Beadle and Inions (1990) note the spectacular growth rates mentioned for eucalypts when grown in tropical areas outside Australia but they conclude that growth rates within Australia are still quite favourable when compared to other temperate regions. They present collected Australian results demonstrating that growth rates of up to 30 m^3/ha/yr are achievable, and thus the results of the STANDSIM simulations presented here are reasonable and cover the upper end of the range of productivities likely to be achieved in Australia.

Very few results are presented in the literature for long rotation sawlog regimes. Haslett (1988) reports that eucalypt plantations in New Zealand will produce 340 m^3/ha of sawlogs at age 40, which is a sawlog MAI of 8.5 m^3/ha/yr. This compares with results presented here which are more conservative, with sawlog MAIs ranging from 3 to 7 m^3/ha/yr depending on site quality.

It must be recognised that all site quality classes are not distributed equally across the land. Most importantly, the highest quality land (SI 43 in this study) only occupies a very small area, with rough estimates of the percentage of Tasmania that has been PI-typed in the E1, E2 and E3+ PI-height classes being 1%, 20%, and 20% respectively, with E1+ (> 76 m) making up such a very small part of the E1 area that it is not regularly separated (T. Kelley, pers. comm.). The authors consider that if current site selection and establishment guidelines are followed then the majority of future eucalypt plantations in Tasmania will have a productivity of at least 15 m^3/ha/yr.

Discount rate

Figure 3 presents the results of a sensitivity analysis of the effects of discount rate on the four management regimes considered. Several important conclusions can be drawn from this graph. Firstly, interest rates have a very strong effect on the profitability of a plantation, with interest rates at or above 8% being so high that all regimes are made financially unattractive.

Secondly, for interest rates at or above 4%, the regimes follow a consistent ranking of pulpwood, commercial-thinning, clearwood veneer, and lastly clearwood only, in order of decreasing NPV. Only for extremely low interest rates of about 2% or less do the longer rotation sawlog regimes become more attractive than pulpwood, but still the ranking within them is the same, with the commercial-thinning regime being the most attractive.

Finally, a drop in interest rates from 6% to 4% is enough to make a commercial-thinning regime financially viable under these assumptions if roading and establishment costs can be kept below $1600/ha.

Financial analysis

The following financial analysis results are calculated on the basis of the NPV of a *single rotation excluding establishment, roading and land purchase costs.* The resulting NPV represents the maximum establishment and land rental cost which will still ensure an economically viable plantation.

Pulpwood regime. Table 4 presents the range of financial outcomes for a eucalypt plantation managed under a pulpwood regime for various royalty and site index values. It indicates that on a reasonable site (SI 30) within 40 km of the processing plant (royalties of $22/t), a pulpwood eucalypt plantation would be economically viable for any establishment and land cost up to approximately $2125/ha.

A plantation on land with SI 30 which is further than 120 km from a processing plant (thus receiving only $14/t in royalties) will only be viable where the establishment and land cost is less than approximately $1282/ha. The boxed area in Table 4 indicates those sites which are considered most likely to be financially viable (> $1600/ha) based on recent Tasmanian plantation establishment costs (Neilsen 1990).

