinning. Before landholders will spend money or time on these types of activities the economic benefits of doing so must be clear. This requires information being presented to landholders describing the potential returns expected from native forests given their particular situation, taking into account various management regimes, the timber being produced, the market value of the timber and the proximity of the property to timber markets.

Anecdotal reports claimed that many landholders who had sold timber from their native forests felt unfairly exploited by the sawmills. From the farm forestry survey, seven out of the 15 respondents who had sold timber in the last five years, indicated that they were satisfied with the returns, and three were unsatisfied. This is thought to be either because landholders did not know the true value of their timber when harvested or had unrealistic ideas of what their timber was worth. Many landholders who have been disappointed with their returns have put the harvested land under pasture instead of letting it regenerate, as they believe that this is a more productive use of their land. It was also reported that there is a perception that prices are kept low because the government holds timber prices to levels that encourage the sawmilling industry to expand and create jobs. A few landholders have also expressed displeasure at how their land was left after harvesting and that this is discouraging them from allowing future harvesting operations on their property.

Another reason that landholders may be reluctant to manage their native forests for timber production is uncertainty about future government actions that may restrict their ability to harvest their timber. The vast majority of respondents to the farm forestry survey indicated this as an important consideration. Some local governments have vegetation preservation orders that may have some impact on whether or not areas could be harvested. Consistent information regarding tree clearing guidelines needs to be produced to give private forest owners the security required to promote investment in the management of this resource. This finding is consistent with those presented by Alexandra and Hall (1988), who recommend that a uniform national approach to the introduction of simple and effective tree tenure legislation, and systems which guarantee rights to harvest should be introduced in a move to overcome concerns about security and tenure.

Insecurity over harvest rights was also identified as a concern in Harrison *et al's* presentation to the Managing and Growing Trees Training Conference held in Bundaberg in 1996. Harrison *et al* (1996), suggest recording areas planted on property title deeds and providing an assurance of adequate compensation in the event that logging is not allowed in an effort to reduce concerns over sovereign risk. There is probably even greater uncertainty over rights to harvest native stands. It is also suggested that more favourable taxation provisions would be beneficial in encouraging landholders to manage their land for timber production.

The results of the sawmill survey supplement showed that the majority of sawmillers felt that the area of private native forest in SEQ was decreasing. The majority of respondents thought that timber coming from private native forest was now predominantly small diameters and regrowth trees. About half of respondents believe that they will be able to get the current levels of timber supplies from private native forest for the next 10–20 years. An interesting finding of the sawmill survey was that on average, sawmillers thought that 62 per cent of private forests were harvested as part of ongoing management for wood production. Clearing and thinning to improve grazing only accounted for 30 per cent of private forest harvesting according to the sawmillers surveyed. This would indicate that sawmillers believe that a large proportion of land owners who sell timber to sawmills are managing their stands for wood production, while most other sources expressed the view that only a limited number of landholders had any interest in managing or sustaining the resource.

This assessment method provides no indication of the proportion of the private native forest that may be available for timber production. Results of the ABARE sawmill survey probably provide the greatest indication of availability, that being that 50 per cent of sawmillers surveyed believed that current volumes would be available for the next 10–20 years or longer and that there was an equal level of agreement and disagreement on the ability of private forests to supply needs. However this must be strongly qualified by the general agreement that the resource has changed in size class, but not necessarily in quality. Thus on extrapolation, 50 per cent of respondents indicated that without significant change in industry structure the current level of private resource being used by industry of approximately 210 182 m^3/year (1995–96) will be available for the next 10 years or more. Significant changes in resource available from public forests, eg. as a result of the RFA, will influence demand for resource from private forest sources.

From the ABARE report *Trees On Australian Farms* it was found that 11 per cent of Queensland farms were using native forest for sawlog production and 28 per cent were utilising it for other forest products. In Queensland's high rainfall zone five per cent of farmers were planning to clear native forests and woodlands in the five years 1994–95 to 1998–99. Unfortunately no information was collected on landholders reasons for clearing so it is not possible to conclude what the future use of this cleared land will be.

3.5 DESCRIPTION OF THE PRIVATE PLANTATION RESOURCE

There are three private plantations within the SEQ bioregion that are of a scale that would be considered commercial and of significant wood flow. Table 3.8 summarises the three plantations.

Table 3.8 Summary of the Three Commercial Private Plantations in SEQ.

Location	Species/ age	Area (ha)	Utilisation
Tamborine	Slash Pine(planted evenly 1967–1979)	1450	Veneer, export chip
Caboolture	Slash Pine	approx 10 000	Sawlog, veneer, export chip
Nth of Bundaberg	Slash Pine(planted 1982–1983)	1000	Not yet utilised

The National Plantation Inventory (NFI, 1997) reports an additional 2000 ha of Slash Pine and 1000 ha of Radiata Pine from within a region approximating the SEQ RFA region. The Radiata Pine actually falls outside of the SEQ RFA region.

If the forests reported in table 3.8 are assumed to be growing at a MAI of 12 m^3/ha/yr (the current approximate MAI of DPI–F's exotic plantations), they would represent an annual yield of approximately 150 000 m^3. However, a high proportion of the Tamborine and Caboolture resources are expected to be liquidated over the next 10 years, some for residential development.

Other minor private plantations exist within SEQ, commonly assisted by government agencies under various assistance schemes. Many of these plantations are established for purposes other than timber but may have an expectation of an opportunity crop of timber. The majority of these plantations are less than 10 ha in area and individually are viewed as of minor significance to the timber industry. There is currently little understanding of the combined potential resource of these plantings.

4. RECOMENDATIONS FOR FURTHER WORK

4.1 STANDING VOLUME OF TIMBER ON PRIVATE LAND

The methods used for this assessment were subject to limited time and resources. However they do provide a useful guide to the state of the resource and highlight areas in the method that could be improved to obtain a more accurate estimate of standing volume. In particular, these relate to the resource stratification and the field measurement technique.

For a more accurate estimate of the size of the timber resource present on private land, the stratification should consider management history and requires more accurate forest typing (which is now available). Air photo interpretation may provide opportunities to obtain a basic understanding of management history. The sampling strategy also needs to cover the whole private native forest resource instead of only the resource that is present along public roads.

In addition to improved stratification, the field assessment would need to be predominantly based on measured plots, using either the DPI–F temporary plot assessment method or a hardwood MARVL-type inventory. This would reduce the reliance on skilled timber assessors and the subjectiveness which is present in the visual assessments. Smaller diameter trees should also be measured to obtain an idea of the potential sawlog resource.

To carry out these recommendations would require substantial resources for API, field assessment, and extensive consultation with landholders to obtain their support for the project and to gain permission to enter properties.

