

Iron, steel and timber: a transient heritage

John Dargavel

Visiting Fellow, Fenner School of Environment and Society,
The Australian National University, Canberra, ACT 0200.

SUMMARY: The paper provides an overview of the Australian sawmilling industry from 1788 to the present against which its heritage stories can be told. Mechanised sawmilling became firmly established from the 1850s. It looked to exports where it could and competed with imported softwoods. Before WWI it was largely an industry of small steam-powered sawmills located in the forests and some metropolitan mills owned by timber merchants. It started to up-grade its technology between the wars. The booming timber market immediately after WWII led to a temporary surge in the number of small mills followed. The industry changed from the 1970s as small, family owned forest mills closed or were taken over by large companies, and as softwood production from pine plantations has replaced hardwood production from native forests. The transient nature of the industry has meant that much of its heritage has been lost.

Key words: band saws, box mills, Bunnings Ltd, circular saws, Donnelly River mill, exports, forest sawmills, frame saws, J. Wright, spot mills, vertical saws, W.H. Warren, water mills

1. STORY AND MEANING

Heritage is story. Without their stories, mills, saws and logs are just iron, steel and wood, they carry no meaning, they are just things. But with their stories, they are our remembrance of the past and the creators of our present. We identify with them and are identified by them; they are our heritage that we may squander, or bequeath if we are so minded.

We who are minded to bequeath our heritage are necessarily storytellers. We know that every story has its teller, its listener and its tale. Our stories have a purpose: some to entertain, others to educate, inculcate a culture, teach a moral or spread a political position. They are explicitly, or more often implicitly, value laden. Differences abound. Every teller tells the story a little differently, every hearer hears it a little differently. Moreover, each generation tells and hears the story with its own concerns in mind and, knowingly or not, finds a different meaning. Each story is thus *transformative* not just because its emphasis changes in the telling, but because it produces and reproduces a meaning that changes. Each story is *transient*, passing through time and generations. Its passage is hazardous for it may be lost for a time or forever, or it may be cherished and zealously guarded. To help its telling and to try to fix its meaning, we keep books, pictures, objects and places. They may be public heritage places like the Donnelly Mill, or the Avenue of Honour in Kings Park, or they may be private places like a family home we share with our grandchildren.

Engineering weaves its stories around objects and places. Some are told through artefacts—tools and ingenious machines for example—preserved as the evidence of our material culture in museums. Their stories are told by curators through captions and

storyboards for all to read. Others are places—bridges, canals and factories, for example—where their setting is essential to the meaning. The stories of such places can be harder to tell than those of museum artefacts, yet they can be easier and more rewarding to comprehend. Places, left to nature or to developers, are transient and are more difficult and costly to keep against the ravages of either.

The forest is in constant change as the centuries, decades, years and seasons pass and as it affected by fires and storms, roading and logging, and by the endeavours of foresters to protect and cultivate it, or the endeavours of others to keep it untouched. Its history, *forest history*, is a flourishing field in Australia with its own Society and publications.¹ Many industries draw resources from the forests: water, gravel, bauxite, wild flowers, tourism and most obviously of interest here timber and other wood using industries.

Timber industry heritage is predominantly concerned with places and has little presence in museums (apart from the Forestry and Timber Museum at Gympie, the Forest and Heritage Centre in Geeveston in Tasmania, and the Manjimup Timber Museum in Western Australia each of which functions as a social history and a tourist display). Preserving the natural heritage—or biodiversity—of the forests has been a fraught public and political concern since the 1970s. It induced governments to conduct extensive regional surveys of forest heritage that luckily included industrial, social, cultural and Indigenous dimensions. Some of the States undertook their own surveys, but it was not until 1990 that the first co-operative Commonwealth-State survey was tried. It took place in the Southern Forest Region of Western Australia.² The approach was extended to other States under the Regional Forest Assessment

process.³ As a result, we probably have more systematic data about the forest industry's heritage than for any other industrial sector. However, much of it is interred in the grey literature of government agencies.

The forest industry *per se*, with a few notable company histories as exceptions, has taken little interest in its history.⁴ In contrast to this, a group of dedicated volunteers in the Light Railways Research Society of Australia (LRRSA) has undertaken thorough surveys of the industrial archaeology of many timber industry sites.⁵ Their work is remarkable for the manner in which they have been able to chart the transport systems from the faint, overgrown marks that have been left in the bush. Their work covers the tramways that brought the logs in, the lines that took the sawn timber away, and frequently extends to the mills and their small settlements. They tell a good story.