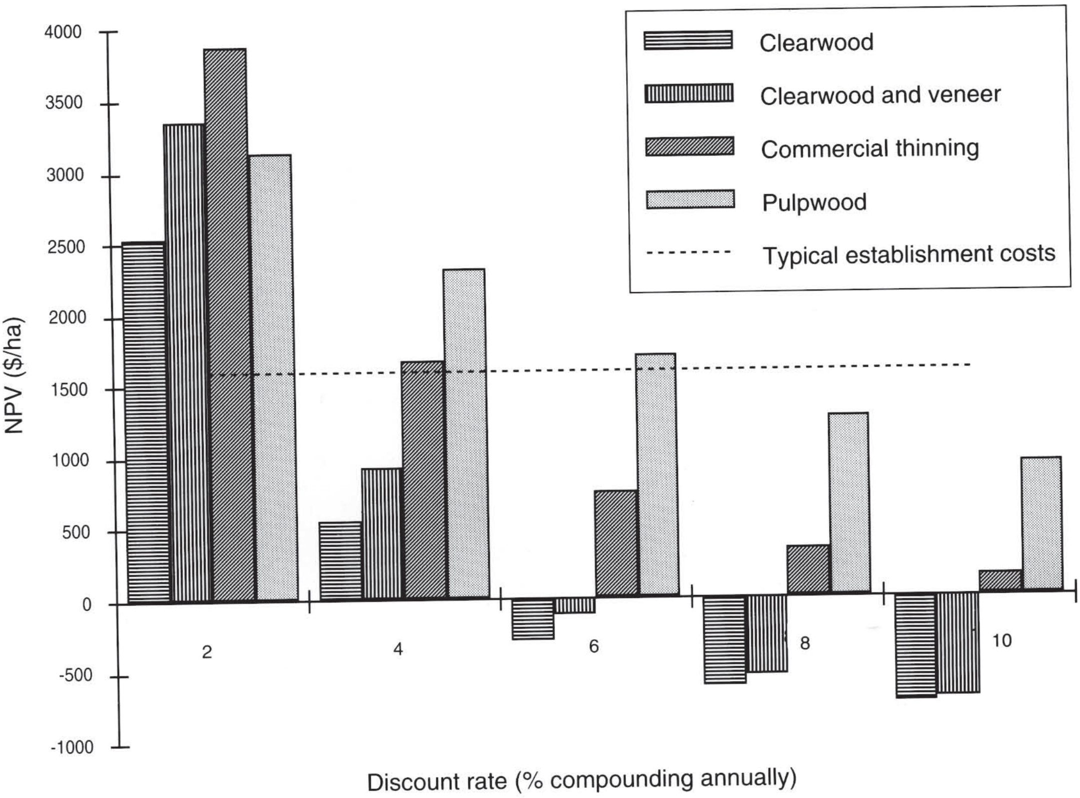

Figure 3. Effect of discount rate on four management regimes assuming SI 30, and royalty rates of $18/m^3$ for pulpwood, $20/m^3$ for knotty sawlog and $30/m^3$ for clear sawlogs. NPV figures exclude roading, and establishment and land purchase costs.

Figure 4 shows the NPV for plantations of four site indices, and the effect of increasing pulpwood royalty. On the basis of the site preparation costs given in Neilsen (1990), it is likely that, depending on the cost of the land, sites would be financially viable only where their NPV exceeds a typical establishment cost of $1600/ha.

Table 4. Nett Present Values ($/ha) for the pulpwood regime, excluding establishment and land costs. These are equivalent to the maximum break-even establishment and planting costs.

Royalty	Site Index			
($/t)	23	30	37	43
11.00	637	965	1213	1405
14.00	873	1282	1590	1828
18.00	1188	1703	2092	2392
22.00	1504	2125	2594	2956

Clearwood sawlog regime. Table 5 presents the range of financial outcomes for a eucalypt plantation managed under a clearwood regime, including the effects of various sawlog and pulpwood royalty rates and site indices. This type of regime has yet to be proven commercially for eucalypts but is currently under investigation (Gerrand 1992).

We have assumed a sawlog to pulpwood ratio of 33:67, but the financial analysis results are not very sensitive to the ratio chosen due to the similarity in price between sawlogs and pulpwood, particularly for sites close to a pulp mill.

Table 5 indicates that a sawlog eucalypt plantation managed under a clearwood regime would not be economically viable even under an optimistic combination of royalty rates and site qualities. The likely higher royalty rates and slightly shorter rotation lengths are not enough to offset the compound interest on the very high management costs incurred early in the rotation under this regime.

Veneer regime. Using the same management regime as for sawlogs, it is possible that a quantity of veneer quality logs could be produced. We have assumed that such logs could be expected to fetch a veneer royalty of $60/m^3. The NPVs for this option are given in Table 6 assuming a veneer:sawlog: pulpwood proportion of 15:18:67.

These figures are between $132 and $377/ha higher than for the equivalent sawlog-only regime. However, they still remain too low tc cover the likely establishment costs to produce financially viable plantations.

Commercial-thinning sawlog regime. Table 7 presents the range of financial outcomes for plantations managed under a commercial-thinning regime for various sawlog and pulpwood royalty rates and site indices.