4.2 PRODUCTIVITY

More detailed modelling would provide opportunities for improving the estimation of potential productivity. The use of permanent plot data rather than SKED outputs as a basis for productivity could improve the accuracy of the modelling.

However, to obtain a more accurate estimate of the productivity of private native forests, permanent growth plots would need to be established in representative areas under management regimes applied to private forests. This is intended by DNR as part of the commitment to monitoring under the Montreal Process.

4.3 LAND CLEARING

Further analysis of land clearing should focus on reconciling clearing rates from various data sources and specific analysis of the tenures in question. Regrowth can in time contribute to timber yield from private land and this requires investigation.

4.4 AVAILABILITY

This project has identified that there is a lack of quantitative data relating to landholder intentions towards the native forest on their land. To fill this information gap a survey is suggested that aims to measure the attitudes of landholders towards their native forests and their intentions towards its use. The sampling strategy would need to be developed so that the range of landholder views and intentions were represented, requiring a large sample to be drawn upon and, if possible, linked to the assessment of native forests on private land. If a survey of this kind were carried out it would provide a snapshot of landholder intentions. As the ownership of property can change, as can government policies relating to taxation, land clearing etc., so would the intentions and attitudes towards the private native forest resource. To obtain an understanding of the implications of government policies, landholders may need to respond to alternative scenarios.

Several issues have been raised which have been identified as discouraging landholders from adopting the management of their native forest resource for sustained timber production. If it is seen as being advantageous to have landholders involved in sustained timber production then these issues need to be addressed. In summary, landholders require information on silvicultural practices, economics and markets. They also require the security of harvesting rights to encourage investment in the management of private native forests.

4.5 PRIVATE PLANTATION RESOURCE

To obtain a greater understanding of the private plantation resource, further consultation with the plantation owners would be required. Details required would include accurate area statements, year of planting by area, growth rates and importantly management intent.

Given the current interest in encouraging landowners to establish plantations, it would be important in any further investigation into the private plantation resource to take small holdings into consideration. As the number of these small holdings increases, so too will their importance to the timber industry.

5. CONCLUSIONS

5.1 PRIVATE NATIVE FORESTS

The total area of private native forest in SEQ is estimated to be 1.4 million ha. This project has found that 1.1 million ha (83 per cent) of the study area is carrying less than 2 m^3/ha of standing sawlog volume. Of the 230 000 ha (17 per cent) of the area which is carrying larger volumes the majority (78 per cent) are moist and dry forest types which are mostly carrying between 2 and 4.9 m^3/ha. The wetter forest types were generally carrying larger volumes of timber with some sites carrying extremely large volumes. The total standing volume of harvestable timber in SEQ on private land (excluding rainforest) is estimated to be 2.7 million m^3. Of this, only 1.8 million m^3 is in stands considered merchantable. Most indications are that this is likely to be a conservative estimate of standing volume. However, it is important to consider the limitations of the methods when using this information.

Application of MAI modelled from State forest data indicates that of the native hardwood forests, 0.5 per cent, 30 per cent and 69 per cent respectively are in the high, medium and low productivity classes. The productivity of rainforest on private land could not be estimated due to a lack of data. The medium productivity forests are projected to provide 78 per cent of the total potential annual sawlog yield due to their extent.

The potential annual yield of timber from the total area of private native forests in SEQ was estimated to be 215 000 m^3. If half of this potential were realised (e.g. half the area managed for long term wood production), approximately 108 000 m^3 would be available on an annual basis. If just the area currently containing merchantable standing volumes were to contribute, only 45 000 m^3 would be available each year. This compares with the 210 182 m^3 cut from private forests in 1995/96. Recognising the limitations of the methods, there is clearly a need for immediate action to address the discrepancy between the current harvest and projected yields.

Land clearing has been reported from two sources to be occurring at a rate of approximately 0.3 per cent per annum and 0.8 per cent per annum across the SEQ RFA region. The largest area of clearing is occurring in the moist dry and woodland forest types representing approximately 60 per cent and 25 per cent of the private forest resource respectively. However, the greatest rates of clearing are occurring on the woodland and unproductive forest types. A clearing rate of 0.8 per cent is estimated to reduce standing merchantable volume by approximately 12 000 m^3 each year and potential annual yield by 1800 m^3/ann each year. Whilst neither of the available clearing rates include regrowth of cleared land back to a forested state, they clearly have implications for the long term supply of wood from private native forests.

Private forest owners in SEQ possess a wide range of views regarding the potential economic uses of native forests that they have on their properties. The method provided little quantitative data on availability apart from the sawmiller survey, which indicated that half of the sawmillers believed that the current level of private resource would be available for the next 10 years or more. Having spoken to various extension officers and landholders, several issues were identified that are preventing more landholders from actively managing their forests for sustained timber production.

These include a lack of information regarding silviculture, economics and marketing as well as an uncertainty about future government decisions regarding harvesting rights.

5.2 PRIVATE PLANTATION RESOURCE

There were three areas of privately owned plantations that were considered large enough to be important to wood flow for the timber industry. These were all slash pine plantations and covered a combined area of about 12 450 ha. These plantations were being grown to provide sawlogs, veneer and export chips. The predicted annual yield from these plantations is approximately 150 000 m^3.

APPENDICES

APPENDIX A Project Specifications

CRA/RFA PROJECT SPECIFICATION

PROJECT NAME: **Private forest inventories**

PROJECT IDENTIFIER: **SE 1.4**

LOCATION/EXTENT: **SEQ biogeographic region**

ORGANISATION/S: **DNR**
DPI–Forestry
BRS

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LINKAGES/DEPENDENCIES:

Concurrent:

BD 9 Forest Community Mapping (provides the basis for standard forest typing between timber resources and biodiversity analysis).
BD 11 Old Growth Forest Mapping (may assist stratification and provide useful disturbance data).

Successors:

SE 2.3 Development of FORUM for W&WP industries (highly dependent on SE 1.4 for base data sets)
SE 2.4 Regional significance of timber industry (related data set)
SE 5.2 Regional Social Profile Analysis (limited linkages)
PI 2 Integration of socio-economic layers (SE 1.4 provides base data set)
PI 5.3 Broad Economic Assessments (linkages from SE 2.3)
PI 6 Timber industry development options (SE 1.4 provides base data set)

TYPE OF STUDY: Resource

1. OBJECTIVES OF THE PROJECT

- To assess and describe the privately owned native forest resources in SEQ, with particular reference to those factors relevant to commercial wood production.
- To assess and describe the privately owned commercial wood production plantation resource in SEQ
- Project addresses clause 4 of the Scoping Agreement

2. BACKGROUND

The private native forest resource in SEQ currently supplies more than half of the native forest timber harvested annually in the region. While the Forest Community Mapping project will describe the extent of particular forest types, there are no existing databases adequately describing the availability or productivity (e.g. growing stock, potential yield, management intent of landholders) of the approximate 2.8 million hectares of private native forest estate in the region. Such a resource description and inventory is necessary if the true extent and productive potential of the resource base is to be input into the economic and social assessments.

