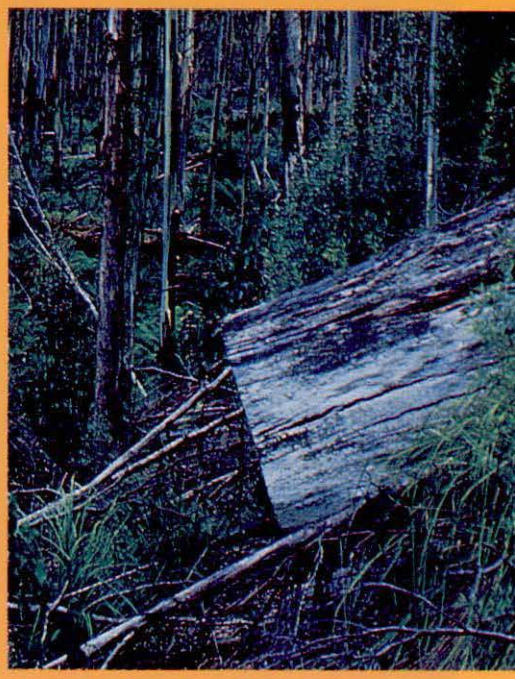
More wood from the trees

Australian native eucalypt forests have never been managed as intensively as our plantations of exotic (imported) trees such as pines. For many pine plantations management involves careful site preparation, selection of the trees, and the application of fertilisers, together with weed control and thinning.



One of the hazards of intensive management of eucalypt regrowth forest: a log, many years old, remains on the ground. This stand, about 12 years old, is growing back — probably after a fire destroyed the original growth.

For this reason, and because they are relatively free from the pests and diseases of their natural habitat, a number of pine plantations in Australia produce much higher average wood yields per unit area than do the eucalypt forests we use for timber production. But now some researchers are suggesting that, to boost production, some of the eucalypt forest that grows back after logging or other disturbances such as fire — termed the young regrowth forest — could be similarly manipulated to enhance its yield.

Australia's native forests are, of course, nearly all hardwoods; what we have lacked to date is softwoods. But now the tables are turning. Softwood, supplied by the 2% of our forested area under pine plantation and by imports from New Zealand, will soon no longer be in short supply here, but our supplies of hardwoods will continue to decrease.

Hardwoods are essential for good-quality printing and writing paper, and important for many structural applications and for their appearance. Currently, because our own forests cannot meet our requirements, we import other hardwood timbers, most of which come from tropical rainforests.

Several possible solutions exist to overcome this shortage. The pulpwood shortfall may be met, in part, by the establishment of eucalypt plantations (see 'Fast-growing eucalypts boost plantation prospects' in

A feller–forwarder loading young eucalypt thinnings (about 19 years old) onto a truck.

Thinned (above) and unthinned stands of *Eucalyptus regnans*, about 18 years old.

Ecos 63). The substitution of softwoods for hardwoods, which may be possible in some markets, should also help. Subjecting some of the 6 million hectares of eucalypt forests currently managed for wood production to a selection of forest-management techniques designed to improve their productivity is the other approach now being proposed.

YEP

Focusing on this idea is a group of researchers from the CSIRO Division of Forestry and Forest Products, working in collaboration with others from the forest industry and Victorian and Tasmanian State forest departments. Together, they have recently completed an ambitious project called the Young Eucalypt Program (YEP). This 5-year research program investigated the growth, harvesting, and use of intensively managed, 'young' (less than 30 years old) eucalypts in south-eastern Australia. Other researchers have carried out similar work in the karri forests of Western Australia.

The YEP scientists concentrated mainly on trees of the ash group — especially the mountain ash (*Eucalyptus regnans*), the world's tallest hardwood, extensive stands of which exist in the temperate forests of Victoria and Tasmania. They wanted to see how various thinning techniques, used both here and overseas, could be applied to suitable regrowth eucalypt forests comprising 'young' trees.

The program was managed by a board representing the participants and chaired by Dr Ken Harris of Petersville Sleigh Pty Ltd. Mr Bill Kerruish of CSIRO directed the research.

One question addressed was how best to reduce the number of young trees so that growth of the chosen surviving trees would be faster. The team also examined the growth response of the remaining trees and the damage that the forestry operations may do to them. They went on to consider what to do with the logged trees, investigating ways of removing their bark and the types of sawn and paper products that younger trees, with their different wood quality, could provide. And finally, the economics of the entire proposal were subjected to analysis.

