



*A Manual for Planted Farm Forestry for the  
Northern Inland of New South Wales*

*Appendix B*

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## **Appendix B: A summary of the main findings of the NHT Funded “Northern Tablelands Farm Forestry Project”.**

### **The Northern Tablelands Farm Forestry Project aimed to:**

- 1) promote farm forestry amongst landholders of the region; and
- 2) establish demonstration plantings and species trials to investigate species relative timber growing performance and the impact of site factors on growth and survival.

This was attempted through the establishment of a number of species (and their provenances) establishment trials (*Acacia* provenance trial Armidale, *Casuarina* provenance trial Dangarsleigh and *Eucalyptus* provenance trial Wongwibinda), and via a three species stratification trial established on approximately 30 sites geographically spread across the tablelands.

Summaries of these trials, except for the acacia trial that failed to establish well, have been included below.

### **Casuarina provenance trial**

Seven provenances of River Oak *Casuarina cunninghamiana* were tested in a randomized block design, with three replicates on a cold site at Dangarsleigh, near Armidale. The aim of the trial was to test the resistance to frost of the different provenances and their early growth. After two years growth, two provenances had significantly better survival (Boorolong Creek junction with Gwydir River and 17.5 km E/SE Armidale) although no provenance stood out in height growth. The provenances with the poorest survival were from the ACT and Manilla. Most deaths in the trial were attributed to frost.

### **Stratification Trial**

This series of trials looks at the effect of site on the growth and performance of three species; *E. viminalis* (White Gum), *E. laevopinea* (Silvertop Stringybark) and *Pinus radiata* (Radiata Pine). The site variables being compared were slope position (upper or lower), aspect (north or south), mean annual rainfall (<800mm, 800-900 mm and >900mm) and soil parent material (granite, basalt and trap). Approximately 30 different sites geographically spread across the tablelands were established on collaborating landholders properties during 1998 and 1999. Sites were selected to encompass many of the different combinations of parent material, rainfall class, aspect and slope position. It was hoped that the results of tree growth and survival monitoring would provide sufficient information to model the performance of each of the 3 species according to site characteristics. The ultimate aim being to indicate the best sites for maximum growth.

Generally, the stratification trial has shown inconsistent results when comparing different species growth and survival against most site factors. The cause of these differences in growth has yet to be determined, however differences in landholder’s establishment and post planting management across sites may explain some of the variation. Some trends however are apparent, these are:

- 1) Upper slope sites are much better than lower slope sites for the growth and survival of all species, with most *E. laevopinea* seedlings being killed outright in the lowest frostiest sites;
- 2) Trees have grown the tallest on sites with high apparent fertility (e.g. stock camps);
- 3) Growth and survival for all species has been poorest on duplex granite soils;
- 4) After 3 years of monitoring *E. viminalis* was always taller than *E. laevopinea* which was always taller than *Pinus radiata*, however pine growth rates are accelerating;
- 5) Pine has the best form and the least insect attack followed by *E. laevopinea* followed by *E. viminalis*.

Apart from the relationship between tree performance and slope position there has been little correlation between tree performance and any of the other site factors.

## **Eucalypt provenance trial**

The trial site is located 25km Northwest of Ebor in the Wongwibinda area. Planted in January 1999, the trial compares 96 provenances of 19 species of Eucalyptus (see Table 1). The aim is to quickly narrow down a large field of possible species to a smaller group that warrant further work and selection. The selection criteria for this narrowing down process will include speed of growth (height and diameter), adaptability to local conditions, resistance to insect damage and form. The relative growth of species will be of equal importance to the absolute growth (i.e. which is the fastest species) as many farm foresters wish to grow their local species and want to know how they compare to faster growing "exotics".

The site occurs in undulating terrain near a hilltop on chocolate basalt soil. The ground was prepared by State Forests who deep ripped (to 1m) and mounded with a D9 and a Savannah plough. The weeds were treated with RoundUp and Simazine, but have not had any follow up herbicide treatments. The trees were all planted from Hiko cells, into moist soil and fertilised with 5g of slow release fertiliser. The trees were grown by Fields Native Nursery from seed both collected locally and collected by CSIRO Australian Tree Seed Centre. Chris and Margot Wright have made a substantial contribution to this trial with land, weed control, fencing and considerable time in planting, maintaining and monitoring the site.

The trial is a row-column design based on square plots of 16 trees. Most plots are replicated 3 times, although due to size limitations some are restricted to 2 replications. Monitoring of all survivors in the trial has been conducted at regular intervals with detailed data analysis available for the first four measurements to April 2002 (Carr 2004). Tree height, trunk diameter, tree health, stem straightness, branching habit and the presence or absence of *Mycosphaerella* leaf disease and insect pests were measured or scored at each monitoring. A weighted index was also compiled to compare seedlots based on survival, growth and form measurements.