The private commercial plantation resource is currently of limited extent in SEQ. However, the extent of this resource needs to be assessed in order to develop a comprehensive overview of the total wood resources available in SEQ.

3. SCOPE OF THE PROJECT

The project will:

- assess and describe the privately owned native forest and plantation resource
- assess standing volume, estimate productivity and aim to understand availability of the private native forest resource
- will include the tenures of freehold and Crown land on which the Crown does not hold timber rights.

4. METHODS

Plantation
Details of the private plantation resource will be extracted from existing databases, particularly the 1995 National Plantation Inventory. CRA unit in DNR will prepare the report.

Native forest
The project will consist of four components, these being:

1. Resource stratification

   Stratification of the private native forest resource will be used for sampling and will provide an overview of the resource according to key parameters that will affect the utility of the forest for wood production, including: size of forest area per holding, site quality and slope.

2. Timber resource extent and productivity assessment

   This component aims to quantify the extent and condition and verify the productivity of the private native forest resource. It will provide an estimate of the gross resource that would potentially be available to the timber industry.

   Sampling points to be identified across the private native forest resource based on the resource stratification. The nearest forested roadside point to be identified as the actual survey point. An estimated 600 points to be identified.

   These points to be visited by an experienced timber assessor and observed from the roadside. The forest to be assessed for forest type, standing volumes and productivity.

3. Modelled productivity

   Extensive data sets that indicate productivity exist for public land, whilst little is known of productivity of private land. Environmental domain data covers all tenures and will be used to extrapolate productivity to private land by modelling the extensive DPI–Forestry permanent plot data or estimated productivity (MAI). Precision of the modelled productivity will be calculated and reported.

4. Review of availability

   This component aims to provide an indication of landholder attitudes towards using their native forest resource for wood production and a guide to the proportion of the potential resource that could be considered available to industry for sustained wood production. In addition, it may be possible to gauge landholder attitudes towards sympathetic management of private forests in this component. This will be undertaken by a review of previous surveys (partic. landcare surveys) and extensive consultation with field extension officers of DPI and DNR. In addition, Sawmill Survey (SE 2.2) to include questions on log supply, log quality, access issues etc. from private forests.

CRA Unit within DNR will prepare the report.

5. CRITICAL PATH

Outcomes/outputs

Outcomes of the project are expected to include:

- estimates of the type and extent of private forest resources (e.g forest type by area, standing volumes) in the region
- predicted potential productivity of private native forest resource
- indication of availability of private forests for sustained wood production
- information on management practices at a broad level
- estimated possible range in quantities of available wood products
- spatial resource maps suitable for economic modelling.

Reporting

Progress reports will be submitted monthly to the Social and Economic Technical Committee.

A final project report on the project outcomes including limitations of the methodology will be submitted to the Steering Committee.

At the end of the project, final data layers will be made available for economic analysis. Preliminary data will be available earlier for exploratory analysis.

6. PERFORMANCE INDICATORS

Performance indicators for this project include:

- the project outcomes are useable for economic analysis
- improvement in the extent and quality of existing information
- completion of the project in timely manner
- funds are properly acquitted.

7. QUALITY CONTROL

The following measures will be implemented to ensure quality:

- Experienced resource assessment project officer to be appointed to undertake project
- Methodological triangulation from field assessment, modelling and landholder attitudes to validate results
- Regular review of project process and outcomes by SE Technical Committee.

APPENDIX B Description of Modelled Vegetation Types and Sampling Intensity

Modelled vegetation type	Description	Commercial importance	Approx. sampling intensity. ha/plot	Number primary plots
1	Rainforest	High	2000	35
2	Areas to north and north-west of bioregion not included in coverage.	High	1000	4
12.18	Rose Gum with Tallowwood and Brush Box	High	1000	4
12.19	Sydney Blue Gum with Tallowwood, White Mahogany, Brush Box and Turpentine	High	2000	8
12.20	Blackbutt with Turpentine and Rose Gum	High	N/A	2
12.21	Brush Box	High	N/A	2
12.24	New England Blackbutt and Sydney Blue Gum	High	2000	40
12.25	Mixed Red bloodwood, Red Mahogany, Turpentine, Tallowwood, Blackbutt, Brush Box and Brown Bloodwood	High	2000	73
12.31	Gympie Messmate with White Mahogany, Tallowwood and Rose Gum	High	2000	5
12.32	Mixed Spotted Gum, Grey Ironbark, Narrow-leaved Red Ironbark, Broad-leaved Red Ironbark with Red Bloodwood, Forest Red Gum, Yellow Box and Grey Box	Medium/high	2000	130
12.33	Mixed White Mahogany, Turpentine and Red Mahogany	High	N/A	4
12.34	Spotted Gum, Forest Red Gum, Grey Box, Red Bloodwood, Queensland Peppermint, White Mahogany and Broad-leaved Red Ironbark	Medium/high	2000	107
12.35	Mixed Spotted Gum, Narrow-leaved Red Ironbark, Gympie Messmate and Brown bloodwood	Medium/high	2000	62
12.38	Mixed Forest Red Gum, Narrow-leaved Red Ironbark and Yellow box	Medium/high	2000	53
12.39	Grey Box (pure stands)	Limited	N/A	2
12.40	Mixed Red Bloodwood, Brown Bloodwood, Scribbly Gum, Red Mahogany, Blackbutt, Turpentine and White Mahogany (coastal).	Medium	6000	8
12.42	Forest Red Gum, Yellow Box	Medium	6000	6
12.49	Narrow-leaved Red Ironbark with Forest Red Gum, Carbeen and Spotted gum	Limited	12000	40
12.53	Red Bloodwood, Queensland Peppermint, Brown Bloodwood	Limited	10000	15

Note:
1. Commercial importance was established using expert knowledge by DPI–F staff.
2. All commercial forest types to have a minimum of 2 plots, some of high importance minimum of four.