Several archaeological and heritage studies of individual mill sites have been published in journals and conference proceedings. For example, Jane Lennon has written on Munro and Lever's mill in what is now the Border Ranges World Heritage area in NSW, and Peter Davies has written on Henry's mill in what is now the Otways National Park in Victoria.⁶ Such studies are continuing. For example, the University of Queensland's Mill Point Archaeological Project is working over several years to uncover the history of Pettigrew's mill and its settlement in Southeast Queensland. Such studies tell the social and cultural stories of such mills.

The LRRSA's work in Australia mirrors the international emphasis placed on transport systems in the engineering heritage studies of the industry. Until well into the twentieth century, the engineering requirements for, and costs of the transport systems were equal to or greater than its requirements for, and costs of the sawmills. Moreover, the great flumes and water-born systems of North America and Europe, and the steam locomotives and timber bridges of the nineteenth century were extensively photographed and readily lend themselves to heritage stories.

There has been much less emphasis on the engineering heritage of the sawmills themselves. There are far fewer images of mills or of the working machinery. Moreover, the forest focus has meant that the sites of the urban sawmills have been comparatively neglected, and as they have now been largely lost to development, it is unlikely that archaeological studies will be as fruitful as in the forests. It should be noted that little of the rich engineering history of either the plywood or the pulp and paper industries has been recorded.

If the stories of engineering heritage and the places that help us tell them are not to be lost, much has to be done. This paper concentrates on the sawmills, rather

than the better-known transport systems. It sets out the changing structure of Australian sawmilling and hence provides the scenery against which stories could be told. It is primarily concerned with the native hardwood sawmills, and leaves the plantation mills for another day. Western Australia provides the scenery for this conference and some of the examples in this paper.

2. ORIGINS

Sawing timber is Australia's oldest industry and its very start epitomises its transient nature. As soon as the First Fleet landed in Botany Bay in 1788, the ships' carpenters set up sawpits and doubtless had the convicts felling trees and sawing timber for the few days until the First Fleet moved round to Port Jackson. The difficulty of transporting logs and timber also epitomises the timber industry and determines where it is sited and how long it lasts. When the Fleet left, the Botany Bay sawpits were abandoned and although the saws were taken away, the investment in infrastructure—the work of digging a pit and setting up a wooden framework—was lost. What a heritage place that would be, if only we could find it!

Manual sawing and hewing provided the bulk of timber used well into the nineteenth century. It formed part of the punishment regimes in the convict stations at Macquarie Harbour and Port Arthur in Tasmania. There are documentary sources through which a little of its story can be told, and archaeologists have been found traces of saw pits in Tasmania.

In 1819 that controversial and outspoken native son, W.C. Wentworth advised intending British migrants that:

... anyone who had the means of taking out a steam engine of six or eight horsepower with the requisite machinery for sawing boards would make it answer to this purpose very well; that a timber merchant also, possessing a capital of three to four thousand pounds, might employ his funds very advantageously in establishing a timber yard.⁷

However, few heeded his advice so that less than twenty sawmills were built during the first half of the nineteenth century, of which four were water powered, some operated as both corn and sawmills, and most were short lived.⁸

These early mills were equipped with reciprocating vertical frame saws that simply mechanised the process of pit sawing. They probably processed baulks or flitches that had been hewn or sawn manually in the forest. Manual and mechanised production co-existed in various arrangements well into the twentieth century.