**Table 1. Details of the origin of seedlots used in the Eucalypt trial, including species and treatment numbers assigned for the trial.**

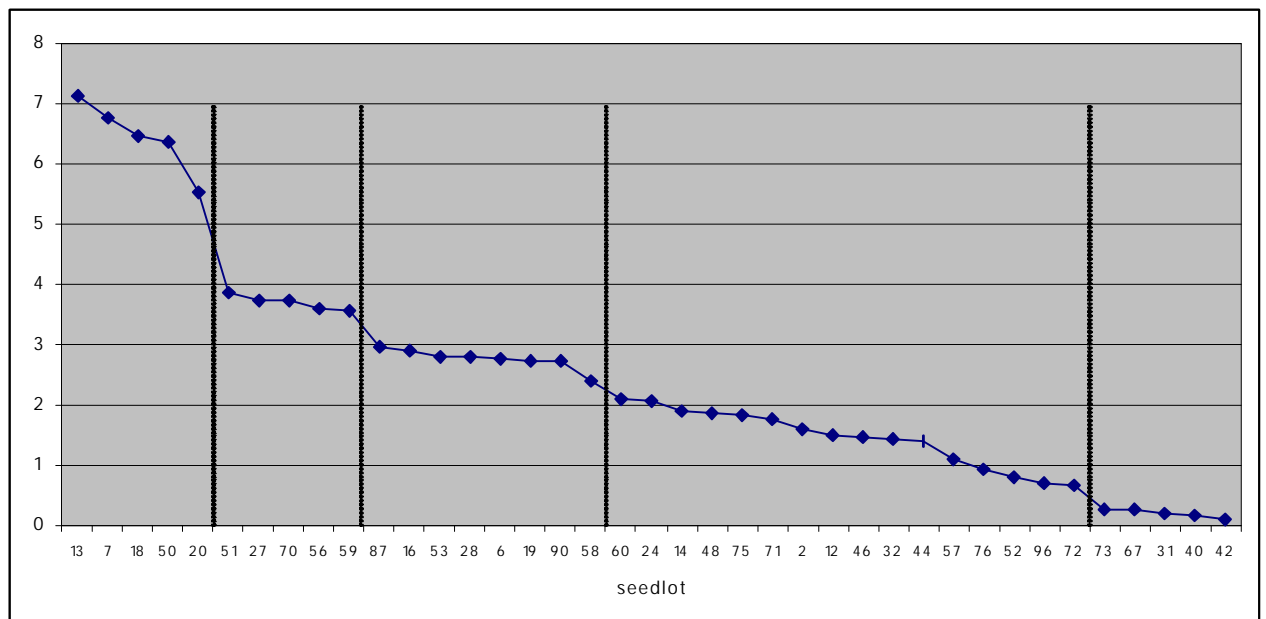
Species number	Treatment number	Species name	Seedlot name	Latitude (S)	Longitude (E)	Altitude (m)	Supplier	Seedlot number	No of parent trees.
1	7	<i>nitens</i>	Captains Flat	35 59'	149 53'	1300	CSIRO	15918	70
1	13	<i>nitens</i>	Mt Erica	37 50'	146 20'	800	CSIRO	16906	6
1	18	<i>nitens</i>	Hastings TSC Orchard	43 25'	146 53'	200	TSC	2031	?
1	20	<i>nitens</i>	Mt Toorongo	37 48'	146 06'	950	CSIRO	16365	8
1	50	<i>nitens</i>	Barren Mt	30 30'	151 05'	1300	CSIRO	13378	12
1	51	<i>nitens</i>	Barrington Tops	31 38'	151 30'	1250	CSIRO	18341	42
1	70	<i>nitens</i>	Majors Point Ebor	30 25'	152 25'	1500	GA Dorrigo	SL254	?
2	14	<i>obliqua</i>	Gibraltar Range	29 38'	152 08'	1000	CSIRO	15910	10
2	31	<i>obliqua</i>	Mawbanna	40 55'	145 21'	848	CSIRO	15907	10
2	36	<i>obliqua</i>	Styx River	30 35'	152 12'	520	CSIRO	15911	10
2	58	<i>obliqua</i>	Butterworth	29 00'	152 00'	1000	GA Armidale	Ritchie.	4
3	12	<i>bicostata</i>	Traralga/Mt Buller	37 06'	146 24'	680	CSIRO	16368	10
3	16	<i>bicostata</i>	Tumut	35 16'	148 13'	850	Max Harris		?
3	56	<i>bicostata</i>	Winterbourne	30 50'	151 50'	900	GA Armidale	GA136	?
3	75	<i>bicostata</i>	Wee Jasper	35 03'	148 34'	780	CSIRO	16300	9
4	19	<i>fastigata</i>	Brindabella Range	35 23'	148 51'	850	CSIRO	15141	15
4	27	<i>fastigata</i>	Victorian border granite	37 04'	148 56'	1300	Bliss		?
4	32	<i>fastigata</i>	Riamukka	31 20'	151 40'	1100	Max Harris		?
4	71	<i>fastigata</i>	Ellesmere, Ebor	30 27'	152 30'	1300	GA Dorrigo	SL107	?
5	23	<i>quadrangulata</i>	Clouds Creek	30 04'	152 38'	650	CSIRO	17581	5
5	76	<i>quadrangulata</i>	Dalmorton	29 53'	152 23'	780	CSIRO	17580	3
5	90	<i>quadrangulata</i>	Mt Skanzi	34 46'	150 26'	500	CSIRO	19367	9
5	91	<i>quadrangulata</i>	Chaelundi	30 05'	152 15'	800	GA Dorrigo	SL257	?
6	38	<i>cameronii</i>	E of Armidale granite	30 30'	152 10'	1000	Bliss		?
6	57	<i>cameronii</i>	Dyamberin	30 14'	152 11'	1200	GA Dorrigo	SL210	?
6	95	<i>cameronii</i>	Winterbourne	30 50'	151 50'	900	Max Harris		?
7	10	<i>viminalis</i>	Waterloo Range	29 44'	151 35'	1000	Bliss		?
7	11	<i>viminalis</i>	SW Glen Innes, cold site	29 48'	151 35'	900	Bliss		?
7	37	<i>viminalis</i>	Tilbuster	30 28'	151 40'	1050	ATG		?
7	59	<i>viminalis</i>	S of Tallaganda SF	35 58'	149 35'	900	CSIRO	18308	6
7	61	<i>viminalis</i>	Wattle Flat	33 09'	149 41'	905	CSIRO	19795	5
7	65	<i>viminalis</i>	Winterbourne Forest	30 50'	151 50'	900	Max Harris		?
7	66	<i>viminalis</i>	UNE basalt	30 29'	151 38'	1000	ATG		?

