

The Eden woodchip scheme and its implications for forest fauna: a political ecology perspective

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ABSTRACT

A 'political ecology' perspective was used to examine the implications of the export woodchip scheme located near Eden in south east New South Wales (NSW) for the region's public forests and their fauna. The modern paper industry's political economy emphasises the importance of a large supply of wood fibre of suitable price and quality for competitive papermaking. The evolution of the Japanese paper industry and the exploitative history of forests in south east NSW interacted to create the opportunity to establish such a supply in Australia for the Japanese papermaker Daishowa Paper Manufacturing Co from 1970. The 'Harris-Daishowa' export woodchip scheme at Eden was based on the guaranteed supply of large volumes of pulpwood from the region's public native forests. Meeting this supply entailed restructuring available forests through clearfell logging over about 40 years. Features of the regime used to manage these forests and supply pulpwood were examined within this context, and the consequences of woodchipping for fauna protection are discussed. Fauna populations were being restructured by this regime, which 'squeezed' them between priorities for wood production and fire management. In particular, forest-dependent fauna, such as gliders, some possums and koalas, have been detrimentally impacted. Substantial changes to public forest management in south east NSW took almost 30 years to achieve. However, while export woodchipping continues, the 'political ecology' of local forest fauna will be influenced by international pulp and paper markets.

Key words: fauna, forestry, Australia, Japan, Eden, woodchip, paper, industry, political ecology.

Introduction

Wood is now the primary source of new fibres for papermaking in industrialised countries. Forests are the main source of this wood, and the growth of paper use through the 20th century contributed to increasing human exploitative pressures on forests (IIED 1996). The transnational flows of paper, pulp and pulpwood (FAO 1998) mean that paper used in one country may be supported by forest exploitation and socio-environmental consequences in another.

The expanding demand of the Japanese paper industry for fibre was an important factor in the growth of transnational flows of wood through the latter part of the 20th century (Marchak 1995), and this Japanese industry now dominates the international trade in pulpwood (FAO 1998, Neilson and Flynn 2003). Australian native forests became integrated into this trade from 1970 with the beginning of the export eucalypt woodchip industry supplying Japanese paper companies (Routley and Routley 1975). Australia's forest history entered a new phase of exploitation, and new management regimes in native forests emerged to supply large quantities of logs for chipping (Dargavel 1985, Dargavel and Jennings 1991). The schemes that comprise

the forest-based export woodchip industry quickly became controversial because of the clearfell logging operations that removed most, or all, of the trees on a site, and other impacts generated through these regimes. The intensity of the public attention was sufficient to stimulate a major government inquiry within a few years of the industry's commencement (Australia 1977).

One of Australia's most controversial export woodchip schemes is that based near Eden on the south coast of New South Wales (NSW) (Figure 1) (Routley and Routley 1975, Quamby 1986, Chipstop 2003). This scheme, owned by South East Fibre Exports - formerly called Harris-Daishowa (Australia) Pty. Ltd. (HDA)¹ - has been a profitable supplier of woodchips to Daishowa Paper Manufacturing Co. (Daishowa) in Japan,² making a total after-tax profit of about \$163 million (in 1998 dollars) between 1970 and 1998 (HDA 2000). Underlying this profitability has been the restructuring of native forests in south east Australia for wood production. In particular, the NSW government's agreement to supply pulpwood to HDA imposed new management priorities on public forests managed by the then Forestry Commission of NSW in south east NSW.³

¹The name of this woodchip scheme was changed to South East Fibre Exports in October 2003 (Chipstop 2003). The older name, Harris-Daishowa (Australia) Pty. Ltd. (HDA), is used here because it is the name by which the scheme is most well known and the name used during the period under discussion.

²Daishowa's financial position deteriorated badly from the late-1980s (Penna 2002). In 2001, the company was taken over to become part of the Nippon Unipac Holdings group with Nippon Paper Industries (Nippon 2000a, b). Daishowa no longer exists as an independent company, although 'Daishowa' appears in the names of some group companies (Nippon 2003c).

³The Forestry Commission of New South Wales later became State Forests of New South Wales.



Figure 1. South east Australia, showing the approximate boundary of the region used to supply hardwood pulpwood from State Forests to the Harris-Daishowa export woodchip mill near Eden under the NSW government's pulpwood supply agreement (FCNSW 1982).

Note: The region enclosed by this boundary contains a mix of private and public land, including State Forests and National Parks. Some pulpwood was also supplied to HDA from NSW State Forests outside this boundary.

This chapter adopts a 'political ecology' perspective to examine the Eden woodchip scheme and explore some consequences for forest management and native fauna of the NSW government's pulpwood supply commitment. As a research paradigm, 'political ecology' synthesises the perspectives of 'political economy' and 'human ecology'. It approaches issues of environmental protection and exploitation by examining the dynamic relationships between a society and its environment through the processes of production and consumption. It seeks explanations for the biogeographical outcomes of human activities in terms of social, political, economic and environmental organisation and interactions (Emel and Peet 1989, Bryant 1992, Collins 1992, Stonich 1993, Greenberg and Park 1994, Rangan 2000, Watts 2000). Thus, the Eden woodchip scheme, the NSW government's pulpwood supply agreement, and their implications for public forests and their fauna are discussed here within the context of the political economy of papermaking, Daishowa's place in the Japanese paper industry, and forest exploitation patterns in south east NSW.

Fibre and the political economy of papermaking

By the early-20th century, wood was the main source of organic fibres used by paper manufacturers in Europe and North America. This followed the invention of paper machines in the late-18th century and the development of mechanical and chemical pulping technologies during the mid-19th century (Higgins 1969, Hunter 1978, Thompson 1992, Magee 1997, Smith 1997). The ability to use wood allowed machine-based paper manufacturers to increase the size and capital intensity of their mills and exploit new, cheaper fibre resources in forests to support greater paper consumption. Access to an expanding supply of new wood fibre became the basis for the growth of the world's modern paper industry (Carrere and Lohmann 1997).