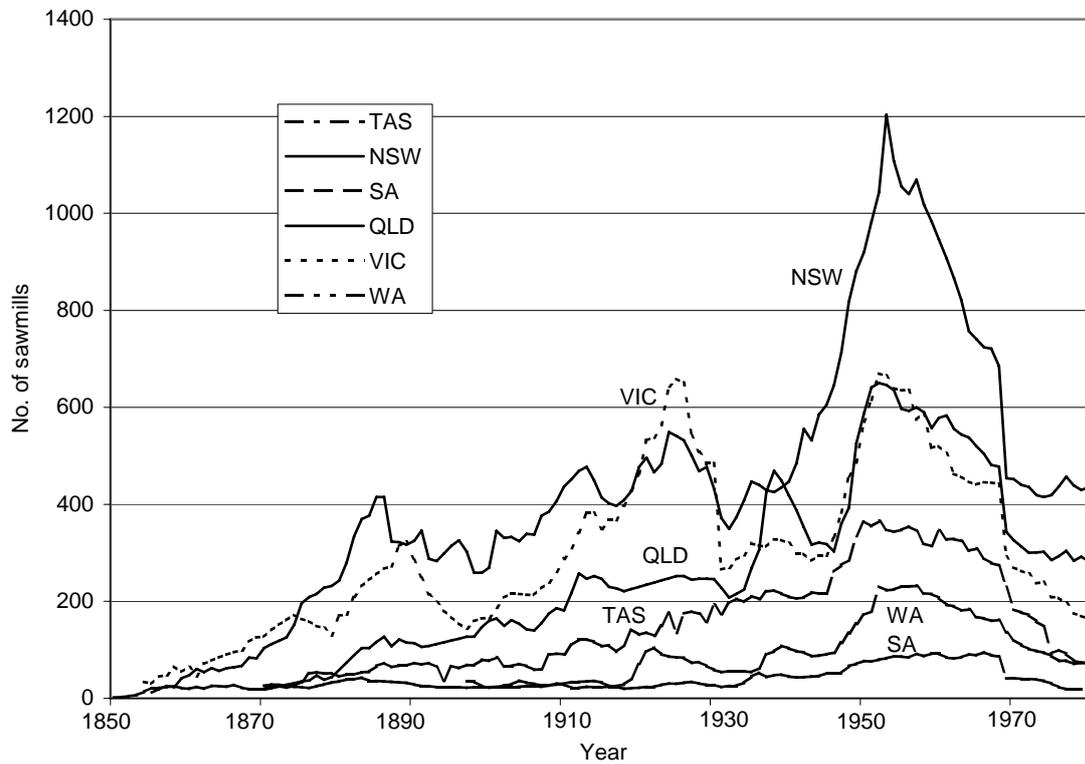


Figure 1. Number of sawmills by State, 1850-1980

Note: Missing data interpolated. Data collection methods not necessarily identical between Colonies/States prior to 1910

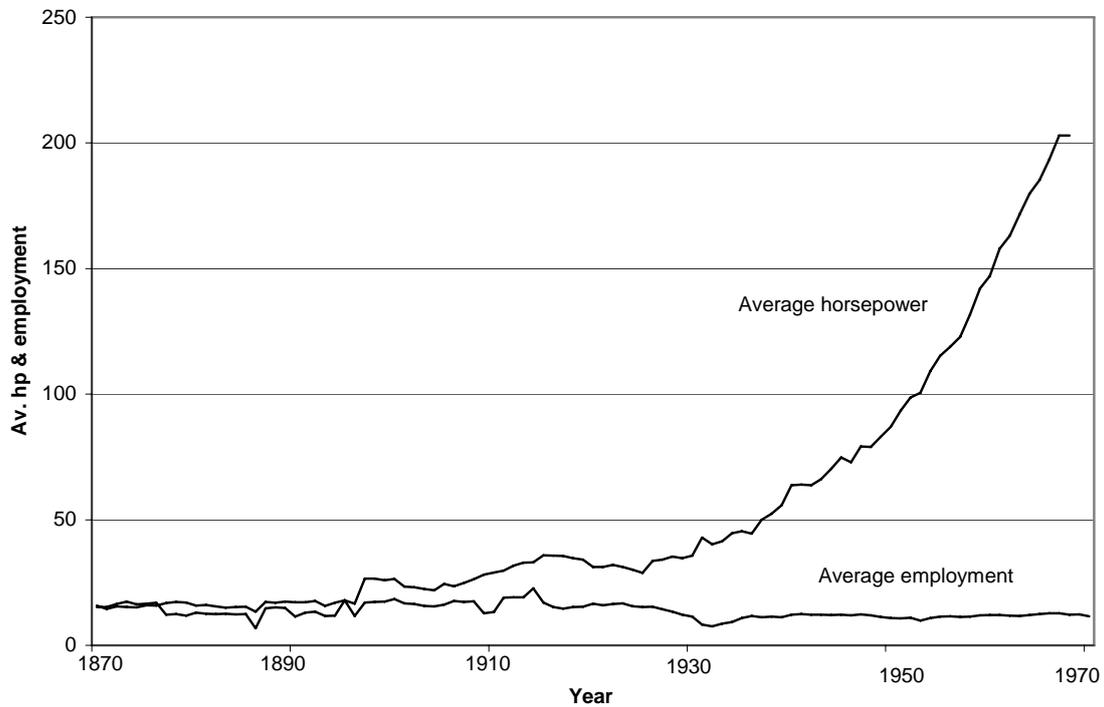


Figure 2. Estimated average horsepower and estimated average employment, Australian sawmills, 1870-1970

Note: Missing data for some Colonies/States and some years. Data collection methods not necessarily identical between Colonies/States prior to 1910.