The commercial-thinning regime assumes that a commercial harvest of pulpwood will be extracted between years 9 and 20, allowing the remaining trees to grow on for potential sawlog production. Based on operational experience, the royalty rates for thinnings were assumed to be half those at clearfall due to smaller piece size, the operational difficulties associated with thinning compared to clearfalling, and extra

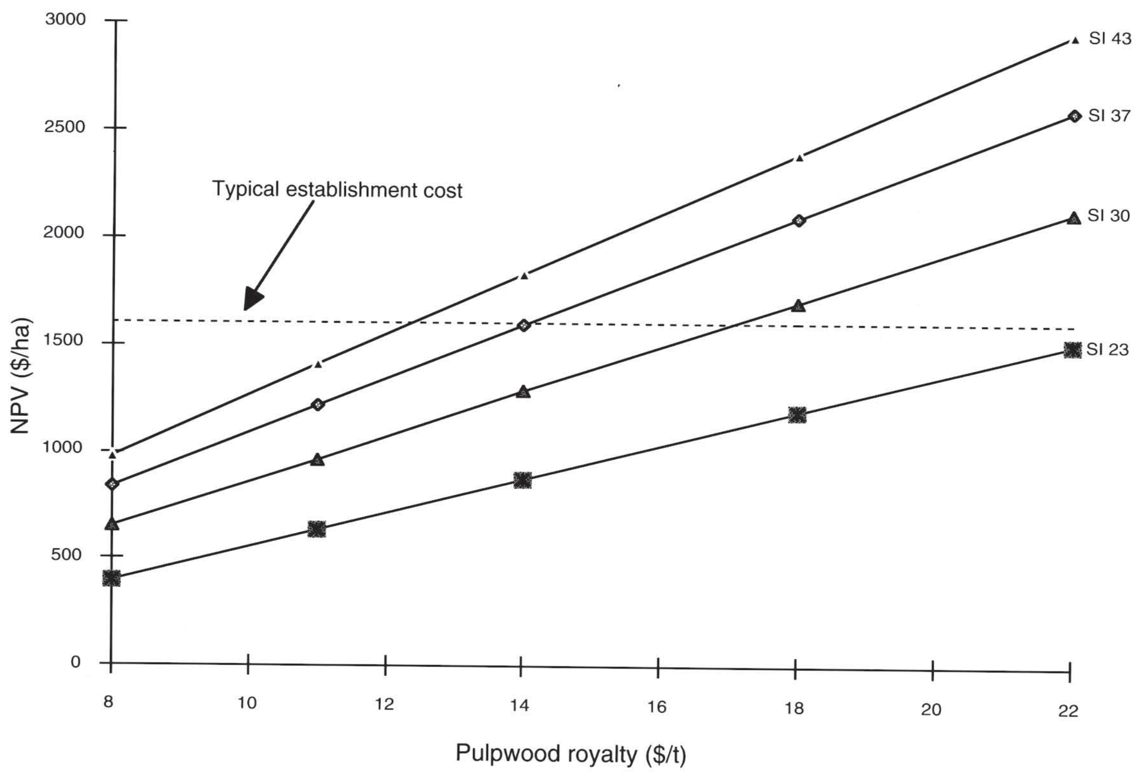

Figure 4. Nett Present Values for four site indices under a pulpwood regime.

supervision costs (B. Farmer, pers. comm.). This significantly reduces the NPV of this regime. Jennings (1992) noted a similar strong effect of thinning on the overall return of a commercially thinned plantation. Her results were based on different methods and assumptions from those used in this paper and are thus not entirely comparable but she notes that if thinning royalties are reduced from $15/m^3 to $8/m^3 then the land expectation value for a high quality site is reduced by 50%.

Final crop tree form and timber quality are likely to be lower in this regime than in the clearwood regime, hence the sawlog to pulpwood recovery ratio is assumed to be 15:85 and the royalty achieved is also likely to be lower as discussed previously.

This material is likely to be considerably different from the current Tasmanian oldgrowth hardwood which produces high quality, knot-free, appearance-grade sawn timber. This raises concerns over the market acceptance of such knotty hardwood, particularly considering the competitiveness of radiata pine.

These figures indicate that a commercially thinned eucalypt plantation would only be financially viable on extremely good sites (SI ≥ 37) where productivities were over 25 m^3/ha/yr and where the plantation was within reasonable proximity to a pulpwood processing plant. In addition, high royalty rates would be required for both pulp and sawlogs. Average sites (SI ≤ 30), even when close to a processing plant, are unlikely to be financially viable when consideration is given to both establishment and land costs.

It should be noted that changes in the sawlog royalty rate have very little impact on the NPVs associated with this management regime due to the impact of the early commercial thinning and the low proportion of sawlogs in the final harvest. NPV is more strongly influenced by rotation length and the age of thinning which should be done as early as possible if NPV is to be maximised. The rotation age is speculative at this stage and is highly dependent on the response of the retained stems, future utilisation standards and royalty rates.

Table 5. Nett Present Values ($/ha) for the clearwood regime, excluding establishment and land costs. These are equivalent to the maximum break-even establishment and planting costs.