Modern, high volume pulp and paper mills are capital intensive (Smook 1992, Biermann 1996), and fibre has long been their most significant variable cost (Hunter 1978, JP 1996, Magee 1997). The economics of every mill is different, and depends on the interactions between markets, available manufacturing and other technologies, and the size, security, quality and the cost of raw material supply. The properties of available fibre resources are very important as they influence the choice of markets, products and pulping technologies. Low quality fibre may reduce a mill's productivity and force an increase in operating costs (Wayman 1977, Grant 1978, Jamieson *et al.* 2000, Jamieson 2001). Consequently, "(w)ood cost is by far the most important single factor affecting (the) profitability" of a modern wood-using pulpmill (Smook 1992: 192). "Wood is the strategic driver of the (pulp and paper) industry ... the key competitive differentiator" (Wilson 1991).

The high volume supply of suitably-priced wood supports the 'technological paradigm' of large-scale, capital intensive papermaking that now dominates global paper manufacture (Higham 1995, Laestadius 2000). Over the last 40 to 50 years, this paradigm interacted with narrow management philosophies based on competition for growth to generate financial instability in the industry. This instability has been expressed through the industry's characteristic cycles of profit and production growth and slump. These cycles have encouraged concentration of ownership and rationalisation of production as companies try to improve profitability and gain greater control over fibre supplies and pulp and paper markets (King 1979, Becker *et al.* 1988, Higham 1995, Navin 1997, Penna 2002).

The structure of the global paper industry continues to change as Asian paper markets – particularly in China – expand, and large areas of low cost plantations mature, or are established, in Asia and the southern hemisphere (Donnelly *et al.* 2003, Neilson and Flynn 2003). Wood-based companies have been competing to serve these markets and gain control over plantation pulpwood supplies. The integration of these plantations into international markets increases pressures on other pulpwood suppliers to reduce costs and/or find new customers (Penna 2002). The economic viability of those chip producers using lower quality pulpwood from native forests is challenged by the quality and price demands of these changing markets (Ausnewz 2001).

The history of Japan's paper/board industry reflects these international trends. Japan's use of paper and paperboard grew dramatically with the nation's economy from the early-1950s. The overall growth in Japan's use of printing paper and cardboard since the mid-1970s has depended on their steadily declining 'real' price. This growth has also been characterised by cycles within the industry of overexpansion and profit slump, concentration of company ownership, rationalisation of production and distribution, and cooperation and competition between companies over access to, and control of, fibre supplies (Penna 2002).

The industry's situation worsened in the 1990s following the collapse of Japan's 'bubble economy' of the late-1980s. Consumption of paper and paperboard in Japan slumped during the early-1990s, then grew again only to stagnate in the late-1990s. Similarly, the profitability of Japan's paper/board companies rose in the late-1980s, slumped in the early-1990s, then improved, but slumped again in the late-1990s (Penna 2002). These conditions helped stimulate further mergers, and now Japan's papermaking sector is dominated by two companies, Nippon Unipac Holdings (NUH) and Oji Paper Co. (Oji), which together manufacture about 50% of the nation's paper use (JPA 2003).

Also, Japan's papermakers increased their use of domestic waste paper and wood from their own and others' foreign plantations, while leading manufacturers are becoming more international in their operations, with a strong interest in China.⁴ However, Japan's growth in paper use has relied heavily on wood from native forests. This dependency on forests for new fibre is a particular feature of Daishowa's history (Penna 2002).

Daishowa and the Japanese paper industry

As Japan's paper industry recovered from World War 2 and grew through the 1950s, suitable domestic native and plantation softwood resources quickly became too small. Pulp and paper interests contributed to the pressure on Japan's Forestry Agency to allow greater wood removals from public broadleaf native forests (Koide 1990, Ooshima 1991, Hagino 1996). These pressures were eventually successful when, in 1957, Japan's government introduced a plan to increase the productivity of the nation's tree-covered land. This plan promoted the conversion of large areas of public broadleaf native forests and private broadleaf fuelwood forests to softwood plantations, and raised the limit on the altitude of forests accessible for logging (Yamauchi 1971, Ouchi 1988, Sugahara and Ouchi 1988).

Consequently, hardwood pulpwood production from Japan's forests increased substantially from the late-1950s. The industry's demand for this wood was supported by its use of dispersed woodchip mills, the introduction of the

Kamyr continuous digester in the pulping process and the modification of kraft pulping techniques to use domestic broadleaf trees. By the mid-1960s, the industry was the prime consumer of hardwood logs from domestic forests. However, competition for pulpwood intensified as the growing demands of papermakers confronted the physical limits of Japan's wood resources (Penna 2002).⁵

Daishowa was one of these papermakers. For almost all its life, Daishowa was a family-run company. It was formed in the 1930s and aggressively competed against the long-established Oji Paper Co., who dominated Japan's paper industry for much of the time between the late-1930s and 2000. The rivalry between these two companies grew as Daishowa increased its sales. However, Oji's size, corporate links and political influence, plus the physical limits of Japan's native forests, forced Daishowa to look overseas for new sources of wood (Penna 2002).

Daishowa began importing softwood chips from the west coast of the USA in the mid-1960s (Daishowa 2001), which helped reduce its raw material costs (JP&P 1964, 1965).⁶ It then turned to the southern hemisphere for other chip supplies. Its Malaysian venture, based on old rubber plantations, collapsed (Nakano 1999). However, with a small Australian company, Harris Holdings, Daishowa formed Harris-Daishowa (Australia) Pty. Ltd. (HDA) in 1967 to export hardwood woodchips from native forests in south east Australia to its Japanese mills (Daishowa 2001). Eucalypt wood in the public forests of south east NSW was uncommitted (FCNSW 1982), and there were public forests in Victoria and private forests and sawmills in NSW and Victoria that had the potential to provide other wood. Daishowa saw the region as a large source of woodchips (JP&P 1968).