3. ESTABLISHING SAWMILLING AND THE TIMBER TRADE BEFORE WWI

Mechanised sawmilling only became firmly established from the mid-nineteenth century due to a rapid demand for wood and labour during the gold rushes and the subsequent economic expansion. The number of sawmills increased steadily (Figure 1) and they became more productive. Typically, a single steam engine drove a circular saw that could break down logs into flitches, which were then re-sawn to size on a smaller saw bench. Generally, the technology of small steam-driven mills remained fairly constant until well into the twentieth century, judging from the estimates of average engine power and employment (Figure 2). A few more water mills were also built during the nineteenth century (22 in Tasmania by 1885).

Because the cost of land transport was high, new mills were built close to water in Tasmania and Northern New South Wales and were able to ship timber to Adelaide, Melbourne and Sydney. As the most accessible areas became cut out, the mills were re-located deeper into the forests every few years, and longer and more elaborate tramway systems built to supply them and take timber to market. The investment needed for forest sawmills was as often as great for the tramway infrastructure as for the engine and milling equipment. Capital was tied up in timber that had to be stacked for 18-24 months to air dry if it was to be sold for higher value uses. Although archaeological research has located the sites of this period, there are few, if any places where these small transient forest mills remain more or less intact.

Western Australian sawmilling developed later and differently from that in the Eastern States, being far more export-oriented. Although a few small sawmills were established to supply the local market, a number of much larger mills were established to supply inter-colonial and later overseas export markets. In 1871 the Government provided extensive forest concessions at Canning, Jarrahdale and Lockeville in to attract the investment needed to provide not only the transport infrastructure, but also complete townships for the large mills. A series of company amalgamations and take-overs resulted in the formation of Australia's largest timber company, Millars Karri and Jarrah (1902) Ltd. It could eventually boast of its 26 sawmills, 580 kilometres of railway, 40 locomotives, 1000 horses and over 3500 men employed. Its Head Office was in London, its main office was in Perth and it had wharves or depots in London, India, South Africa New Zealand, the Philippines and China. Several hundred hewers working in the forests also supplied the extensive export trade in jarrah for railway sleepers, mine timbers and paving blocks. New South Wales,

Tasmania and Queensland also exported durable heavy timbers to these markets.

Throughout the nineteenth century, Australia's attempts to enter the world timber markets had relied on the Royal Navy's timber inspectors in London to judge the timbers' properties, but better information on strength properties was needed if Australia was to market its timbers in the twentieth century. W.H. Warren, the first Professor of Engineering at Sydney University and the First President of the Australian Institute of Engineers, started to test the material properties of Australian timbers scientifically, and reported the results in a series of papers between 1890 and 1915. Western Australia distrusted any tests of its jarrah conducted in New South Wales and commissioned its own. No story of the timber industry would be complete without the shenanigans of timber cutters, sawmillers and exporters slipping in less durable species into their loads, and the efforts of state timber inspectors to catch them.

Box mills were an important part of the timber industry until the 1960s when cardboard captured the market. They were probably the most transient of all classes as they were generally very small, being either stand-alone enterprises or add-ons to other sawmills. They were located near to the products they were to pack and many operated seasonally. Most used the poorest class of logs, although white pine was imported from New Zealand to make butter boxes mostly for export. Fruit boxes were simply hand-nailed together, but the machine-jointed butter boxes would have needed quite sophisticated machinery. Very little if anything now remains with which to tell their story.

Australia had limited resources of easily worked softwood timber suitable for joinery, lining boards and similar uses. It started importing softwood timber in the 1850s first from the Baltic and later from the Pacific Northwest of North America. With large resources and a well-developed industry, these timbers could compete with Australian hardwoods on our domestic markets. Metropolitan timber merchants installed sawmills to re-saw the imported timber baulks to customers' requirements. They also stocked hardwood from the forest sawmills and some bought, leased or less commonly built forest sawmills to ensure their own hardwood supplies. Joinery works were frequently parts of these businesses, some of which became large, mechanically complex manufactories employing 50-100 people. The merchants commonly supplied general building materials and hardware as well as timber. These businesses were also transient—although on a longer time scale than the forest mills—as urban development induced them to shift to outer areas. Little if anything of their built or engineering heritage can be retrieved to tell their story, and we have to rely on documentary sources.

3.1 J. Wright and Sons

J. Wright and Sons is the best documented timber merchant in Australia and its records enable us to see how the stories of forest mills, urban mills and imports come together.⁹

Lured by the gold rush, James Wright came to Victoria in 1853 and set up a timber and coal yard in Melbourne's Swanston Street (now the CBD). In 1859 he went into a partnership that operated as the Carron Timber, Saw and Moulding Mills in Flinders Lane and on vacant blocks nearby. In the building boom of the 1880s, he built a two-storey mill and timber yard in Sturt Street, South Melbourne (now the South Bank precinct). It had a single large steam engine with major saws on the ground floor with woodworking machinery for making doors, sashes and other joinery above it. The stock books give a picture of the variety of timbers that were drawn from different Australian and foreign forests (Table 1).