Royalty ($/m^3)		Site Index			
Pulp	Sawlog	23	30	37	43
11	15	-938	-678	-434	-85
14	20	-865	-532	-218	230
18	20	-809	-422	-57	466
18	25	-777	-358	-38	604
22	30	-690	-184	294	977

Table 6. Nett Present Values ($/ha) for the clearwood veneer regime, excluding establishment and land costs. These are equivalent to the maximum break-even establishment and planting costs.

Royalty ($/m^3)		Site Index			
Pulp	Sawlog	23	30	37	43
11	15	-806	-416	-47	480
14	20	-747	-298	125	732
18	20	-692	-189	287	96
18	25	-675	-154	338	1043
22	30	-602	-9	551	1354

Table 7. Nett Present Values ($ /ha) for the commercial-thinning regime, excluding establishment and land costs. Thinning royalty equals 50% of clearfall pulp rate. These are equivalent to the maximum break-even establishment and planting costs.

Royalty ($/m^3)		Site Index			
Pulp	Sawlog	23	30	37	43
11	15	99	351	642	1055
14	20	215	536	906	1434
18	20	350	748	1204	1855
18	25	365	774	1245	1917
22	30	514	1012	1584	2401

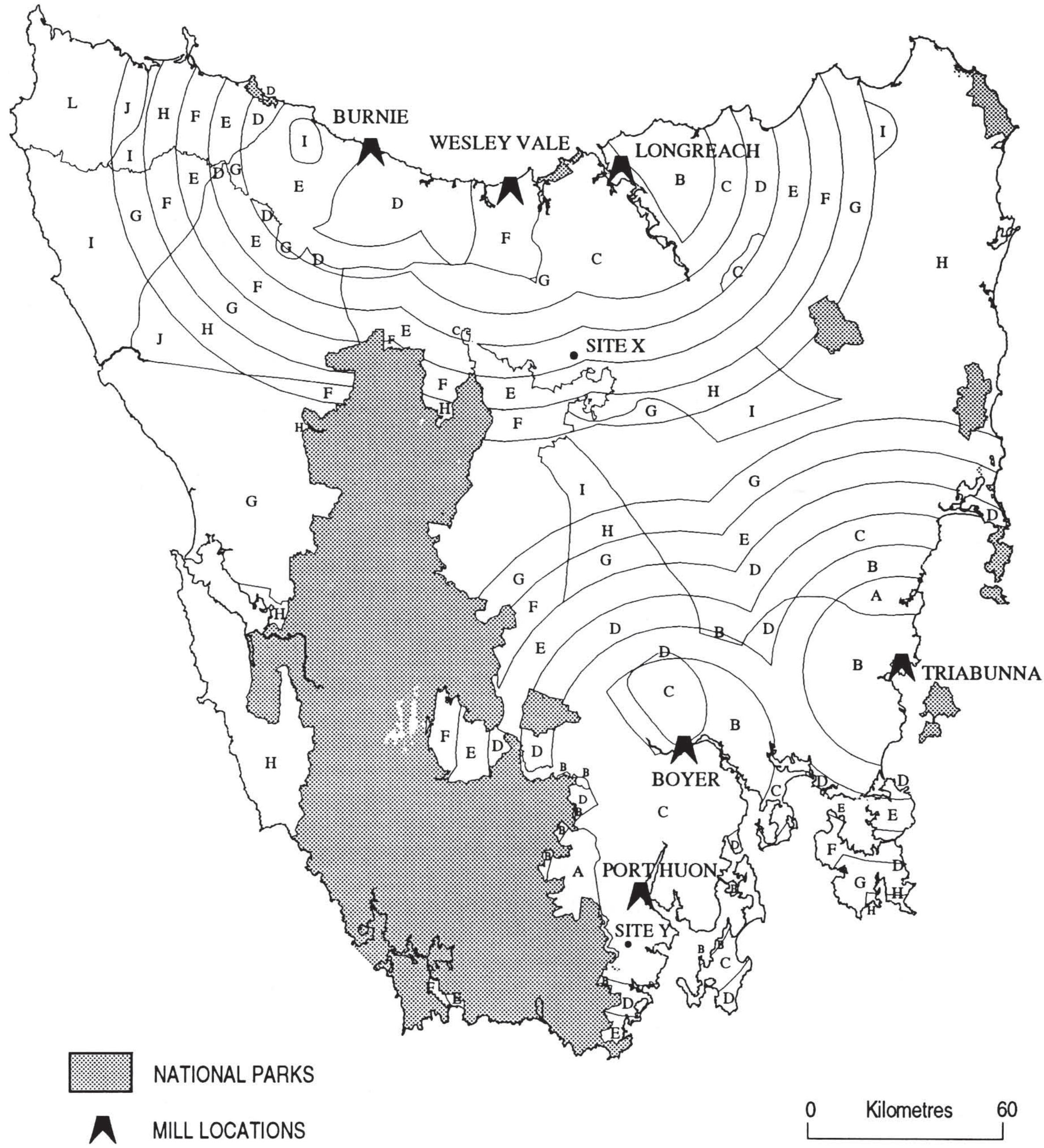

Figure 5. Map showing zones for the Nett Present Value (NPV) of eucalypt plantations in Tasmania grown under a pulpwood regime. In deriving the zones, site preparation and planting costs were excluded but an estimate of annual rental based on Figure 2 and Table 1 was included. A key to the letter-coded zones is given in Table 8.

Using the map of NPV for eucalypt plantations in Tasmania

Figure 5 presents a graphical representation of NPV zones for eucalypt plantations across Tasmania. The map is held by the Forestry Commission as a clear overlay at a scale of 1:500 000 to enable easy use but is presented here in reduced form due to space restrictions.

The map highlights the impact of the interaction of land values and distance to market on financial viability. The major feature of the map is that it shows zones representing the maximum break-even establishment and land purchase cost for eucalypt plantations grown on the short rotations (10–20 years) for pulpwood, using data presented in Tables 3 and 4. Sawlog rotation lengths are longer and NPV figures would be lower than shown here.

The NPV zones shown on the map include an assumed land value given in Table 1 and Figure 2 for 30 land-value zones as broadly determined for State forests by the Valuer General. These values are generally lower than cleared private land and thus the map may not represent NPVs on private land correctly.

Table 8 presents NPVs (*excluding establishment costs*) for four site indices for the labelled zones in Figure 5. The values given in Table 8 are not merely the mid point of the $100 category because they are based on an area weighted average of the NPV in that zone.