APPENDIX C Plot Sheet Proformas Plot Sheet

Visual Assessment Plots – Private forests

Plot Number Assessors:
Nearest town: Date:

GPS AMG: Easting [ ] Northing [ ]

Direction from Road: North [ ] East [ ] South [ ] West [ ]

Forest Type:	primary spp	secondary spp	height	density / leaf size)

Standing sawlog volume category:

< 2 m³/ha	2 – 4.9 m³/ha	5 – 11.9 m³/ha	12 – 19.9 m³/ha	20 – 40 m³/ha	> 40 m³/ha Please estimate

Other products:

	Absent	Present
High value rounds * (subset of S/L vol)		
Minor forest products * (Excluded from S/L vol)		

***High value rounds = Poles/girders**
***Minor forest products = Sleepers/ landscaping/ fencing etc**

Forest condition:

Old Growth / Disturbance	Class	Y/N	Class	Y/N	Class	Y/N
Old growth proportion %	Scenescent		Mature		Regrowth	
Logging disturbance	Absent		Light		Heavy	
Time since last logged	< 10 years		> 10 years		Very old (> 40 years)	
Grazing disturbance	Absent		Light		Heavy	
Fire disturbance	Absent		Light		Heavy	
Treatment	Absent		Light		Heavy	
Other disturbance	Absent		Light		Heavy	

Slope: 0 – 15° [ ] 15 – 25° [ ] > 25° [ ]

Comments:

Plot sheet – measured plots – private forests

Plot number Assessors:
Nearest town: Date:

Plot locations:

Roadside AMG			Easting		Northing	
Subplot 1:	From	Roadside	Bearing		Distance	
Subplot 2:	From		Bearing		Distance	
Subplot 3:	From		Bearing		Distance	
Subplot 4:	From		Bearing		Distance	

Count of Commercial species under 20 cm DBH and greater than 6 m height:

	Subplot 1		Subplot 2		Subplot 3		Subplot 4	
	Eucalypts	Other	Eucalypts	Other	Eucalypts	Other	Eucalypts	Other
Sawlog potential								
No sawlog potential								
Dead								

Forest condition (Complete subsequent subplots only if different from subplot 1):

Old Growth / Disturbance	Class	1	2	3	4	Class	1	2	3	4	Class	1	2	3	4
Old growth class (%)	Scenescent					Mature					Regrowth				
Logging disturbance	Absent					Light					Heavy				
Time since last logged	< 10 years					> 10 years					Very old				
Grazing disturbance	Absent					Light					Heavy				
Fire disturbance	Absent					Light					Heavy				
Treatment	Absent					Light					Heavy				
Other disturbance	Absent					Light					Heavy				

Ground cover:

	Ground cover				Regeneration	
	Bare ground	Litter	Vegetation	Rock	0–1 stem	> 1 stem
Subplot 1						
Subplot 2						
Subplot 3						
Subplot 4						

Disease/ stand health (for full range of plots):

Disease absent / healthy stand	Disease present / some trees in poor health	Disease heavy / many trees in poor condition
☐	☐	☐

Other species in locality:

Comments:

APPENDIX D Summary of Visual Assessment Results

	Modelled vegetation type	Modal volume Class	Mean volume m^3/ha & 95% CI	Mean time since last logged	Old Growth	Mean proportion (%) of Mature	Regrowth
1	Rainforest	1	10.88+ – 11.39	1.31	1.33	19.78	36.67
2		1	2.81+ – 3.84	1.25	0.94	42.19	50.63
18	RSG +/- TWD BBX	1	1.00+ – 0.00	2.75	0.00	20.00	55.00
19	SBG +/- TWD WMY BBX TRP	1,5	25.91+ – 32.41	1.00	4.29	57.86	23.57
20	BBT +/- TRP RSG	1	16.69+ – 28.62	2.30	2.50	58.00	39.50
21	BBX	5	17.98+ – 22.33	3.00	0.00	55.00	20.00
24	Mixed RBW RMY TRP TWD BBT BBX BBW	1	3.01+ – 1.57	2.04	5.73	40.45	53.64
25	Mixed RBW RMY TRP TWD BBT BBX BBW	1	2.92+ – 1.06	2.37	3.98	30.59	55.75
31	GMS +/- PROP WMY TWD RSG	1	1.49+ – 0.74	2.70	3.00	33.00	57.70
32	Mixed SPG GRI NRI BRI others EUG PROP RBW FRG YBX GBX	1	2.03+ – 0.48	2.00	2.37	36.64	57.15
33	Mixed WMY TRP RMY	1	1.00+ – 0.00	0.00	0.00	75.71	10.00
34	SPG FRG GBX RBW QPM WMY BRI	1	1.79+ – 0.37	1.92	4.41	44.34	46.83
35	Mixed SPG NRI LONG GMS BBW	1	2.19+ – 0.82	1.72	2.71	40.65	53.75
38	Mixed FRG NRI YBX BIT	1	1.87+ – 0.67	1.86	1.58	46.21	46.93
39	GBX (pure stands)	1,5	15.50+ – 184.24	3.00	0.00	50.00	0.00
40	Mixed RBW BBW SCG RMY BBT TRP WMY (coastal)	1	0.90+ – 0.23	0.90	5.00	31.00	54.00
42	EUG FRG YBX BIT	1	1.00+ – 0.00	1.50	4.17	62.50	33.33
49	NRI +/- FRG CBN SPG	1	2.42+ – 1.07	2.07	4.29	44.88	43.69
53	RBW QPM BBW others	1	1.12+ – 0.51	1.50	4.25	51.45	39.50
	For an explanation of species see Appendix B.	1=<2m^3/ha 2=2–4.9m^3/ha 3=5–11.9m^3/ha 4=12–19.9m^3/ha 5=20–40m^3/ha 6=>40m^3/ha		1=<10 years 2=>10 years 3=very old (>40 years)			

APPENDIX E Broad Forest Type Descriptions by Regional Ecosystem and Key Species.