Species number	Treatment number	Species name	Seedlot name	Latitude (S)	Longitude (E)	Altitude (m)	Supplier	Seedlot number	No of parent trees.
7	79	<i>viminalis</i>	Gara trap	30 32'	151 47'	950	ATG		?
7	93	<i>viminalis</i>	Stratification trial (Walcha)	31 05'	151 31'	900	Chris Eveleigh		?
8	6	<i>globulus</i>	Flinders Island	40 07'	148 01'	20	CSIRO	18707	46
8	24	<i>globulus</i>	Snow Hill	41 55'	147 50'	650	TSC	639	?
8	28	<i>globulus</i>	Tarraleah	42 18'	146 27'	700	TSC	759	?
9	40	<i>cypellocarpa</i>	Jeeralangs	38 19'	146 33'	220	CSIRO	18789	10
9	67	<i>cypellocarpa</i>	Delegate, Vic	37 04'	148 56'	1250	Bliss		?
9	69	<i>cypellocarpa</i>	Bundarra granite	30 15'	150 50'	950	Bliss		?
9	86	<i>cypellocarpa</i>	Nundle/Hanging Rock	31 28'	151 10'	1000	CSIRO	19803	10
10	2	<i>dalrympleana</i> ssp <i>heptantha</i>	Warwick	28 14'	152 22'	900	CSIRO	13348	5
10	5	<i>dalrympleana</i>	Ingelba	31 10'	151 25'	1000	Max Harris		?
10	17	<i>dalrympleana</i>	NW of Dundee, Basalt	29 30'	151 45'	1000	Bliss		?
10	21	<i>dalrympleana</i>	Mt Mckenzie	29 10'	152 00'	1200	Mole Station		?
10	33	<i>dalrympleana</i>	Uralla	30 40'	151 30'	1100	GA Armidale	GA10 & 6	
10	45	<i>dalrympleana</i>	Faddens	43 15'	147 39'	550	TSC	940	?
10	55	<i>dalrympleana</i>	Echo	42 11'	146 37'	900	TSC	805	?
10	77	<i>dalrympleana</i>	SW of Guyra, granite	30 20'	151 30'	1250	Bliss		?
10	78	<i>dalrympleana</i>	Nundle SF	31 27'	151 15'	1250	CSIRO	12563	4
11	44	<i>nobilis</i>	Nundle	31 27'	151 15'	1260	CSIRO	19806	10
11	48	<i>nobilis</i>	Styx River	30 37'	152 10'	1000	CSIRO	19452	8
11	53	<i>nobilis</i>	Ebor	30 27'	152 30'	1300	GA Dorrigo	SL286	?
11	54	<i>nobilis</i>	Mt Kaputar	30 17'	150 08'	1250	CSIRO	19805	10
11	62	<i>nobilis</i>	Sailor Jack	29 55'	151 45'	1000	Mole Station		?
11	74	<i>nobilis</i>	Coolah Tops	31 44'	149 58'	1030	CSIRO	19801	10
12	26	<i>andrewsii</i>	Mole Station	29 00'	151 29'	700	Mole Station		?
12	83	<i>andrewsii</i>	Bundarra granite	30 15'	150 50'	800	Bliss		?
13	39	<i>campanulata</i>	Clouds Creek	30 05'	152 38'	650	Max Harris		?
13	41	<i>campanulata</i>	Diehappy SF	30 29'	152 40'	700	CSIRO	16833	10
13	42	<i>campanulata</i>	Niangala	31 17'	151 24'	910	CSIRO	11652	2
13	73	<i>campanulata</i>	Compartment 135, Mt Hyland	30 10'	152 25'	1300	GA Dorrigo	SL098	?
13	94	<i>campanulata</i>	SE of Tenterfield	29 15'	152 15'	750	Bliss		?
14	1	<i>caliginosa</i>	Sunnyside trap	30 25'	151 40'	1100	ATG		?
14	4	<i>caliginosa</i>	Manimbah	30 32'	151 41'	900	ATG		?
14	9	<i>caliginosa</i>	SE Glen Innes, blue granite	29 45'	151 35'	1000	Bliss		?
14	29	<i>caliginosa</i>	Eastlake	30 50'	151 38'	1100	Fields		?
14	47	<i>caliginosa</i>	New England Hwy, SW Uralla	30 45'	151 22'	1020	Chris Eveleigh		?