The map can be used to compare the financial viability of one or more sites (see below) through evaluating the effects on profitability of various combinations of site preparation costs, productivity (using site index as an estimate of site quality), and transport costs (using distance to mill). A considerable refinement of the results shown could be achieved by using a digitised coverage of the actual road network to determine distance to the various mill sites at a later stage.

To determine the viability of one location. The graphical presentation of the data in the map provides a guide to the maximum amount that can be spent on site preparation and planting and still break even. For example, a plantation at Site X on Figure 5 is in the NPV zone E, and thus from Table 8, if we assume a site index of 23, it would be financially viable if the site preparation costs were kept below $1037/ha.

Table 8. Area-weighted average Nett Present Values (excluding site preparation and planting costs) for zones shown in the map for pulpwood eucalypt plantations in Tasmania for four site indices (based on age 20). These are equivalent to the maximum break-even establishment and planting costs applicable to each zone.

Site index	SI 23	SI 30	SI 37	SI 43
PI-type approx.*	E3+	E2	E1	E1+
MAI (m^3/ha/yr)	15	20	25	30
Rotation (years)	20	15	12	10
NPV zone	NPVs ($/ha)			
A	1411	2004	2476	2840
B	1329	1929	2407	2776
C	1260	1813	2281	2643
D	1140	1616	2048	2382
E	1037	1465	1870	2183
F	928	1337	1724	2022
G	833	1200	1531	1787
H	751	1167	1491	1741
I	663	1110	1450	1713
J	568	990	1337	1606
K	(No area between $400 and $500/ha)			
L	391	876	1239	1519

* PI-type is only a poor estimate of site index.

The map assumes a single site index (as an estimate of site quality and productivity) across the State but Table 8 can be used to allow for varying growth rates and hence rotation lengths. It is not necessary to know the site index if the MAI for the plantation can be estimated or if the PI-type is known, although the latter is less accurate. Thus, if Site X is assumed to be SI 30, the break-even establishment cost increases to $1465/ha.

Comparing more than one location. A plantation at Site Y (NPV zone C, $1260/ha) is more financially attractive than Site X ($1037/ha) where both are SI 23 because it has a higher NPV due to closer proximity to a mill site which more than offsets a slightly higher land value. However, if Site X is of higher site index (e.g. SI 30), then it would be more attractive than Site Y because the NPV for zone E at the faster growth rate is $1465/ha (higher than Site Y at $1260/ha).