Broad forest type	Mapped REs			Key species (from field assessment)	Common names
Rainforest	*12.2.1*	*12.8.13*	*12.11.11*	*Ficcus spp.*	Figwood
	12.2.2	*12.8.18*	*12.11.12*	*Acacia aulacocarpa*	Brown salwood
	12.2.3	*12.8.21*	*12.11.13*	*Grevillea robusta*	Southern silky oak
	12.2.4	*12.8.22*	*12.12.1*	*Flindersia australis*	Crows ash
	12.3.1	*12.9–10.6*	*12.12.13*	*Toona australis*	Red cedar
	12.8.3	*12.9–10.15*	*12.12.16*		
	12.8.4	*12.9–10.16*	*12.12.17*		
	12.8.5	*12.11.1*	*12.12.18*		
	12.8.6	*12.11.4*	*12.12.26*		
	12.8.7	*12.11.10*			
Wet forest	*12.2.8*	*12.8.10*	*12.11.2*	*Eucalyptus grandis*	Rose gum
	12.3.2	*12.8.11*	*12.11.16*	*E. microcorys*	Tallowwood
	12.8.1	*12.8.12*	*12.12.2*	*E. cloeziana*	Gympie messmate
	12.8.2	*12.9–10.1*	*12.12.20*	*E. saligna*	Sydney blue gum
	12.8.8	*12.9–10.14*		*E. pilularis*	Blackbutt
	12.8.9	*12.9–10.20*		*Syncarpia glomulifera*	Turpentine
Moist dry forests	*12.3.3*	*12.9–10.5*	*12.11.19*	*Corymbia citriodora*	Spotted gum
	12.3.7	*12.9–10.9*	*12.12.3*	*E. propinqua*	Grey gum
	12.3.9	*12.9–10.17*	*12.12.4*	*E. tereticornis*	Forest red gum
	12.3.11	*12.9–10.18*	*12.12.5*	*E. acmenoides*	White mahogany
	12.5.1	*12.9–10.21*	*12.12.6*	*E. intermedia*	Red bloodwood
	12.5.6	*12.9–10.23*	*12.12.11*	*E. fibrosa*	Broad leaved red
	12.5.7	*12.11.3*	*12.12.12*		ironbark
	12.5.11	*12.11.5*	*12.12.15*	*E. signata*	Scribbly gum
	12.8.14	*12.11.6*	*12.12.23*	*E. eugenioides*	White stringy bark
	12.8.24	*12.11.9*	*12.12.24*	*E. drepanophylla*	Grey ironbark
	12.8.25	*12.11.15*	*12.12.25*	*E. moluccana*	Grey box
	12.9–10.2	*12.11.17*	*12.12.27*		
Woodland	*12.2.5*	*12.8.16*	*12.11.8*	*Angophora floribunda*	Rough barked
	12.2.6	*12.8.17*	*12.11.14*		apple
	12.2.11	*12.8.20*	*12.11.18*	*A. leiocarpa*	Smooth barked
	12.3.10	*12.9–10.3*	*12.12.7*		apple
	12.5.2	*12.9–10.4*	*12.12.8*	*E. crebra*	Narrow leaved red
	12.5.3	*12.9–10.7*	*12.12.9*		ironbark
	12.5.5	*12.9–10.8*	*12.12.14*		
	12.5.8	*12.9–10.13*	*12.12.21*		
	12.5.12	*12.9–10.19*	*12.12.22*		
	12.7.1	*12.9–10.24*	*12.12.28*		
	12.7.2	*12.11.7*			
Unproductive	*12.1.1*	*12.3.4*	*12.8.15*		
	12.1.2	*12.3.5*	*12.8.19*		
	12.1.3	*12.3.6*	*12.8.23*		
	12.2.7	*12.3.8*	*12.9–10.10*		
	12.2.9	*12.3.12*	*12.9–10.11*		
	12.2.10	*12.3.13*	*12.9–10.12*		
	12.2.12	*12.3.14*	*12.9–10.22*		
	12.2.13	*12.5.4*	*12.12.10*		
	12.2.14	*12.5.9*	*12.12.19*		
	12.2.15	*12.5.10*			

APPENDIX F Estimating native forest productivity on freehold and leasehold land in SEQ

FEAP Modelling
Kristen Williams
Graeme Bell
And in consultation with:
Robert Denham
Kerrie Mengersen

Requested by:
Rohan Huegenin, CRA
30th January 1998

Reporting date:
24th March 1998

Question to be addressed:
What is the standing harvestable volume of native forest on freehold and leasehold land in SEQ?

Information base:
Estimates of MAI (mean annual increment, m^3/ha/yr) in MUIDs (native forest management units) on State forest land, calculated from NFPPs (native forest permanent plots) and applied to MUIDs by DPI (method unknown).

Estimates of mean and variance (standard deviation) for 19 climatic or topographic variables and four substrate variables within MUIDs. Location and area of MUIDS.

Method:
Multiple linear regression was used to model the relationship between MAI (within MUID units) and environment. The average environment for each MUID was described by 19 climatic or topographic variables and four substrate attributes defined from geological type or stratigraphic units. Substrate attributes represented a mapping resolution of 1:500 000. Climate attributes were defined by indicative BIOCLIM parameters (McMahon *et al.* 1996) using a 100 m DEM, and the same DEM was used to define a set of topographic attributes (D. Ward pers. comm., March 1998). Since MUIDs also vary in their spatial extent and degree of environmental heterogeneity, covariates for these factors were tested for their importance in explaining MAI . Spatial variability for each MUID was included as the location attributes (easting and northing) for the polygon centroids, and the corresponding MUID area. The covariates for within MUID environmental heterogeneity were included as the standard deviations of the polygon zonal averages that were estimated for each of the climate (or topographic) and substrate variables.

Since the specified environmental factors are not expected to be complete, the error term in the regression model for MAI will include a component associated with undefined environmental factors. Therefore, the covariates for the spatial extent and degree of environmental heterogeneity associated with the defined environmental factors provide a mechanism for specifying some of the extra variance in MAI. The specified environmental factors and their variance-covariates were subsequently treated equally for the purpose of building the regression model.

Non-linear relationships between MAI and environment were tested by including up to the fourth order polynomials of each factor or covariate as candidate variables during the model building phase. Model building was undertaken by sequential backward elimination of the least significant, highest order polynomial in a variable set, irrespective of the significance of its lower order polynomials in each case. A square-root transformation of MAI contributed to the stabilising of the variance between the residuals and the predicted values. Two of the 1419 MUIDs were influential outliers and were removed from the sample, and the model refitted.

The results indicate that a significant relationship exists between the estimates of MAI for each MUID and its environmental descriptors. Of the 45 candidate variables and variance-covariates, 26 were significant ($p < 0.05$) for at least their highest order polynomials. These included three substrate attributes, 15 climatic or topographic factors, and eight covariates. Polynomial combinations were also significant for some of these variables (a further 29 degrees-of-freedom). These factors and covariates explain about 69 per cent of the variance for the relationship between MAI and the environment of MUIDS.

This predictive model for MAI was subsequently extrapolated to the private native forest estate. Corresponding estimates for the explanatory variables and variance-covariates were calculated from a regular grid (~ 2 500 000 m^2 polygon units). Only those areas of native forest on freehold and leasehold land were considered. Predictions of MAI were only applied to those sites that corresponded to the environmental domain over which the model was developed. Extrapolated units represented 0.1 per cent of the area under consideration (i.e. 1872 ha over 1 817 244 ha of private/leasehold native forest).