Thinning

By thinning dense, naturally regenerated stands at an early stage, the forester can produce more wood from the land. The increased productivity flows from the fact that the growth potential of the site becomes concentrated on fewer trees that, as a result, grow faster. A naturally regener-

ated stand at 4 years of age may contain about 20 000 trees per ha, but will thin itself to about 150 trees per ha by maturity. Controlled thinning removes trees that would die before maturity anyway.

Very early thinning, called 'thinning to waste' or 'spacing', may take place anywhere from about 4 to 14 years, using special clearing saws or other means. The small trees felled in this way are of little use, but that is not the case with later thinnings.

One of the key findings of the program was that from about 18 years onwards it's possible to harvest the thinnings for pulpwood, thereby obtaining a financial return as well as encouraging tree growth. However, in a regrowth forest there are a number of constraints on applying these methods.

One of the most important problems is the debris left after the last logging of the area. Although this might have occurred decades or even a century ago, much of the then-unwanted material still remains on the forest floor. This debris restricts access, as does the vigorous undergrowth often associated with eucalypt forest. Unlike those in pine plantations, the trees here are not growing in carefully designed and spaced rows. Instead, they are often crowded and jumbled. The YEP researchers tried many techniques on the recalcitrant regrowth hardwood stands, and with some success.

The right tools

Essential to their success was appropriate technology. The program included assessment of various new forestry tools, designed to keep unnecessary impact to a minimum. A new type of 'feller–forwarder' can move over rough ground, and cut trees with relatively little damage to those remaining. Its design also ensures that it causes less damage to the soil than previous models.

As part of the program, scientists carried out studies on controlled wounding of trees, as existing trees can be damaged when others are felled. Here, a piece of bark has been removed and the wood below scratched.

Another machine is the 'feller–buncher'. Part of the problem with small trees has been that, by comparison with large ones, they are uneconomic to harvest one by one and transport to the road. They yield insufficient wood in return for the effort. But the latest feller–buncher, which cuts trees and puts them into neat bunches for transport to the roadside, has been designed to accumulate several small stems, so making it feasible to harvest those that have to be removed in the thinning.

Bark presents another problem with small trees. Workers must remove this before the wood is processed, as it has no role in the making of paper. In many eucalypts it's particularly fibrous. Moreover, in small trees it accounts for a greater proportion of the cross-sectional area of the stem so the ratio of bark to wood is higher than in large logs. Removing the bark is laborious — another reason why the industry regarded small eucalypts as just not worth using.

Recently, however, CSIRO researchers in collaboration with the forest industry devised an efficient eucalypt-friendly type of mechanical de-barker. (Other participants in the program have also come up with possible solutions to de-barking.)

Previous de-barkers were mainly designed for use on the flaky bark of pine, not on the strip-like fibrous coverings of some eucalypts. The new device, patented by CSIRO, can even process the tricky stringybarks, and does so far more quickly than working by hand or using inappropriate machines. And, making the process even more efficient, you can use it in the forest, which means that you needn't waste money transporting bark to the mill. (However, for some applications, mill de-barking still remains more appropriate, and the CSIRO de-barker can be used there as well.) The bark, along with small branches and foliage, is left in the forest to rot. This is important because all of these are rich in nutrients, which thus return to the soil.

What can our forest industry use the young, small logs for? It has grown up on a diet of old, large eucalypt trees for both timber and paper-pulp, and the existing technology is designed to process this large material. A few thinnings have been harvested for posts and mining timbers, but the scale of these operations has always been small.

A cabinet made by Robert Blacklow, of Hobart, shows that 50-year-old *E. regnans* wood can be suitable for furniture-making.

YEP studies have shown that wood from younger trees has a higher value for pulping than old wood. The work also showed that technical problems associated with sawing and drying wood as young as 50 years could be resolved, given the appropriate technology.

Forests and the future

The researchers have concluded that, by changing forestry practice and tools, we can increase the productivity of some of our regrowth eucalypt forests by as much as 30–60%. Most of the results of the work will come as a bonus for future generations, when the final logging of the intensively managed stands for sawlogs takes place. (The careful management will reduce the rotation period — the time until the main harvest — from 80 years to 50, so bringing forward the gain.) But even now, by making good use of young trees removed at thinning, we can derive more wood from each hectare of land.

Successful application of the study findings will require careful selection of machines, suitable training of workers in the industry, and effective monitoring of progress. The researchers have identified 100 000 ha of suitable forests in Victoria and Tasmania that could be managed in the suggested fashion. Further work will need to assess the implications for wildlife and fire management. The potential long-term benefits of the YEP, in addition to greater efficiency in hardwood production, include a possible reduction in the area of eucalypt forest logged, and/or a decreased demand for hardwood imports.

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