The map is in no way a definitive presentation but is useful for comparing the relative merits of various potential plantation sites rather than the absolute dollar values. No responsibility for the accuracy of land values or viability of plantations shown in this map is accepted by the authors or the Forestry Commission, Tasmania.

Discussion

Growth rates and rotation lengths

The rotations described in Table 3 were based on the achievement of a specific piece size and standing volume but may be longer than the financially optimum rotation. Harvesting, handling and processing costs were excluded from this analysis. A more complete analysis would require yield tables, recovery figures, royalties and harvesting costs for each size and quality category. Most of these data are currently unavailable and were considered too speculative for this paper.

Clearly, the MAI actually achieved is dependent upon good initial establishment and subsequent management such as ability to control weeds and pests which can have significant deleterious effects on growth (Wilkinson and Neilsen 1990; Elliott *et al.* 1990). Candy *et al.* (1992) present data which indicate gains in NPV of over $1000/ha through use of an integrated pest management strategy to control defoliation by the Tasmanian leaf beetle *Chrysophtharta bimaculata*. Because this strategy is still being developed, it is unclear what the costs will be routinely for these operations over a whole rotation and we have not included a figure for insect control in our financial analysis.

Royalty rates

In a somewhat dated but nonetheless comprehensive review of log pricing in Australia, Byron and Douglas (1981) conclude that, historically, royalty rates, in addition to being unrelated to market forces, generally underestimate the prices that the market could bear. Future demand levels and changed pricing mechanisms such as auctioning are a few of the many factors that will influence royalty rates. There is little doubt that this situation may change substantially during the time taken for any of the rotations presented here and we have not attempted to speculate on this but preferred to use existing achieved market prices.

Plantation establishment costs

Neilsen (1990) presents estimates of Tasmanian plantation establishment costs varying from $1300 to $1885/ha depending on terrain and level of logging residue. These figures represent the estimated establishment cost per hectare given that all reasonable efficiencies are attained and only apply to first rotations. Turnbull *et al.* (1989, 1992) note that establishment costs for some areas in southern Tasmania have been in excess of $2000/ha due largely to the high residue levels, wet conditions and the very broken terrain. We have chosen $1600/ha as a representative cost for an average site. In Tables 4 to 7, NPVs are highlighted and enclosed in a box where they exceed this figure for estabishment costs and are thus likely to be profitable.

It is important to note that the above analysis is calculated on the basis of a single rotation. The inclusion of future rotations (where profitable) will increase the NPV and may make some sites with very high preparation costs financially viable (de Laborde 1992). Subsequent rotations should be between $400 and $700/ha cheaper due to the existing infra-structure in the form of roads and reduced clearing and site preparation costs. For example, where a second rotation is $500/ha cheaper to establish and follows a 15-year pulpwood plantation, it will add over $200/ha to our current NPV, thus allowing a financially marginal plantation to become profitable. However, deferring the second rotation by initially undertaking a 40-year sawlog rotation will reduce this benefit to under $50/ha.

Conclusions

This analysis has highlighted a number of factors which are critical to the financial viability of any plantation establishment programme.

The analysis indicates that both pulpwood and commercially thinned sawlog eucalypt plantations have the potential to be financially viable where establishment costs are minimised and high quality sites are utilised. Given a constant site quality, it is obvious that financial returns will be maximised by locating a plantation as close as possible to a processing plant. It is also worth noting that better site quality may mean that a plantation located at a greater distance from the nearest processing plant actually returns a higher nett financial benefit. The map presented in Figure 5 can assist in assessing future plantation developments to determine whether they have the potential to show positive returns. It enables simple comparisons of one or more sites to determine which is likely to be the most financially viable, and enables estimates to be made of an upper limit to the establishment and land costs that can be incurred for the plantation to break-even.

Our analysis indicates that a pulpwood plantation on a good site (SI 30) within 40 km of a processing plant will be financially viable for any establishment and land costs up to $2125/ha. But, where the plantation is located further than 120 km from the processing plant, it will be financially viable only if the establishment and land costs are less than $1282/ha. An average quality pulpwood plantation (SI 23) will only be viable when located close to a processing site (i.e. approximately 40 km or less) and then only if establishment and land costs can be kept below $1504/ha.

Commercially thinned sawlog plantations on average sites (SI 30) have NPVs approximately $500 to $1000/ha less than for pulpwood plantations. However, on higher quality sites, this gap closes so that on sites of SI 43, the single rotation NPVs are equivalent although they have been returned over differing rotation lengths. This increase in rotation length is reflected in higher land rental costs. Both these factors stress the high importance of selecting high productivity sites.