Like other Japanese paper companies (JPA 2001a), Daishowa increased its reliance on foreign wood. As well as importing woodchips, the Daishowa group invested in foreign pulpmills to supply its Japanese papermills and other markets. Pulpmills were built in British Columbia in the late-1960s and during the 1970s. In the late-1980s, Daishowa bought more North American pulp and paper mills and announced its plan for a pulp mill in Alberta, Canada (Daishowa 2001). These ventures gave Daishowa access to secure and relatively cheap wood, and as with the HDA woodchip scheme, they relied primarily on native forests, especially publicly-owned forests (Penna 2002).

However, Daishowa's heavy investments during the late-1980s brought its downfall. During the 1990s, Daishowa's total paper and paperboard production stagnated, as did its production of fine paper (JPA 2001b) - the main use of hardwood pulpwood. The company's intake of foreign hardwood chips reflects this - declining and diversifying from 1995. Notably, its hardwood chip intake from Australia declined from 1991 (PBR 2001).

⁴Information on Japan's two leading manufacturers can be found at their respective web sites - Oji Paper Co: <http://www.ojipaper.co.jp/english/>; Nippon Unipac Holdings: <http://www.nipponunipac.com/e/>.

⁵The cost of pulpwood was the main factor increasing the cost of raw materials for papermakers until at least the early-1970s (Narita 1980).

⁶Importing woodchips could help a paper company control its overall resource costs, and, in particular, was used to restructure local woodchip suppliers and regulate the cost of domestic chips (Narita 1980). Also, during the late-1960s, government bureaucracies and paper companies began cooperating to assist woodchip imports by managing prices and competition between manufacturers (Penna 2002).

The real prices for Daishowa's products declined under domestic competitive pressures, and its poor profitability was never sufficient to remove the company's substantial debt. Daishowa was taken over in 2001 by Nippon Paper Industries to form NUH (Paperloop 2001, Penna 2002).

The forests and early forest use in south east NSW

The history of the forests in south east NSW since their colonisation by European settlers during the 19th century has been dominated by exploitation for markets outside the region. Forests and woodlands were cleared by farmers for cattle, sheep and food crops to supply distant urban markets. Trees were used for the production of sawn timber, sleepers, fuelwood and wattlebark that were primarily exported from the region or used in the processing of exported produce. The topography of the region confined most clearing to the richer, flatter river valleys (Lunney and Matthews 2003).

The coastal forests, in particular those near wharves at Eden, Tathra and Bermagui, were 'picked over' for the large, straight trees that provided good sawlogs (Lunney and Matthews 2003). This style of logging and the impact of fires (FCNSW 1982) meant that many forests in the region became "relatively unproductive ... with a high proportion of defective trees (that were) not an economic resource until a market for the low quality wood became available" (Jurskis 1999). These trees of low commercial value had been recognised as a potential source of pulpwood for papermaking from the 1930s (FCNSW 1982). Until the HDA woodchip mill was established, the local sawmilling industry could only access limited areas of these forests, so the sale of logs from public forests to sawmillers was expected to decline (FCNSW 1976, Bridges and Dobbins 1991).

Commercial priorities influenced the early patterns of both logging and forest reservation in south east NSW. Forests in the early nature reserves were identified as being those least able to be logged because of slope, soil and erosion potential. Within the wood production forests, logging was concentrated on flatter areas with richer soils, while the larger, unlogged areas were generally steep, less fertile and less likely to contain suitable habitat for local wildlife (Lunney and Leary 1988, Lunney 1989). Large parks and reserves were proposed for south east NSW in the late-1960s by conservation advocates (Lunney and Matthews 2003). However, the NSW government reserved relatively small areas of public forests at that time, leaving the overwhelming bulk of the forests open for integrated logging for pulpwood and sawlogs (Scott 1975). The government argued that woodchip exports would bring increased prosperity to the local economy "by making possible virtually complete utilisation of the vast forest resources of the region" (ATJ 1971: 67)

Despite this history, at the beginning of the 1990s, the 'South East Forests' still contained a rich Aboriginal heritage, significant areas of 'wilderness', 40 rare and threatened plant species, and 46 mammal, bird and reptile species on the Threatened Species List of the NSW National Parks and Wildlife Act (SEFA 1992, 1993). Some forests also became listed on Australia's Register of the National Estate as important components of the nation's natural and cultural heritage (AHC 2002).⁷ The region's remaining forests are important habitat for fauna already depleted by clearing, hunting and competition with introduced animals (Lunney and Leary 1988).

Most of the remaining forests in the Eden region are drier eucalypt forests dominated by Silvertop Ash or stringybark species, primarily in the coastal lowlands and ranges. Wetter, more sheltered coastal gullies and ranges, and the higher elevation areas of the coastal escarpment contain taller forests with Messmate, Mountain Grey Gum and Yellow Stringybark. In parts of the escarpment and interior tablelands, Brown Barrel and Shining Gum occur. There are relatively small areas of rainforest, mainly along creeks and gullies (FCNSW 1982).

The establishment and development of the Eden woodchip scheme

The first pulpwood assessment of the Eden region in 1967 estimated that its public forests had sufficient pulpwood on which to base an export woodchip industry. This assessment used photo-interpretation of selected coupes, field measurements, wood volume tables from another region, and pulpwood log and billet specifications (FCNSW 1976, 1982).

Apparently, FCNSW staff based in the Eden region at this time envisioned (Lunney and Matthews 2003: 304)

"a limited, staged and more tightly-managed enterprise than the one that eventuated. The initial Commission objective was to commence on a limited scale and evaluate the logging in the light of the needs of sustainability of the forest and related forest management practices. However, the State Government entered into contracts with the Japanese buyers which overrode bureaucratic caution".