Table 1. Sources of timber, J. Wright & Sons, 1880s

Source	Timber
Baltic	Deal, Pine, Spruce
India	Teak
New Zealand	Kauri, Red beech, Rimu
UK	English beech, oak
USA	American ash, American beech, Alaska pine, Basswood, Hickory, Oregon, Pacific pine, Pitch pine, Sugar pine, Walnut
Queensland and/or New South Wales	Bolly gum, Brisbane pine, Cedar, Hoop pine, Maple, Pencil cedar, Rosewood, Silky oak, Tallow wood
Tasmania	Beech, Blue gum, Blackwood, Huon pine, Pencil pine, Sassafras
Victoria	Ash, Cypress, Hardwood, Ironbark, Red gum
Western Australia	Jarrah

4. BETWEEN THE WARS

The period between the wars started the changes that shaped sawmilling from the 1950s. Although there were some pre-cursors, the industry started to replace steam with electricity and diesel power, install drying kilns, import more sophisticated machinery such as band saws, and mechanise some of the timber handling. It all required capital which was remarkably short in the Depression of the 1930s, during which many of the smaller mills closed. The differentiation of the industry increased because only the larger sawmilling firms and the timber merchants could afford the kilns and other equipment. Apart from the British-owned Millars Timber and Trading Co. Ltd—colloquially 'the Combine'—in Western Australia, these larger and merchant firms were mostly family-

controlled, private companies. Owner-operators ran most of the small forest mills, but found that they had become subsidiary to the larger enterprises with kilns, when they had the higher qualities to sell.

4.1 Snapshot of Western Australia sawmilling in 1921

A snapshot in 1921 provides a picture of the changing industry after it had recovered from the First World War and before the Depression.¹⁰ Its differentiated nature can be illustrated by ranking the 144 mills by engine size (Figure 3). There were seventeen mills with over 100 h.p., the largest of which had 700 h.p. At the other end of the scale, there were twenty-three mills under 10 h.p. Mills were recorded as 'spot mill' or by their sawing machinery (Table 2).

Table 2. Type of sawmill, Western Australia, 1921

Type of mill	Number
Band saw	2
Band saw, and traveller	2
Circular saw	36
Circular saw and band saw	1
Horizontal saw	1
Spot mill	39
Spot mill and traveller	3
Twin saw	45
Twin saw and traveller	2
Vertical saw	5
Vertical saw and twin saw	7
Vertical saw and 2 travellers	1

4.1.1 Spot mills

The 42 spot mills were small mills, typically set up on farms to cut timber for fruit cases or other local uses. A single engine powered their circular saw. They were moved from spot to spot as required and many operated intermittently or seasonally. Most found their logs nearby, while others cut fruit cases from billets supplied by other mills. They left few marks that could be found in the landscape now.

4.1.2 Single and twin circular saws

The majority of sawmills were comparatively small and were set up to stay on one place for several years—3 to 7 years were probably typical. They were equipped with a single engine driving circular saws. By the 1920s about half the mills had replaced their single main saw with twin circular saws, one mounted above the other, that enabled them to cut larger logs in one pass. This technology was more expensive and required more energy to drive it, but by 1921 it had been taken up by twenty-four of the mills under 50 h.p. Some of these mills pulled their logs directly from the forest to the mill, but others needed short tramways, or

in later years roads, to bring in their logs from the forest, and many built houses and huts near the mill for the workers. However, they only built short tramways, typically up to 4-8 kilometres, before they moved the mill to a new location. Iron rails houses and huts were usually salvaged and used at the new sites. However, the marks and artefacts they left in the landscape—their transient heritage—still enable us to tell something of their story.

4.1.3 Large mills

The thirty-seven large mills (over 50 h.p) were equipped twin circular saws and/or vertical saws. It is interesting that thirteen mills were equipped with vertical saws, historically the earliest form of sawing

known. Some of these were giant machines capable of breaking down the largest logs. Four of the large mills had band saws that were the most technically sophisticated form of sawing.

The large mills were built to be lasting structures. The forest had to be moved to them—rather than move the mill to the forest—so that extensive tramway systems had to be built through the forests.¹¹ Millars' 500 h.p. mill at Mornington, for example, brought its logs in over 28 kilometres of its tramlines from its log landing in the forests. It then sent its timber 10 kilometres to the main railway line and 43 kilometres to the port.