A major benefit of the commercially thinned sawlog regime is that no significant additional nett investment during the life of the plantation is required in order to produce sawlogs, unlike the clearwood management regime. With all the sawlog regimes, it is possible to realise the trees remaining after thinning as pulpwood before they reach sawlog size if so desired, but the price obtained per m^3 is likely to be similar for all regimes and unlikely to cover the higher costs of early thinning and pruning incurred in the clearwood regime.

On the basis of our analysis, the authors consider that it is unlikely that a clearwood management regime will be financially viable under any reasonable growth and royalty assumptions.

Acknowledgments

We would like to thank the following Forestry Commission staff who contributed information and made useful comments on an earlier version of this paper: Brian Hodgson, Brian Farmer, Darrel Stringer, Rod Rich, Dennis Chester and Garry Gregg. Thanks are also due to Tony Rainbird (Resources Branch, Forestry Commission, Tasmania) who prepared the maps for publication. Funding for the work reported here was provided by the Intensive Forest Management (IFM) program.

References

Anon. (1991). *Reserve Bank Bulletin*, October 1991.

Beadle, C. L. and Inions, G. (1990). Limits to growth of eucalypts and their biology of production. In: *Prospects for Australian Forest Plantations* (eds J. Dargavel and N. Semple), pp. 183–193. Centre for Resource and Environmental Studies, Australian National University, Canberra.

Byron, R. N. and Douglas, J. J. (1981). *Log Pricing in Australia*. BFE Press, Canberra.

Cameron, J. I. and Penna, I. W. (1988). The Wood and the Trees: a Preliminary Economic Analysis of a Conservation Oriented Forest Industry Strategy. Australian Conservation Foundation, Hawthorn, Victoria.

Campbell, R. G., Ferguson, I. S. and Opie, J. E. (1979). Simulating growth and yield of mountain ash stands: a deterministic model. *Aust. For. Res.* 9: 189–202.

Candy, S. G., Elliott, H. J., Bashford, R. and Greener, A. (1992). Modelling the impact of defoliation by the leaf beetle, *Chrysophtharta bimaculata* (Coleoptera: Chrysomelidae), on height growth of *Eucalyptus regnans*. *For. Ecol. and Management* 54: 69–87.

Clark, J. (1990). Plantations can save our native forest. *Habitat* 18(4): 10–14.

Coleman, J. (1989). STANDSIM: A forest simulation model for *Eucalyptus regnans*, *E. delegatensis* and *E. sieberi*. Draft Users Manual for PC Version. Young Eucalypt Program, CSIRO.

Elliott, H. J., Kile, G. A. and Cameron, J. L. (1990). Biological threats to Australian plantations: implications for research and management. In: *Prospects for Australian Forest Plantations* (eds J. Dargavel and N. Semple), pp. 271–280. Centre for Resource and Environmental Studies, Australian National University, Canberra.

FAFPIC (1987). Forest industries growth plan. A submission to the Australian Government. Forest and Forest Products Industry Council, Melbourne, Victoria.

Farrington, A. and Hickey, B. L. (1989). Wood sources for the Port Huon Mill: NSSC pulping of some young eucalypt species. *Appita* 42(6): 419–423.

Gerrand, A. (1992). Summary of eucalypt plantation sawlog and veneer research project. In: *Division of Silvicultural Research and Development Annual Report*, pp. 41–42. Forestry Commission, Tasmania.

Goodwin, A. (1988). Accuracy of classification of CFI plots to Mature Height Classes. Unpublished report to the Forestry Commission, Tasmania.

Goodwin, A. and Candy, S. G. (1986). Single tree and stand growth models for a plantation of *Eucalyptus globulus* Labill. in northern Tasmania. *Aust. For. Res.* 16: 131–144.

Goodwin, A. and Thompson, D. (1989). Review of STANDSIM. Unpublished report to the Forestry Commission, Tasmania.

Haslett, A. N. (1988). A Guide to Handling and Grade-sawing Plantation Grown Eucalypts. FRI Bulletin No. 142, Rotorua.

Jenkin, B. (1992). Eucalypt Plantation Silvicultural Regimes. 1990 Gottstein Fellowship report, Victoria.

Jennings, S. (1992). A preliminary assessment of the economics of hardwood sawlog production on private forest land in Tasmania. Unpublished report to the Forests and Forest Industry Council, Tasmania.