Species number	Treatment number	Species name	Seedlot name	Latitude (S)	Longitude (E)	Altitude (m)	Supplier	Seedlot number	No of parent trees.
14	49	<i>caliginosa</i>	Gara	30 33'	151 48'	1000	ATG		?
15	8	<i>laevopinea</i>	Ravensworth	30 20'	151 40'	1200	GA	GA184	?
15	15	<i>laevopinea</i>	W of Chiswick, Basalt	30 35'	151 30'	1000	Bliss		?
15	35	<i>laevopinea</i>	Local trap	30 31'	151 40'	900	ATG		?
15	52	<i>laevopinea</i>	Marengo SF	31 25'	152 28'	850	GA Dorrigo	SL315	?
15	64	<i>laevopinea</i>	Bakers Creek	30 15'	151 00'	750	Bliss		?
15	68	<i>laevopinea</i>	Woolbrook	31 07'	151 24'	1000	Chris Eveleigh		?
15	85	<i>laevopinea</i>	Billys Creek	30 10'	152 35'	800	GA Dorrigo	SL374	?
15	89	<i>laevopinea</i>	Emmaville	29 25'	151 35'	1000	Max Harris		?
15	96	<i>laevopinea</i>	Stratification trial (Woolbrook)	31 00'	151 20'	750	Chris Eveleigh		?
16	30	<i>saligna</i>	Tenterfield	28 58'	152 18'	850	CSIRO	13338	2
16	46	<i>saligna</i>	Armidale	30 46'	152 02'	910	CSIRO	13335	10
16	60	<i>saligna</i>	Gibraltar Range SF	29 36'	152 10'	1000	CSIRO	18362	26
16	72	<i>saligna</i>	S of Walcha	31 15'	151 45'	1100	Bliss		?
16	82	<i>saligna</i>	Chaelundi(SL 269)	30 20'	152 25'	1300	GA Dorrigo	SL269	?
16	87	<i>saligna</i>	Styx River SF	30 37'	152 10'	975	CSIRO	19453	12
17	22	<i>macrorhyncha</i>	Uriarra Rd, ACT	35 15'	149 00'	650	CSIRO	19786	10
17	25	<i>macrorhyncha</i>	ACT Cotter/Uriarra	35 15'	149 00'	650	CSIRO	14853	5
18	3	<i>camaldulensis</i>	Nyngan	31 33'	147 11'	200	CSIRO	19872	8
18	81	<i>camaldulensis</i>	Manilla	30 45'	150 45'	300	GA	GA83	?
18	92	<i>camaldulensis</i>	Lake Albacutya	35 45'	142 58'	150	CSIRO	19708	68
19	34	<i>youmanii</i>	Alfreda, Ebor	30 21'	152 15'	1250	GA Dorrigo	SL221	?
19	43	<i>youmanii</i>	Exmouth Rd, Armidale	30 22'	151 35'	1270	CSIRO	18996	11
19	63	<i>youmanii</i>	26 8 K SE Tenterfield	29 09'	152 07'	1100	CSIRO	16003	1
19	80	<i>youmanii</i>	New England Tableland	31 00'	151 30'	1140	CSIRO	14910	10
19	88	<i>youmanii</i>	E of Dundee	29 34'	151 56'	1050	CSIRO	13345	4