In the late-1960s, the FCNSW contracted to sell HDA 450,000 tons net of eucalypt pulpwood per year from State Forests and small areas of other crown lands in south east NSW. This was later increased to 530,000 tonnes gross for 20 years from 1970 (FCNSW 1976, 1982, DPIE 1998).⁸ However, because Harris Holdings could not maintain its financial requirements, it was bought by a consortium comprising Australian Paper Manufacturers, Brambles and Dillinghams Corporation in 1969 (HDA 1990, 1999).

HDA built its chipmill at Twofold Bay opposite Eden (Figure 2); the Commonwealth government issued an export licence, which was then required for the export

⁷The Australian Heritage Commission identified National Estate areas, and was the Commonwealth government's adviser on their protection (AHC 1994). It was replaced by the Australian Heritage Council in January 2004 (AHC 2004).

⁸The general area from which this wood was to come was called the South East Forestry District, later changed to the Eden Native Forest Management Area (EMA) (FCNSW 1976, 1982).

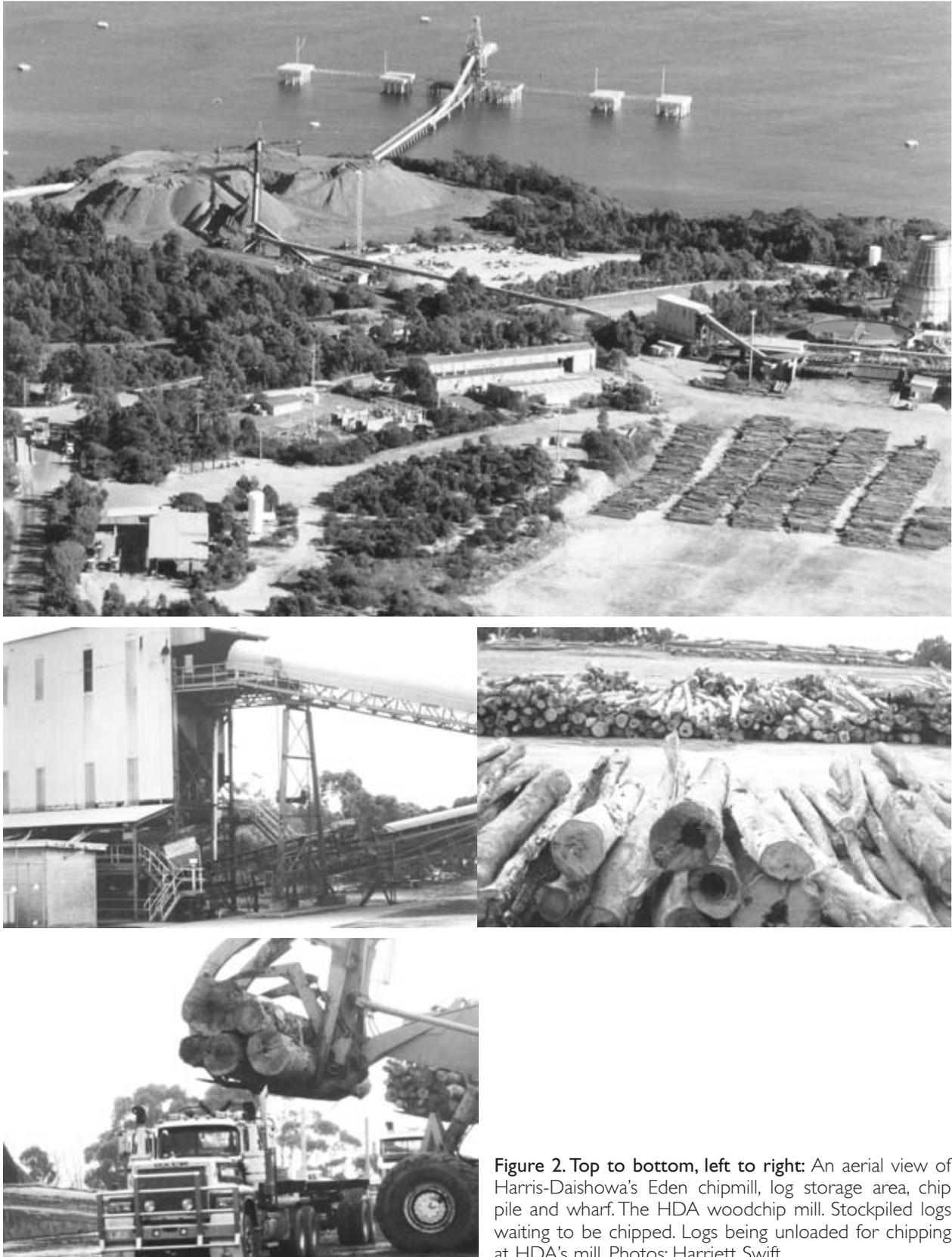


Figure 2. Top to bottom, left to right: An aerial view of Harris-Daishowa's Eden chipmill, log storage area, chip pile and wharf. The HDA woodchip mill. Stockpiled logs waiting to be chipped. Logs being unloaded for chipping at HDA's mill. Photos: Harriett Swift.

of unprocessed natural resources. HDA began logging during 1970, and exported its first woodchips to Daishowa in Japan during early 1971 (Scott 1975, HDA 1990). However, because of financial losses, the Australian

consortium controlling Harris Holdings pulled out in 1971, and Daishowa (62.5%) and C. Itoh (37.5%), a large Japanese general trading company, became HDA's joint owners (HDA 1990, 1999).⁹

⁹C. Itoh later became known as Itochu (Itochu undated).