Laffan, M. (1993). *Site Productivity and Land Suitability for Eucalypt and Radiata Pine Plantations in Tasmanian State Forest. A Framework for Classification and Assessment of Land Resources*. Soils Technical Report No. 3. Forestry Commission, Tasmania.

de Laborde, R. M. (1992). Financial analysis of silvicultural practices. In: *Symposium on Intensive Forestry: The Role Of Eucalypts* (ed. A.P.G. Schonau), pp. 846–857. Proceedings of the International Union of Forest Research Organisations Conference, 2–6 September 1991.

Lawrence, P. R. (1981). *Provisional Site Index and Yield Tables for Eucalypts in Southern Tasmania*. Forestry Commission, Tasmania.

Mc Kimm, R. J., Waugh, G. and Northway, R. L. (1988). Utilization potential of plantation grown *Eucalyptus nitens*. *Aust. For.* 51(1): 63–71.

Neilsen, W. A. (1990). *Plantation Handbook*. Forestry Commission, Tasmania.

Neilsen, W. A. and Wilkinson, G. R. (1990). Eucalypt plantation silviculture: implications for sawlog production in Tasmania. In: *Prospects for Australian Plantations* (eds J. Dargavel and N. Semple), pp. 209–223. Centre for Resource and Environmental Studies, Australian National University, Canberra.

Opie, J.E. (1972). STANDSIM. A general model for simulating the growth of evenaged forest stands. In: *Proceedings Third Conf. Advisory Group of Forest Statisticians*. International Union of Forest Research Organisations, Paris, 1970 in Inst. Nat. de la Recherche Agron. Publ. 72–3: 217–239.

Opie, J.E. (1976). *Volume Function for Trees of all Sizes.* Forestry Technical paper No. 25. Forests Commission, Victoria.
Orme, K., Orr, S., Gerrand, A. and Todd, G. (1992). Potential of low fertility sites for plantations in north-eastern Tasmania. *Tasforests* 4: 69–77.
Roberts, E. R. and McCormack, R. J. (1991). Thinning technologies. In: *The Young Eucalypt Report* (eds C.M. Kerruish and W.H.M. Rawlins), pp. 50–106. CSIRO, Australia.
Schonau, A.P.G. and Coetzee, J. (1989). Initial spacing, stand density and thinning in eucalypt plantations. *For. Ecol. and Management* 29: 245–266.
Tibbits, W.N. (1986). Eucalypt plantations in Tasmania. *Aust. For.* 49(4): 219–225.
Turnbull, C.R.A., Beadle, C.L., Traill, J.C. and Richards, G. (1992). Benefits, problems and costs of excavators and bulldozers used for clearing operations in southern Tasmania. *Tasforests* 4: 45–55.
Turnbull, C.R.A., Traill, J.C. and Beadle, C.L. (1989). Productivity and costs of establishment of eucalypt plantations on native forest sites in southern Tasmania. In: *Efficiency of Stand Establishment Operations.* Proceedings of the International Union of Forest Research Organisations Symposium 11–15 September 1989, Rotorua.
Waugh, G. and Rozsa, A. (1991). Sawn products from regrowth *Eucalyptus regnans.* In: *The Young Eucalypt Report* (eds C.M. Kerruish and W.H.M. Rawlins), pp. 178–209. CSIRO, Australia.
Wells, K. F. (1991). The young eucalypt forest resource. In: *The Young Eucalypt Report* (eds C.M. Kerruish and W.H.M. Rawlins), pp. 19–27. CSIRO, Australia.
West, P. W. (1991). Thinning response and growth modelling. In: *The Young Eucalypt Report* (eds C.M. Kerruish and W.H.M. Rawlins), pp. 28–49. CSIRO, Australia.
Wilkinson, G. R. and Neilsen, W. A. (1985). Site evaluation of the northern poor sites and silvicultural recommendations for the establishment of eucalypt plantations. Unpublished report for the Eucalypt Plantation Task Force. Forestry Commission, Tasmania.
Wilkinson, G. R. and Neilsen, W. A. (1990). Effect of herbicides on woody weed control and growth of plantation eucalypt seedlings. *Aust. For.* 53: 69–78.
Wingate-Hill, R. and MacArthur, I.J. (1987). Economics of debarking and chipping smaller diameter regrowth eucalypt thinnings. *Aust. For.* 50(3): 157–165.
Wingate-Hill, R. and MacArthur, I.J. (1991). Debarking small diameter eucalypts. In: *The Young Eucalypt Report* (eds C.M. Kerruish and W.H.M. Rawlins), pp. 107–151. CSIRO, Australia.

Tasforests