Results:

Model: MODEL1
Dependent Variable: SQRTMAI

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	55	41.66556	0.75756	54.509	0.0001
Error	1362	18.92866	0.01390		
C Total	1417	60.59422			

Root MSE	0.11789	R-square	0.6876
Dep Mean	0.44471	Adj R-sq	0.6750
C.V.	26.50919		

Parameter estimates:

OBS	_MODEL_	_TYPE_	_DEPVAR_	_RMSE_	INTERCEP	EAST	EAST2	EAST3	PERM
1	MODEL1	PARMS	SQRTMAI	0.11789	–70.0583	–.00004495	.00000000012982	–1.1373E–16	0.067380

OBS	PERM2	TEXTURE	FERTILE	FERT2	AP	AP2	AP3	HMPI
1	–.0055405	–0.016395	–0.066030	.0068055	–0.011324	.0000080489	–.0000000019901	5.15589

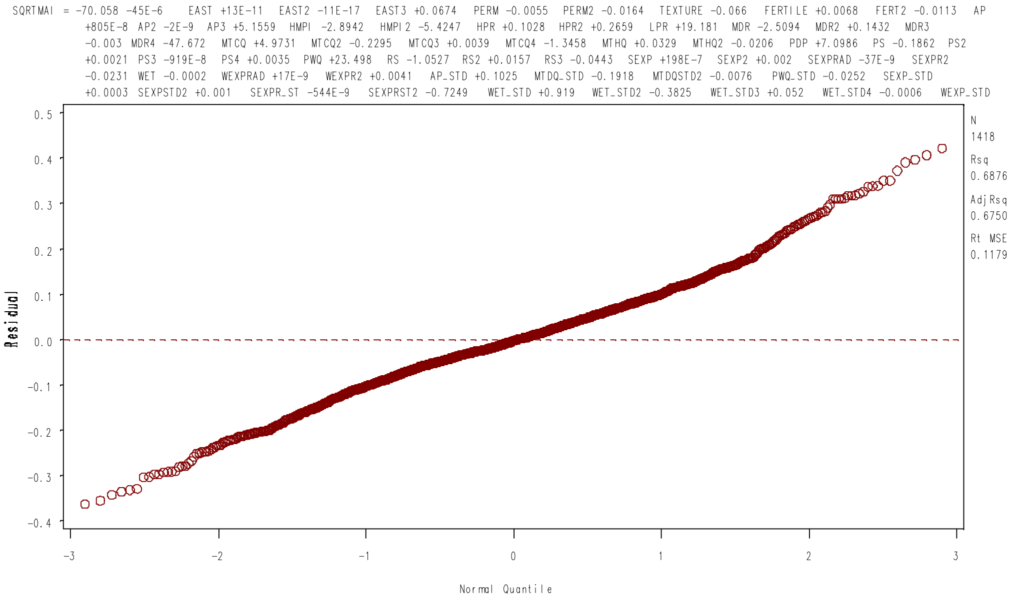
OBS	HMPI2	HPR	HPR2	LPR	MDR	MDR2	MDR3	MDR4	MTCQ	MTCQ2
1	–2.89422	–5.42472	0.10276	0.26594	19.1809	–2.50935	0.14320	–.0030242	–47.6716	4.97311

OBS	MTCQ3	MTCQ4	MTHQ	MTHQ2	PDP	PS	PS2	PS3	PS4
1	–0.22954	.0039320	–1.34577	0.032852	–0.020573	7.09857	–0.18619	.0021459	–.0000091910

OBS	PWQ	RS	RS2	RS3	SEXP	SEXP2	SEXPRAD	SEXPR2	WET
1	.0034600	23.4985	–1.05273	0.015675	–0.044317	.000019763	.0020315	–.000000037274	–0.023059

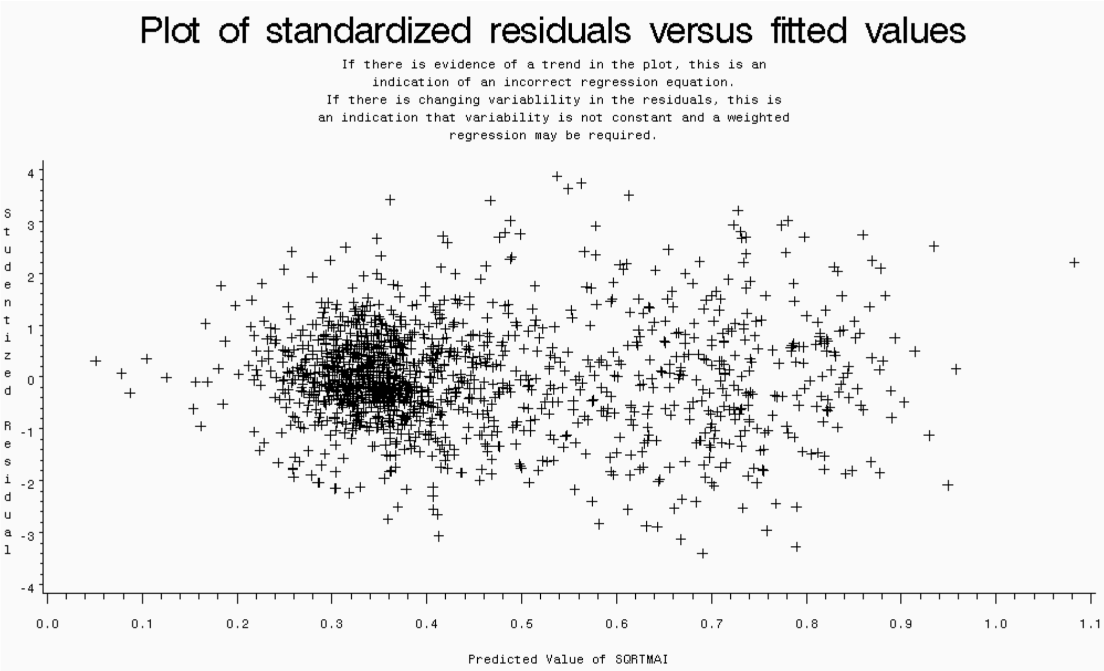
OBS	WEXPRAD	WEXPR2	AP_STD	MTDQ_STD	MTDQSTD2	PWQ_STD	SEXP_STD	SEXPSTD2
1	–.00023921	.000000016530	.0041323	0.10253	–0.19182	–.0076086	–0.025244	.00034263