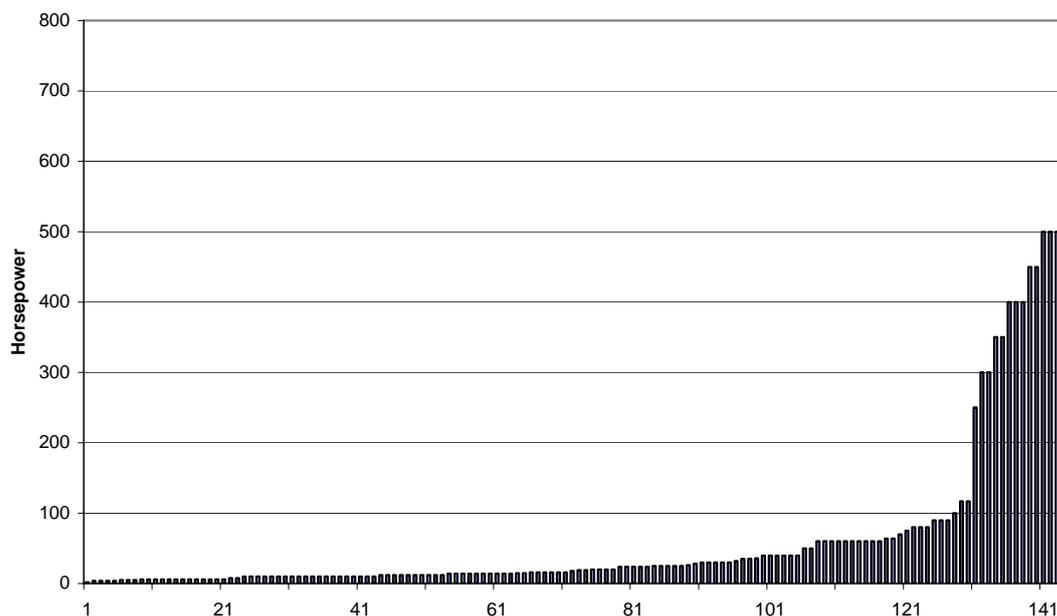


Figure 3. Western Australia, sawmills, ranked by horsepower of mill, 1921

Substantial townships were needed to house the workers in these large mills. Being distant from other centres, they needed their own blacksmith's shop, saddler, store, hall, sports ground, school and boarding house for single men. The story of life at Lewis and Reid's 60 h.p. mill in the Collie District has been told by Edward and Jean Trautman, while Katharine Susannah Prichard's novel, *Working bullocks*, paints a picture of life in one of the largest mill settlements.¹²

5. POST-WAR BOOM

Timber was demanded after the Second World War as never before. The returning servicemen and women wanted homes, migrants flooded in, factories were built to industrialise Australia, and there were no

dollars to import American timber or machinery. The existing mills were run down after the Depression and the War, but cut as much as they could. It was not enough. In an extraordinary response the number of sawmills in Australia was doubled in the eight years (Figure 4).¹³

The 1400 or so new spot mills were a triumph of backyard engineering, with circular saws mounted on improvised benches and driven by whatever diesel or petrol engines could be found. Some of the green sawn timber they produced was of very poor quality, but builders and owner-builders putting up their own first houses, had to take whatever they could get. Perhaps, their story could be told through warped house frames and oral histories, if artefacts or sites of the mills themselves can not be found.