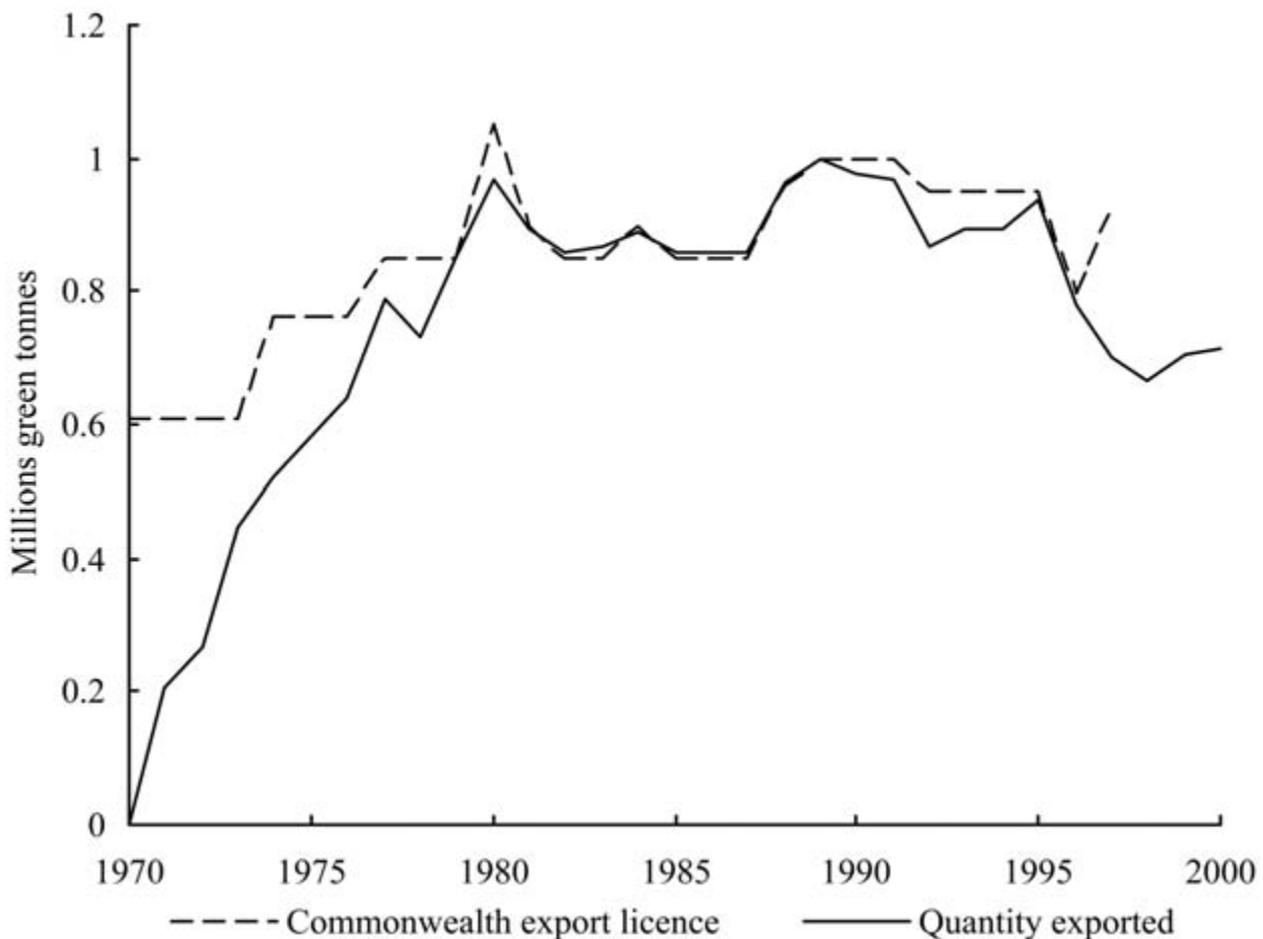


Figure 3. Annual woodchip exports of Harris-Daishowa (1970-2000). Sources: HDA (1977, 1990), DPIE (undated), Phillips (1990,2000).

HDA's exports of woodchips (Figure 3) grew to the early-1980s with Daishowa's expanding paper production in Japan, then fluctuated in line with Japan's economic activity and paper use, as well as Daishowa's priorities (Penna 2002). In 1996, the Commonwealth (Labor) government reduced HDA's export licence from 930,000 tonnes to 765,000 tonnes per year as part of national licence reductions (RSR 1997). In 1997, the new Commonwealth (Liberal-National Coalition) government lifted HDA's licence to 930,000 tonnes per year from the Eden and East Gippsland areas for the three years to the end of 1999 (DPIE undated). Commonwealth licences for the export of woodchips taken from NSW and Victoria have not been needed since the state governments signed respective Regional Forest Agreements (RFA) with the Commonwealth government from the late-1990s.¹⁰

However, despite the removal of export licences, HDA's woodchip exports declined from 1996 as Daishowa's total hardwood chip imports declined and diversified (PBR 2001), including some chips from Tasmania (Phillips 2000). HDA's chip exports in 2000 totalled almost

713,000 green tonnes (HDA 2000), and the company's use of pulpwood from different sources has varied over the 30 years from 1970, in line with changing supply and demand pressures (Figure 4).

HDA's log intake from public forests in the Eden Management Area (EMA) (Figure 5) reached the supply level guaranteed by the NSW government in 1977. It was above this level for most of the period to 1989, but began declining from the mid-1980's. It then fluctuated around 500,000 tonnes from 1990 to 1995 while continuing to decline (HDA 1990). This declining intake of logs from the EMA was compensated by wood from other sources (Figures 3 and 4).

The 1990s were turbulent years for pulpwood supply from Eden's State Forests as the imbalances between resource availability and log supply commitments became more obvious and political pressures for more conservative forest management strengthened. The size of the annual guaranteed pulpwood supply was reduced to 504,000 tonnes in 1992, to compensate for new national parks and reserves, later ratified by the NSW and Commonwealth

¹⁰The RFA process for Australian public forests was an outcome of the National Forest Policy Statement as agreed by the Commonwealth, State and Territory governments. Its stated aim was to develop plans for the conservation and exploitation of public forests. The process used studies of forest areas and their scientific, economic, cultural and environmental values, as well as negotiations between relevant interest groups (Australia 2003). A public symposium on the RFA held in 1998 "acknowledged that the program is the best that Australia has been able to develop so far and that public discussion and questioning is an important means for advancing such public programs", but "(s)peaker after speaker reported considerable dissatisfaction with the process and the manner in which the program is being conducted" (Anon 1998).