The results of the available data analysis to date are summarised by Figure 1 which uses the weighted index value of each seedlot as a performance indicator. Note that only the top 40 seedlots are graphed, all others scored poorly in terms of survival and/or growth rate and/or tree form.

The following results and discussion of the Eucalypt provenance trial are selected extracts from Carr (2004).



**Figure 1: Weighted index for the top 40 seedlots in the eucalypt trial after 38 months (Carr 2004) – see table 1 to relate seedlot codes to provenance and species.**

Figure 1 shows the best 40 seedlots ranked by the weighted index. There appeared to be five distinct groups of seedlots amongst the best 40 when compared on the weighted index. These are indicated by the solid dark lines in Figure 1.

Based on the results and limitations of this trial, particular seedlots of *E. nitens*, *E. fastigata*, *E. bicostata*, *E. nobilis*, *E. saligna*, *E. globulus*, *E. dalrympleana*, *E. quadrangulata*, *E. obliqua* and *E. viminalis* have the most potential for commercial plantings on the Northern Tablelands of NSW. These seedlots have shown rapid growth, good form and health and high survival over the 38 months of this trial.

### Shining Gum *Eucalyptus nitens*

*Eucalyptus nitens* stands out as having the most potential for commercial hardwood forestry on the Northern Tablelands. In this trial, after 38 months, it had the best mean height and mean diameter, had > 95% survival and was ranked fifth on mean health score and stem straightness score and first on branching habit. Based on the weighted index all seven seedlots of this species were ranked in the top eight.

On the results of the weighted index, there was little difference between the seedlots from Mt Erica (13), Captains Flat (7), Tasmanian Seed Centre Seed Orchard (18) and Barren Mt (50). The Mt Toorongo (20) provenance was slightly lower than the top group, while the Barrington Tops (51) and Majors Point (70) provenances were slightly lower again, but still better than 88 of the other 89 seedlots. The differences among seedlots were most obvious in height, as diameter was similar for all seedlots except Majors Point.

Overall, *Eucalyptus nitens* showed the best performance after 3 years in this trial and warrants further attention in developing hardwood plantation species for the Northern Tablelands. No provenance could be ruled out of any future provenance testing or breeding and selection for seed production. While the Mt Erica provenance topped the weighted index ranking, the low susceptibility of the TSC seed orchard seedlot (18) to leaf-eating beetles and the low susceptibility of the Barren Mountain provenance (50) to Christmas beetles and *Mycosphaerella* leaf disease, and the high index value of both, recommends their use in future trials and woodlots.

While *E. nitens* stood out as the most successful species in this trial, there were three other species where the majority of the seedlots performed very well. This group included *E. bicostata*, *E. globulus* and *E. fastigata*.

### ***Eurabbie Eucalyptus bicostata* and Tasmanian blue gum *E. globulus***

At the species level, *E. bicostata* and *E. globulus* had very similar results to each other, and were second only to *E. nitens* in overall performance. *E. bicostata* and *E. globulus* ranked high on height, DBH, survival and branching habit but low on stem straightness after 38 months. Both species had excellent mean health scores in 2000, but were ranked low in 2001 and 2002. This coincided with these species being ranked either first or second on occurrence of leaf eating beetles in 2001 and 2002 and *Mycosphaerella* leaf disease in 2002. In all measures the proportion of infested trees of these species was significantly greater than all other species. Both juvenile and adult leaves of both species were affected by beetles but only juvenile leaves were affected by *Mycosphaerella*.

The seedlots of *E. bicostata* in this trial were all ranked in the top 30 seedlots on the weighted index. The outstanding provenance, based on this index, was Winterbourne (56) from the Northern Tablelands. The Tumut provenance (16) was also ranked highly. These two provenances had significantly better height and diameter growth and health than the Wee Jasper (75) and Mt Buller (12) provenances. There was no difference among seedlots on stem straightness or branching habit.