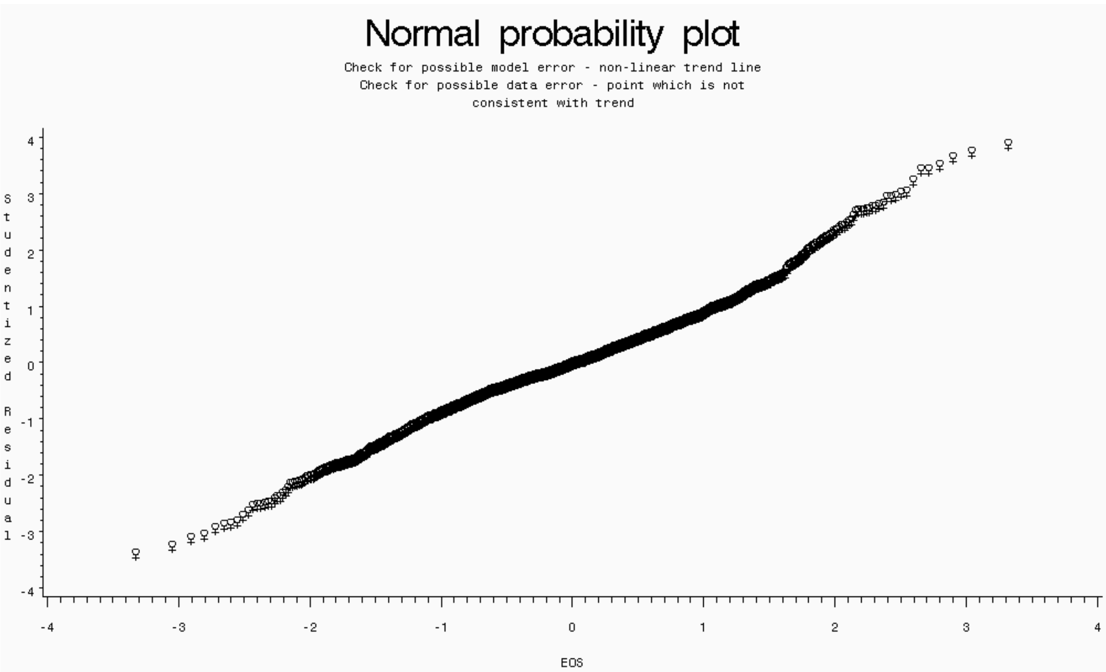
OBS	SEXPR_ST	SEXPRST2	WET_STD	WET_STD2	WET_STD3	WET_STD4	WEXP_STD	SQRTMAI
1	.00097269	–.00000054380	–0.72491	0.91901	–0.38253	0.052046	–.00064191	–1



Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-70.058260	63.43938873	-1.104	0.2696
EAST	1	-0.000044950	0.00002282	-1.970	0.0491
EAST2	1	1.298165E-10	0.00000000	2.321	0.0205
EAST3	1	-1.13732E-16	0.00000000	-2.513	0.0121
PERM	1	0.067380	0.02043390	3.297	0.0010
PERM2	1	-0.005541	0.00200303	-2.766	0.0058
TEXTURE	1	-0.016395	0.00474792	-3.453	0.0006
FERTILE	1	-0.066030	0.02297319	-2.874	0.0041
FERT2	1	0.006806	0.00221273	3.076	0.0021
AP	1	-0.011324	0.00237223	-4.773	0.0001
AP2	1	0.000008049	0.00000174	4.636	0.0001
AP3	1	-1.99011E-9	0.00000000	-4.914	0.0001
HMPI	1	5.155889	0.97194995	5.305	0.0001
HMPI2	1	-2.894218	0.50119262	-5.775	0.0001
HPR	1	-5.424718	2.51695517	-2.155	0.0313
HPR2	1	0.102762	0.05018444	2.048	0.0408
LPR	1	0.265943	0.08526927	3.119	0.0019
MDR	1	19.180904	4.64289952	4.131	0.0001
MDR2	1	-2.509353	0.59406680	-4.224	0.0001
MDR3	1	0.143202	0.03358811	4.263	0.0001
MDR4	1	-0.003024	0.00070749	-4.275	0.0001
MTCQ	1	-47.671587	9.59446215	-4.969	0.0001
MTCQ2	1	4.973109	1.00623819	4.942	0.0001
MTCQ3	1	-0.229545	0.04670847	-4.914	0.0001
MTCQ4	1	0.003932	0.00080913	4.860	0.0001
MTHQ	1	-1.345775	0.40314842	-3.338	0.0009
MTHQ2	1	0.032852	0.00888556	3.697	0.0002
PDP	1	-0.020573	0.00361476	-5.691	0.0001
PS	1	7.098573	1.90608924	3.724	0.0002
PS2	1	-0.186195	0.05043402	-3.692	0.0002
PS3	1	0.002146	0.00058964	3.639	0.0003
PS4	1	-0.000009191	0.00000257	-3.577	0.0004
PWQ	1	0.003460	0.00125529	2.756	0.0059
RS	1	23.498463	4.24035495	5.542	0.0001
RS2	1	-1.052725	0.18733879	-5.619	0.0001
RS3	1	0.015675	0.00275490	5.690	0.0001
SEXP	1	-0.044317	0.01745716	-2.539	0.0112
SEXP2	1	0.000019763	0.00000862	2.292	0.0220
SEXPRAD	1	0.002032	0.00052151	3.895	0.0001
SEXPR2	1	-3.727384E-8	0.00000001	-3.766	0.0002
WET	1	-0.023059	0.00818734	-2.816	0.0049
WEXPRAD	1	-0.000239	0.00008714	-2.745	0.0061
WEXPR2	1	1.6529853E-8	0.00000001	2.304	0.0214
AP_STD	1	0.004132	0.00128933	3.205	0.0014
MTDQ_STD	1	0.102531	0.07430194	1.380	0.1678
MTDQSTD2	1	-0.191824	0.07123086	-2.693	0.0072
PWQ_STD	1	-0.007609	0.00254982	-2.984	0.0029
SEXP_STD	1	-0.025244	0.00718583	-3.513	0.0005
SEXPSTD2	1	0.000343	0.00010384	3.300	0.0010
SEXPR_ST	1	0.000973	0.00028345	3.432	0.0006
SEXPRST2	1	-0.000000544	0.00000017	-3.289	0.0010
WET_STD	1	-0.724913	0.19488823	-3.720	0.0002
WET_STD2	1	0.919006	0.21489134	4.277	0.0001
WET_STD3	1	-0.382532	0.08569860	-4.464	0.0001
WET_STD4	1	0.052046	0.01146982	4.538	0.0001
WEXP_STD	1	-0.000642	0.00021271	-3.018	0.0026


Plot of standardized residuals versus fitted values
If there is evidence of a trend in the plot, this is an indication of an incorrect regression equation.
If there is changing variablility in the residuals, this is an indication that variability is not constant and a weighted regression may be required.
Studentized Residual
4
3
2
1
0
-1
-2
-3
-4
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
Predicted Value of SQRTMAI


Normal probability plot
Check for possible model error - non-linear trend line
Check for possible data error - point which is not consistent with trend
Studentized Residual
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4
EOS

APPENDIX G People Contacted Regarding Land Owner Intentions

Mike Askham	Noosa Landcare	Noosa
Bob Baldwin	Tree Care Extension Officer – DNR	Murgon
Gordon Banks	Private Forest Owner	
Trevor Beetson	Principal Forest Officer – DNR	Toowoomba
Laurie Capill	Extension Officer – DPI–F	Brisbane
Gerry Davidson	Private Forest Owner	
Ernie Rider	Tree Extension Officer	Rockhampton
Owen Thompson	Private Forest Owner	Maryborough
Peter Voller	Forest Extension Officer – DNR	Dalby
Craig Whiteford	Senior Officer–Forests Resource Management	Rockhampton

APPENDIX H Sawmill Survey Supplement and Summary of Results

1. Area of private forest

Although LANDSAT analysis will provide quantitative data on the issue, this question aims to elicit landholders perception of the extent of the private forest resource.