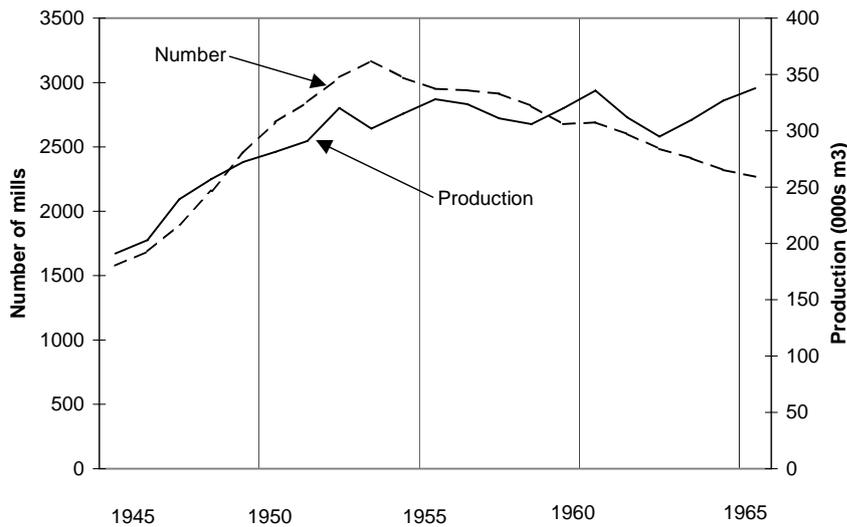


Figure 4. Number of sawmills and sawntimber production, Australia, 1945-1965

The existing large mills re-equipped and rebuilt, but this was a slower process partly because it was difficult to import new machinery and the tradition of moving and refurbishing old machines had to continue. At the same time, the geography of the industry started to change as the mills were moved out of the forests into more settled areas. There were several reasons. Many of the 70 people burnt to death in the 1939 Victorian bush fires had been in isolated forest mills. Moreover, the primitive living conditions and limited education opportunities in such settlements were no longer acceptable to post-war families, or in the tight labour market. Roads, bulldozers with winches and trucks were replacing tramlines and locomotives, while at the mills, diesel engines were replacing steam. In settled areas mills could be connected to the electricity grid.

The transition happened slowly. It can be told in the story of the large mill built by Bunnings Ltd at Donnelly River, Western Australia in 1949 that was still operated by steam power until it closed in 1978. We can tell its story because the mill structure and many of the surrounding cottages still exist, and because Jenny Mills has written the history of the company.¹⁴ The Donnelly's sawmill's significance has been recognised by its inclusion on Western Australia's Register of Heritage Places. Importantly, it has its storytellers keen to see its engineering heritage preserved.

Once Australia's immediate post-war demands had been met, sawn timber production stayed fairly stable and the new small mills faded away (Figure 4). This trend was accentuated during the 1960s when cardboard boxes replaced wooden boxes. It seems that we have little left with which to tell the story of the small mills.

By the end of the 1960s, the sawmilling industry was well established and was upgrading its timber handling and drying processes. However it faced a static market with declining per capita consumption, few export opportunities and renewed competition from the Pacific Northwest that provided large section oregon, mainly to the East Coast markets. It was still mostly in the hands of family-owned private companies, and even if the spot mills had almost disappeared, there were still plenty of small sawmills that were set up much as they had been at the beginning of the century, apart from replacing steam with diesel engines. Australian sawmilling was still a diffuse, low technology, largely rural-based industry⁶. From the 1970s to today

The last thirty years have seen Australian sawmilling change drastically. Although a few small and medium sized mills linger on as family companies, the industry is now essentially concentrated into the hands of a few corporations, while production is centralised into a few large, modern, highly automated mills. The greatest change has been the shift in overall sawn timber production from the native hardwood forests to the pine plantations (Figure 5).

The plantations produce uniform log sizes ideally suited to the sophisticated, computer-controlled mills in which they are now sawn, dried, planed and packaged in plastic. No doubt, pine sawmilling will one day have its story, its storytellers and its listeners, but this paper needs to consider the implications of the current situation for the story we wish to tell, the story of Australian hardwood sawmilling and its engineering heritage.

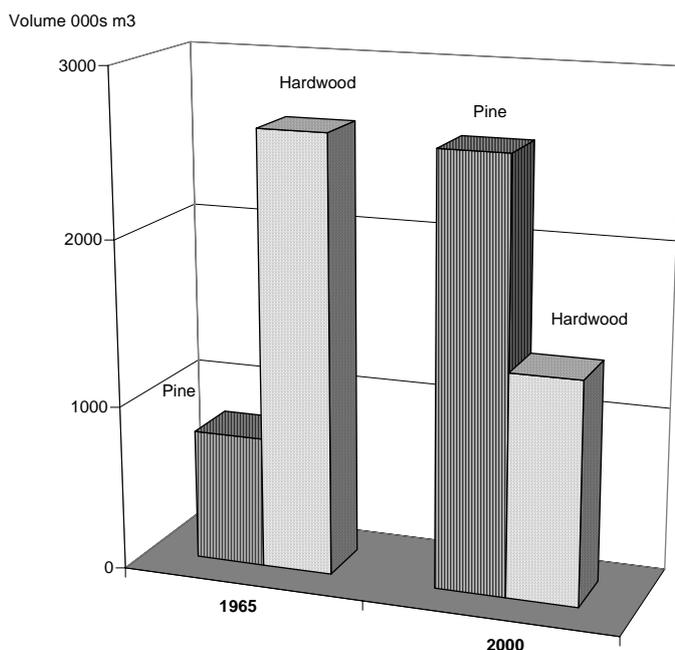


Figure 5. Sawn timber production, 1965 and 2000

The decline of small and medium-scale hardwood sawmilling occurred in the context of pro-rata reductions in the allocations of log resources from state forests in particular regions and States. The larger companies bought up the smaller mills in order to assemble a viable parcel of resource rights that would enable them to continue in the industry. Many smaller firms saw this as an opportunity to leave the industry and in some cases were helped by industry assistance packages. It is not clear how much of the story of this period will be able to be told from what sites, artefacts and documents may remain.