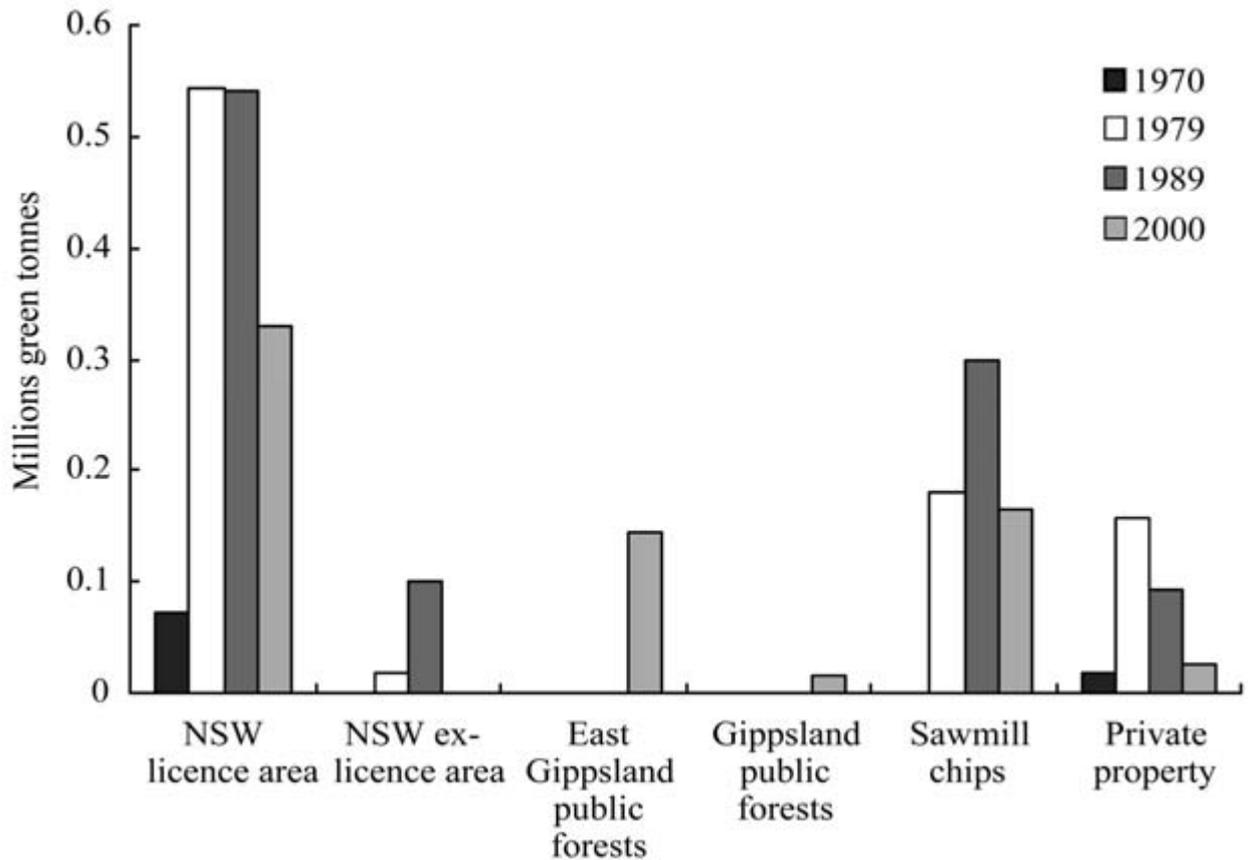


Figure 4. Sources of pulpwood for Harris-Daishowa (1970-2000). Sources: HDA (1990), Phillips (2000). Note: The value for 'NSW Licence Area' at 2000 is for NSW public forests generally.