This question is about the area of private forest.

What is your view about changes in the area of private forest over the past 5 – 10 years?

- decreasing rapidly
- decreasing slowly
- no change
- increasing

2. Condition of private forest

Irrespective of what is perceived to be happening to the extent of the forest resource, this question asks about perception of the ability of those forests to supply resource.

This question is about the condition of the private resource.

What are your views about trends in the ability of the remaining forests to supply timber for your mill?

- Forests are heavily cut over and less able to supply needs.
- Availability of timber is now restricted predominantly to smaller diameters and regrowth trees.
- Quality of private resource has not changed in recent times.
- Other – please specify.

3. Future supplies

This question aims to understand the future supply of private resource. In particular, it is aimed at whether mills will continue to be able to source sufficient resource from private forests to maintain viability, irrespective of whether that will require a change in the product mix cut from the resource (e.g. may require greater focus on landscape market)

This question is about the future of private supplies to your mill.

How long do you think you will be able to get timber supplies from private forests?

- Up to 5 years
- 5 – 10 years
- 10 – 20 years
- more than 20 years.

4. Landholder reason for harvesting

The following question is aimed at understanding why landholders actually harvest their resource.

> From your experience, what proportion of private forest harvesting for your mill over the past five years was for:

- ongoing management for wood production
- thinning to improve grazing
- clearing (e.g. for pasture, crops, urban development)
- other (please specify)
- don’t know.

1. Views On Area Of Private Forest	1	2	3	4	
Question	Decreased Rapidly	Decreased Slowly	No Change	Increased	Mean Value
What is your view about changes in the area of private forest in SEQ over the past 5 to 10 Years?	12	12	7	1	1.91

2. Condition Of Private Forest	1	2	3	4	5	
Statement	Strongly Disagree	Disagree	Neither Agree Or Disagree	Agree	Strongly Agree	Mean Value
Forests have been heavily cut and are now less able to supply needs.	5	7	10	7	3	2.88
Availability of timber is now restricted predominantly to smaller diameters and regrowth trees.	2	4	9	6	11	3.63
Quality of private resource has not changed in recent times.	7	6	2	14	3	3

3. Future Supplies	1	2	3	4	5	
Question	<1 Year	Up To 5 Years	5 To 10 Years	10 To 20 Years	>20 Years	Mean Value
How long do you think you will be able to get the current levels of timber supplies from private forests?	1	6	7	8	6	3.43

4. Landholder Reason For Harvesting	
What proportion of private forest harvesting for your mill was for:	AVE %
Ongoing management for wood production	62.3
Thinning to improve grazing	16.5
Clearing	14.6
Other	3.2
Don't know	3.4

APPENDIX I Comparison of Visual Assessment Results and Measured Plots

Plot number	Forest type	Visually assessed volume	Actual measured volume
1001	Moist Dry Forests	<2	0
1005	Moist Dry Forests	<2	0
1536	Moist Dry Forests	<2	2.502
1392	Moist Dry Forests	2–4.9	1.673
2311	Moist Dry Forests	5–11.9	6.336
1458	Moist Dry Forests	<2	3.399
2110	Moist Dry Forests	<2	3.579
1096	Moist Dry Forests	2–4.9	6.115
1478	Moist Dry Forests	5–11.9	5.414
1539	Moist Dry Forests	<2	4.181
1061	Moist Dry Forests	<2	5.093
2039	Wet Forest	>40	105.044
1166	Moist Dry Forests	<2	6.196
1585	Moist Dry Forests	<2	6.402
1479	Moist Dry Forests	<2	7.454
1590	Moist Dry Forests	2–4.9	11.369
2077	Wet Forest	5–11.9	17.085
2549	Moist Dry Forests	5–11.9	17.234
1481	Moist Dry Forests	<2	10.32
1233	Moist Dry Forests	<2	12.088
1040	Wet Forest	20–40	18.334
1240	Moist Dry Forests	2–4.9	16.398
1388	Moist Dry Forests	2–4.9	17.835
1052	Wet Forest	20–40	45.107
2166	Moist Dry Forests	<2	16.223
2551	Moist Dry Forests	12–19.9	31.812
2220	Moist Dry Forests	12–19.9	32.263
2051	Wet Forest	20–40	47.163
1062	Wet Forest	5–11.9	25.935
2542	Moist Dry Forests	<2	21.072
1430	Moist Dry Forests	2–4.9	29.553
1043	Wet Forest	>40	82.104
1044	Wet Forest	>40	124.021
1528	Wet Forest	20–40	134.784

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GLOSSARY

ABARE: Australian Bureau of Agriculture and Resource Economics

AIS: Area Information System

CRA: Comprehensive Regional Assessment. A joint Commonwealth/State assessment of all forest values – environmental, heritage, economic, and social, leading to the establishment of a Comprehensive, Adequate and Representative Reserve System, agreements on forest management, and the signing of a Regional Forest Agreement (RFA).

DBH: Diameter at Breast Height. A standard tree measurement.

DNR: Queensland Department of Natural Resources.

DPIF: Queensland Department Of Primary Industry– Forestry.

Farm Forestry: The growth and management of trees on farms as part of the farm enterprise for the purpose of producing wood and/or non-wood products.

GPS: Global Positioning System. A satellite navigation device.

MAI: Mean Annual Increment.

Native Forest: Any locally indigenous forest community containing the full complement of native species and habitats normally associated with that community, or having the potential to develop these characteristics.

Private Native Forest: Areas of native forest, which occurs on freehold, or leasehold land where the government doesn’t own timber rights.

RET: Regional Ecosystem Type.

RFA: Regional Forest Agreement. An agreement between the Commonwealth and a State Government about the long term management and use of forests in a particular region; its purpose is to reduce uncertainty and duplication in government decisions making by producing a durable agreement on the management and use of forests for up to twenty years.

SEQ: South East Queensland.