There was no significant difference among provenances of *E. globulus* for growth, health and form variables in this trial, although the Snow Hill provenance (24) was slightly better for height, stem and branch form and health throughout the trial, while the Tarraleah provenance (28) had the greater diameter throughout.

While both these species performed very well in this trial, their susceptibility to leaf-eating beetles and leaf disease and the subsequent low health scores indicate that caution should be exercised before adopting these species for plantations on the Northern Tablelands. While it could not be assessed if the trees health affected their growth, continued attacks by insects or disease may slow the growth of these species considerably. If plantings of these species are to be undertaken, the Winterbourne provenance (56) of *E. bicostata* is recommended based on its superior weighted index ranking and the higher percentage of trees of this provenance in the top health class in all years.

### **Brown Barrel *Eucalyptus fastigata***

The four *Eucalyptus fastigata* seedlots used in this trial were ranked in the top 30 on weighted index after 38 months growth. The Victorian border granite provenance (27) was ranked seventh, with only seedlots of *E. nitens* ahead of it. As a species, brown barrel was ranked fourth on height, third on DBH, equal fifth on survival and first on health after 38 months.

There was considerable variation among the four provenances used in this trial. The Brindabella Ranges provenance (19) had superior height and diameter growth throughout the trial, but the poorest survival (still 88%), stem straightness and branching habit. The Victorian-border granite provenance (27) was not significantly different to the Brindabella provenance in growth or survival, but had significantly better stem and branch form. Both provenances had better growth than the provenances from Riamukka and Ellesmere, Ebor. This highlighted a clear distinction between the provenances from southern latitudes and those from northern latitudes. This distinction was clearest for growth (in favour of the southern provenances) and survival (in favour of the northern provenances) and least clear for form characteristics and tree health.

The high health scores in each year were supported by the fact that virtually no trees were affected by insects or disease, with the exception of a marginally significant occurrence of leaf-eating beetles on the Ellesmere, Ebor provenance (71) in 2002.

The high health and form scores and relatively high growth and survival and the lack of infestation by insects or diseases in this trial indicated that *E. fastigata* is a very promising species for farm forestry on the northern Tablelands. This species could be further developed by establishing provenance trials that incorporate high altitude provenances for frost hardiness and low altitude provenances for growth, including a selection of provenances local to the Northern Tablelands.

## **Forest white gum *Eucalyptus nobilis*, Mountain white gum *E. dalrympleana* and Manna gum *E. viminalis***

These three species are closely related, but *E. nobilis* stood out in this trial. The performance of the Tallaganda State Forest provenance (59) of *E. viminalis* was so far superior to the other *E. viminalis* provenances as to be closer to the results for *E. nobilis*. For *E. dalrympleana*, the performance of the Warwick provenance (2) was far superior to other provenances in the trial.

Compared to other species, the performance of *E. nobilis* was moderate, based on height, DBH, stem straightness and health. It had the highest survival, but ranked poorly on branching habit. Individual seedlots performed better than the species mean with provenances from Ebor (53), Styx River (48) and Nundle (44) ranking in the top 30 on the weighted index.

The early results from this trial clearly indicate the wide spread of values for different provenances of *E. viminalis* and emphasise the outstanding performance of seedlot 59 (Tallaganda State Forest) from southern NSW. Other provenances had relatively poor growth, form, health and occurrence of insects, although survival was high.

Like *E. viminalis*, *E. dalrympleana* had one outstanding provenance: Warwick (2). This provenance was morphologically very similar to *E. viminalis* in the field from 5 months after planting. The other nine provenances were grouped closely together on the weighted index (low scores), but the Warwick provenance ranked twenty-fifth. The form of this provenance and its superior height and diameter were the primary reasons for its relatively high index ranking. While other provenances had similar growth to the Warwick provenance (Dundee basalt (17) and Mt McKenzie (21)), their form was considerably worse.

## **Sydney blue gum *Eucalyptus saligna***

The species means for most variables for *E. saligna* do not indicate that this species has any potential for forestry on the Northern Tablelands, but the performance of individual provenances indicates otherwise. After 38 months Sydney blue gum was moderately ranked on both species mean height and diameter, and survival. However, there was a large spread of values for different seedlots within the species. One provenance in particular, Tenterfield (30), had low values for height, diameter, survival, health and form throughout the trial.

As a species, the ranking for stem straightness, branching habit and health of *E. saligna* was very high throughout the trial. This was reflected in the high weighted index results for the Styx River (87), Gibraltar Range (60), Armidale (46) and Walcha (72) provenances; ranked eleventh, nineteenth, twenty-seventh and thirty-fourth of the 96 seedlots used. The weighted index results highlighted the provenances that had the best combination of growth and form, but all seedlots of *E. saligna* had very good branch and stem form.