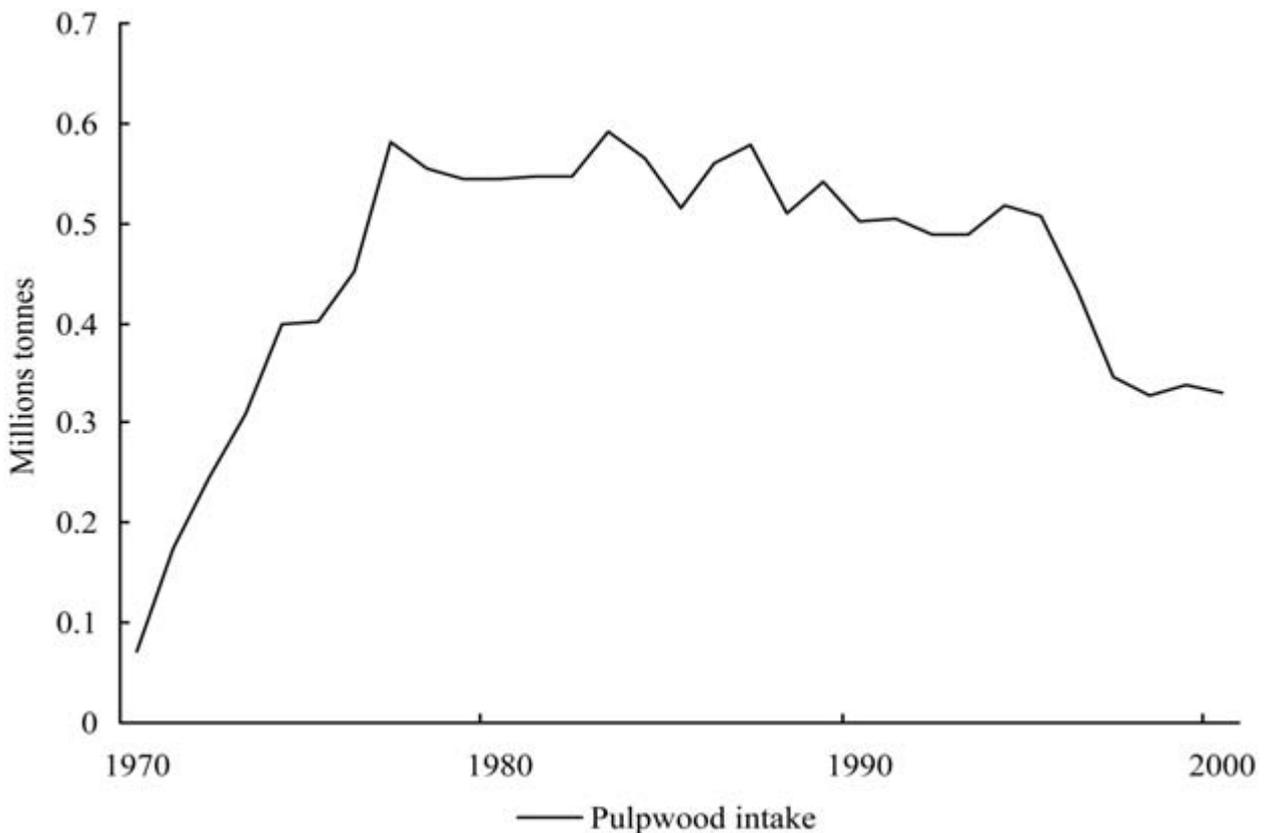


Figure 5. Annual intake of eucalypt pulpwood by Harris-Daishowa from public forests in the Eden Management Area (1970-2000). Sources: HDA (1990), Jurskis (2000), Phillips (2000). Note: The value for 2000 is an estimate by the author based on information supplied by HDA in 2000.

governments in the South East Forestry Agreement. The NSW Government's 1995 Forest Reform Strategy was implemented from the beginning of 1996. Consequently, a logging moratorium was imposed on some forests and logging prescriptions were increased in preparation for the Interim Assessment Process (IAP) and the Comprehensive Regional Assessment (CRA) that identified public forests likely to be reserved as part of a Regional Forest Agreement. Unsustainable sawlog allocations in the EMA were reduced, and the level of available pulpwood was further reduced - to 460,200 tonnes in 1996 (DPIE 1998). HDA took 434,000 tonnes of pulpwood from EMA State Forests in that year (Jurskis 2000).

During the IAP in 1996, the SFNSW decided to extend the time older forests in the EMA would be cut out (from 2012 to 2020) to match the time regrowth forests could be phased in for sawlog supply. Sawlog allocations and the pulpwood supply commitment for the EMA state forests fell again in 1997 (DPIE 1998). HDA's guaranteed level of pulpwood supply became 340,000

tonnes per year (gross) (DPIE 1998), and HDA's intake of pulpwood from the EMA between 1997 and 1999 fell to around this level (Jurskis 2000).¹¹ This smaller pulpwood supply commitment was basically the same as that later guaranteed to HDA from the Eden region by the NSW government (345,000 tonnes per year - gross) through the Eden RFA (Figure 6) (NSW 1999).¹²

However, the reduction in pulpwood supply from the EMA as ratified by the RFA provided some benefits to HDA, which had been contractually locked into using older trees in the Eden forests that are not of high papermaking quality.¹³ The company was able to begin diversifying its wood purchases to improve the quality of its woodchips by including better quality pulpwood from other areas, particularly eastern Victoria (Phillips 2000). The RFA for East Gippsland was signed in 1997; it encourages the thinning of regrowth forests and the sale of 'residual', or low quality, logs from the region's public forests (Australia 1997). HDA began substantially increasing its wood intake from East Gippsland in 1997 (DNRE 2000), and