7. MEANING AND STORY

This paper declared from the start that heritage is story, that it is story that gives meaning to all the artefacts and sites that we keep. But conversely it is the presence of these objects and places that gives meaning and validity to the story. They are more than background or props to the story, they are the material evidence, the sources that storyteller after storyteller can refer back to. But will the evidence still be there when future generations turn to it?

This ubiquitous question is a potent one for a transient industry like sawmilling diffused across the landscape. It seems particularly potent for its engineering heritage that relies on its material evidence to tell its story. Much can be done if today's engineers and companies take up the challenge of answering it.

REFERENCES

- 1 Two standard texts are: Carron, L.T. 1985. *A history of Australian forestry*, ANU Press, Canberra; and Dargavel, John, 1995. *Fashioning Australia's forests*, Oxford University Press, Melbourne. The Australian Forest History Society has held a series of national conferences since 1988, the proceedings of which have been published. For details of these other publications and newsletters see: <http://www.foresthistory.org.au/> Of particular interest in Western Australia is Bunbury, Bill, 1997, *Timber for gold; life on the Goldfields woodlines, 1899-1965*. Fremantle Arts Centre Press.
- 2 Purdie, Rosemary and Cavanagh, Mike. 1993. Regional Assessment of the heritage values of forests. In John Dargavel and Sue Feary (eds). *Australia's ever-changing forests II: Proceedings of the Second National Conference on Australian Forest History*. Centre for Resource and Environmental Studies, Australian National University: Canberra, pp.241-260.
- 3 Lennon, Jane. 1998. History, cultural heritage and the regional assessment process. *Australian Journal of Environmental Management*, 5(1), pp.38-46.
- 4 For a bibliography to 1988, see: Dargavel, John, 1988. A review of Australian forest industry and labour history. in K.J. Frawley and N. Semple (eds). *Australia's Ever changing forests: Proceedings of the First National Conference on Australian Forest History*. Department of Geography and Oceanography,

Australian Defence Force Academy, Campbell, ACT, pp. 257-274.

5 See <http://www.lrrsa.org.au> for their journal, *Light Railways*, books and other publications.

6 Lennon, Jane, 2002. Long Creek: from logging to World Heritage; and Davies, Peter, 2002. Forest communities: real or imagined. both in John Dargavel, Denise Gaughwin and Brenda Libbis (eds.), *Australia's ever-changing forests V: Proceedings of the Fifth National Conference on Australian Forest History*. Centre for Resource and Environmental Studies, Australian National University: Canberra, pp.274-288; 311-323.

7 Wentworth, W.C. 1978 [Facsimile of London: Whittaker 1819]. *Statistical, historical and political description of the colony of New South Wales*. Doubleday Australia, Lane Cove, NSW, pp. 418-9.

8 Dargavel, John, 1988a, The first sawmills. in John Dargavel (ed.) *Sawing Selling & Sons: histories of Australian timber firms*. Centre for Resource and Environmental Studies, Australian National University, Canberra. pp.19-22.

9 Dargavel, John, 1988b. J. Wright & Sons. in John Dargavel (ed.) *Sawing Selling & Sons: histories of Australian timber firms*. Centre for Resource and Environmental Studies, Australian National University, Canberra, pp.119-131.

10 Lane Poole, C.E. 1921. Annual Report of the Forests Department for the year ended 30th June 1921. *Western Australia, Papers presented to Parliament*.

11 For a detailed description of WA timber transport systems, see Gunzburg, Adrian and Austin Jeff. 1997. *Rails through the bush: timber and firewood tramways and railway contractors of Western Australia*. Light Railways Research Society of Australia, Melbourne.

12 Trautman, Edward and Trautman, Jean, 1980. *Jinkers and jarrah jerkers*. Gannet Press, Fremantle; Prichard, Katharine Susannah, 1991 *Working bullocks* [reprint of Jonathon Cape, London 1926] Angus & Robertson, North Ryde, NSW.

13 From 1576 mills in 1945 to 3169 in 1953.

14 Mills, Jenny, 1986. *The timber people: a history of Bunnings Limited*. Bunnings Ltd, Perth.