From the early results of this trial and from the literature, *E. saligna* is a promising species for forestry on the Northern Tablelands. The preference expressed by local sawmillers for this species also supports this potential. Well-grown logs are likely to receive premium prices, making this an attractive option for small-scale growers. Before any commercial plantations are established, further selection is required to ensure that frost tolerant provenances and families are chosen and to eliminate slow-growing provenances. On the basis of this trial, the Styx River provenance best combines these traits, with the Armidale provenance being the hardiest of the remaining provenances tested. The Tenterfield provenance is not recommended.

## **Messmate stringybark *Eucalyptus obliqua***

*Eucalyptus obliqua* ranked moderately on height, diameter and survival, and highly on stem and branch form after 38 months. However, the species means for each variable were lowered by poor results for one seedlot. Three individual seedlots of this species ranked eighteenth, twenty-first and thirty-seventh on the weighted index. Height and diameter growth was only around 70% of *E. nitens*, but form and health were very similar. This indicates that this species is worth considering for future development and for plantation establishment in the region.

There were clear distinctions among seedlots on most variables, with the two Gibraltar Range provenances (Butterworth (58) and Gibraltar Range (14)) clearly having the best form, health and survival, and slightly less growth than the other two provenances.

### **White-topped box *Eucalyptus quadrangulata***

As a species, *E. quadrangulata* had good mean growth, form and survival throughout the trial. It ranked fifth on height and eighth on diameter after 38 months. It also ranked well on form and health.

Within the species, there were slight but significant differences among the provenances, with the Mt Skanzi provenance (90) standing out on the basis of the weighted index. The survival of the Clouds Creek provenance was very poor (most likely due to the cold winter in 2001) when compared to other provenances. The mean survival of the remaining three seedlots was 87%.

*Eucalyptus quadrangulata* was attacked by the same insects and diseases and to a similar extent to the closely related *E. nitens*. There were differences among provenances in susceptibility, with the Mt Skanzi provenance most susceptible to Christmas beetles in 2001 and sawfly larvae in 2002 and the Clouds Creek provenance most susceptible to sawfly larvae and Chrysomelid beetles in 2002.

Apart from the Mt Skanzi provenance, the Dalmorton (76) and Chaelundi (91) provenances showed promise. Given that this species has not been previously planted on the Northern Tablelands or in similar environments elsewhere, no decisions about the potential of this species should be made on the basis of this trial alone. While growth, survival and form were good, its growth after 7 to 10 years will give a better indication of its potential. Further trials, should also be conducted in colder parts of the Northern Tablelands, even as small unreplicated plantings, to increase knowledge of the frost-tolerance of this species.

### **The stringybarks (*E. laevopinea*, *E. caliginosa*, *E. youmanii*, *E. macrorhyncha*)**

These species grew slowly relative to most of the other species in this trial. This is common for Monocalyptus species in trials and plantations. Some Monocalyptus species grow slowly at first compared to Symphyomyrtus species and later catch up. It is likely that the relative ranking of some of the seedlots of these species will improve as the trial progresses. Therefore it is difficult to write off the better performing seedlots of these species at this stage.

*Eucalyptus macrorhyncha* had the worst performance of all the stringybarks in this trial. Both provenances were from the ACT, so gave no indication of the likely performance of the Northern Tablelands provenances. These two seedlots cannot be recommended for planting on the Tablelands based on slow growth, poor survival, poor health and poor form.

*Eucalyptus caliginosa* had slow growth, acceptable survival and health, and moderate form. It performed better than *E. macrorhyncha*, was equivalent to *E. youmanii* and slightly inferior to *E. laevopinea*. There were significant differences among provenances for most variables. The weighted index showed no provenances in the top 40, but the Gara (49) provenance was clearly better than all the other provenances. The Manimbah (4) provenance had the worst ranking for this species on the weighted index. The growth of the Gara, New England Highway (47) and Sunnyside trap (1) provenances were best over the trial.

While the growth of all provenances of *E. caliginosa* was slow, the form was sufficient for sawlog production after thinning. Therefore all provenances would be suitable for local multi-purpose plantings, where timber production is secondary to other goals. No provenance could be recommended for general plantation establishment at this stage, particularly as there is nothing in the literature to indicate future performance. This may change as the trial matures.

*Eucalyptus youmanii* had similar performance to *E. caliginosa* with slow growth, moderate survival, health and form. There were also differences among provenances in most variables, although these differences were only significant between the best and worst provenances. On the weighted index, the New England (80) and East of Dundee (88) provenances were best, while the Alfreda, Ebor (34) and SE of Tenterfield (63) provenances were the worst. The top two provenances had superior height, DBH and health and the East of Dundee provenance had the best form for the species. The Alfreda

provenance had poor growth, health and form, while the SE of Tenterfield provenance had significantly lower survival than all the other provenances.

Like *E. caliginosa*, *E. youmanii* can only be recommended for use in multi-purpose plantings with timber or firewood as a secondary goal. Local provenances should be used for this purpose.

*Eucalyptus laevopinea* was the best performer of these four stringybarks, with significant differences among provenances. This species had similar performance to *E. cypellocarpa* and *E. campanulata*.

The most profound differences among provenances were in survival. The Emmaville (89) and Billy's Creek (85) provenances had very poor survival. Forty percent of the trees of the Emmaville provenance died in the first five months, indicating that there may have been something wrong with the seedlings, rather than any susceptibility to environmental conditions. The seedlings were small when collected from the nursery, but there was no record that they were unhealthy. The remaining seedlings of this provenance had the highest health score in March 2000. Most losses in the Billy's Creek provenance occurred in the period between March 2000 and February 2001, and were most likely due to the cold conditions. This provenance is likely to be the least frost tolerant based on these results. Despite having very good growth and health, the poor survival (and the poor branching habit) of the Billy's Creek provenance rule it out for plantations on the Northern Tablelands.

The Marengo State Forest (52) and Stratification trial (Woolbrook) (96) provenances were clearly the best of this species based on the weighted index, where they ranked thirty-second and thirty-third respectively. Of these two, Marengo had the better height, DBH and stem straightness, while Woolbrook had the better survival and branching habit. While both provenances had sufficient number of stems straight enough for sawlog production, the Marengo provenance had 40% of its trees with branching habit less than 4, indicating that some pruning might be necessary to improve the branching.

There was a low incidence of insect attack on this species although leaf-eating beetles affected about 30% of the trees of the Marengo and Ravensworth (8) provenances in 2002.

The natural form and the familiarity with this species by the timber industry make *E. laevopinea* a potential option for the Northern Tablelands. The results from this trial indicate that selection of appropriate provenances will be crucial if plantations of this species were to be established. However, the growth rates of all provenances at this stage do not warrant commercial plantings, unless they provide substantial other benefits. In areas where stringybarks naturally occur, there are usually several species in close proximity, so *E. laevopinea* may be the preferred option for timber production, using the local provenance.

### **Diehard stringybark *Eucalyptus cameronii***

This species showed moderate growth in the trial, achieving heights and diameters of about 60% of *E. nitens*. Its performance was intermediate between the top ranked Monocalyptus species (*E. fastigata* and *E. obliqua*) and the bottom ranked species. Growth was not sufficient at this stage to recommend it as a species for farm plantations.

### **Monkey gum *Eucalyptus cypellocarpa***

*Eucalyptus cypellocarpa* had moderate growth, good survival and moderate form and health in this trial. Compared to the closely related blue gums, shining gum and white-topped box, the performance was poor, being closer to the Monocalyptus species. Given that none of the provenances naturally occur on the eastern part of the Northern Tablelands, this species cannot be recommended for plantation establishment in that area, even for environmental benefits

### **The New England blackbutts *Eucalyptus andrewsii* and *E. campanulata***

While these two species are closely related, their performance in this trial clearly differentiates them. *Eucalyptus campanulata* had the better growth, health and form of the two, while *E. andrewsii* had marginally better survival. The mean survival of *E. andrewsii* was better than *E. campanulata*, but this was due to the performance of two provenances of the latter species. The Clouds Creek (39) and

Diehappy State Forest (41) provenances had very poor survival and should not be considered for planting on the Northern Tablelands. Most seedlots of both species had significant losses in the cold winter of 2001, which highlighted the low frost tolerance of these species.

In areas where *E. campanulata* naturally occurs, the better provenances could be planted for timber production, particularly in the east of the region, but would probably not be economic for timber alone. The high risk of losses due to frost would restrict their establishment to warm, upper slope sites only. The performance and ranking of these seedlots may be different on granite, where both species naturally grow.

*Eucalyptus andrewsii* is not recommended for timber production based on the poor survival and growth in this trial. Local provenances could be used on warm sites or where an overstorey exists to protect new seedlings from frost.

### **River red gum *Eucalyptus camaldulensis***

The growth, survival, health and form of *E. camaldulensis* were poor throughout the 3 years of this trial. It appears to have suffered from the cold and never looked like thriving. It had the lowest mean health score in 2000 and 2002. All provenances had a high proportion of trees in the lowest three health classes. The species cannot be seriously considered as a plantation species for the tablelands.