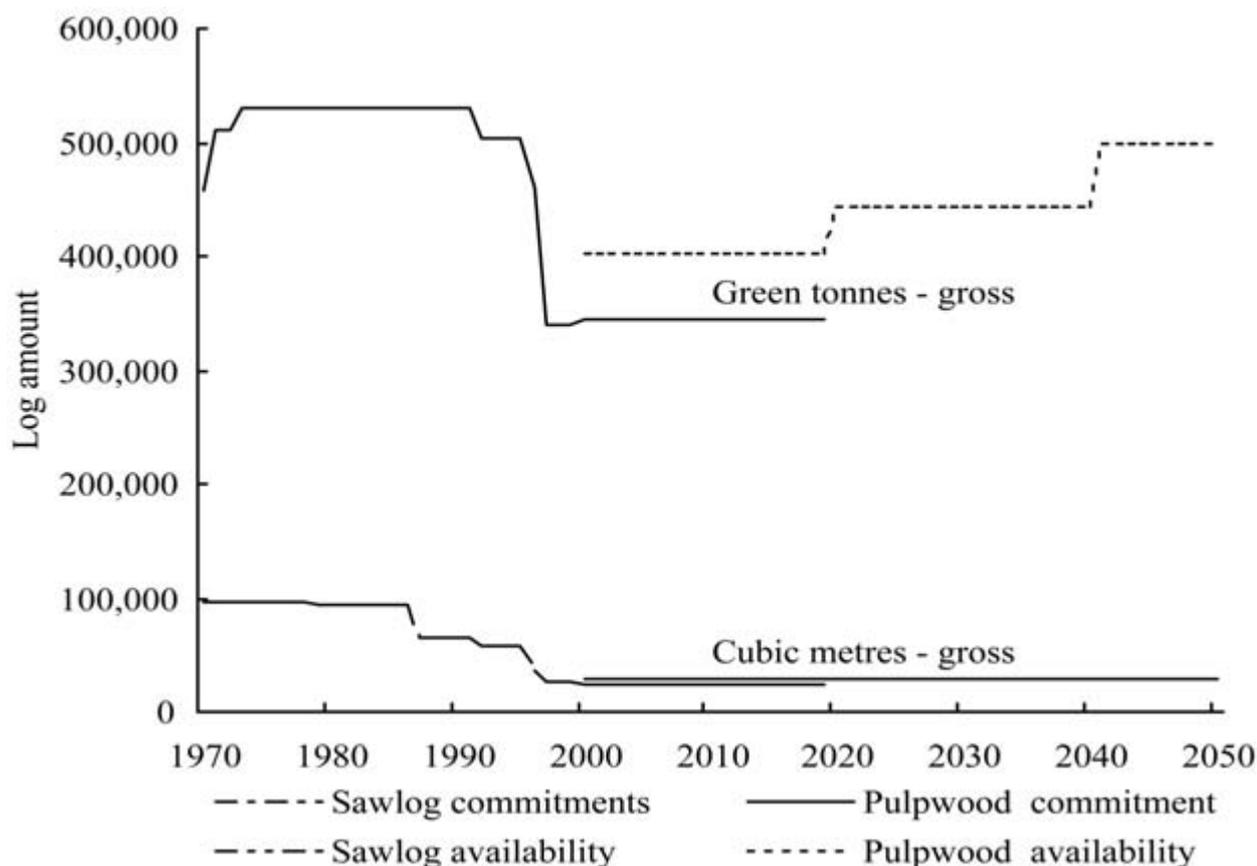


Figure 6. Sawlog and pulpwood availability and supply commitments for the Eden region. Sources: DPIE (1998), SFNSW and BRS (1998).

Notes: 1. The early values for the 'Pulpwood Commitment' (450,000 tonnes and 510,000 tonnes) are net values (DPIE, 1998).
2. The value for pulpwood at 1996 is based on a 1:13 ratio with sawlogs and not a legal agreement (DPIE, 1998).

¹¹The volume of pulpwood taken from public forests in the EMA by HDA for each of these three years was approximately 345,000 tonnes, 327,000 tonnes and 338,000 tonnes respectively (Jurskis 2000).

¹²A map of the parks and reserves created through the RFA can be found at http://www.racac.nsw.gov.au/pdf/eden_rfa_map.pdf.

¹³The Japanese papermakers do not rate wood from south east NSW very highly for papermaking (Bills pers. com. 2001), and as with other Australian export hardwood woodchip schemes, the price paid for HDA's woodchips is discounted relative to the price for those from Tasmania (Phillips 2000).

has licences to remove 'residual' logs and thinnings. In 2000, HDA took pulpwood from East Gippsland comprising about 120,000 tonnes of 'residual' logs and about 25,000 tonnes of thinnings (Phillips 2000).

Also during the 1970s, HDA began buying logs from private forests and woodchips from sawmills, but neither of these sources was sustainable. The area of private forests in the region was always limited (Scott 1975), but the potential for logging was restricted by legislative changes in NSW during the late-1990s (Phillips 2000). The production of sawlogs in the south east NSW and in Victoria's East Gippsland declined because of limited supplies, overcutting and forest reservation (Morgan 1997, DPIE 1998), so the supply of sawmill chips fell too. These trends increased the importance of East Gippsland's public forests as a source of pulpwood for HDA.

Thus, the commercial use of State Forests along the coast and in the hinterland around Eden in NSW has been dominated by a wood supply regime aimed at meeting the NSW government's guarantee of pulpwood to HDA and providing sawlogs to local sawmills (FCNSW 1976, 1982). However, the woodchip scheme itself was established and operating before there was any opportunity for public comment (Quamby 1986) or formal analysis of its potential impacts on the region's forests (Scott 1975). In particular, the NSW government's pulpwood supply agreement with HDA has had important consequences for the management of Eden's public forests and local forest fauna.

NSW public forest pulpwood supply

The sale of eucalypt logs from State Forests in the EMA to HDA has depended on a forest management regime developed to meet the NSW government's pulpwood supply agreement. This regime has several key features: the size of the pulpwood resource and the rate of logging; the silvicultural system used to extract and grow wood; the fire management practices used to protect the commercial wood resource; and relationships between the specifications for pulpwood and sawlogs.

The wood resources and logging rate

The early estimate of the area of forests on which the chip scheme could be based was refined to 231,900 ha (80%) of the 297,248 ha of State Forests and some small areas of other public land in the region. This estimate excluded rocky, steep or uneconomic areas, as well as small reserves and special management areas, but did not allow for streamside reserves. The available pulpwood resource was estimated at 20.374 million tonnes (23.124 million cubic metres – m³) and the available resource of 'quota' sawlogs was estimated at 2.816 million m³ (FCNSW 1982).¹⁴

Thus, the NSW government's commitment to supply 530,000 tonnes of pulpwood per year from 1970 meant that all the available coastal and higher elevation public forests of the Eden region would be cut over after about 42 years – i.e. by 2012. However, to meet the then size of sawlog allocations to local sawmills, the estimated sawlog resource would have to be extinguished by around 2002. If the lives of the pulpwood and sawlog resources in the mature forests of the EMA were to coincide, sawlog allocations had to be reduced (FCNSW 1982). Reductions occurred from the mid- to late-1980s, but were also affected by the expansion of the region's national parks in the 1990s (DPIE 1998).

In 1981, the Preferred Management Priority classification was introduced so that by the early 1990s, logging was modified or restricted in 54,000 ha to protect various values (Bridges and Dobbyns 1991). However, new national parks totalling 46,000 ha were established in 1994-95, and a further 50,000 ha were dedicated in 1997 (DPIE 1998). By the end of the RFA process, the gross and net areas of public forests in the EMA available for logging had fallen to 198,144 ha and 152,651 ha respectively, and the pulpwood logging cycle had been extended to 2020 (DPIE 1998, SFNSW and BRS 1998). HDA's guaranteed minimum annual pulpwood supply from the Eden region to 2020 was set by the RFA at 345,000 tonnes (Australia and NSW 1999, NSW 1999). Annual pulpwood availability to this time was calculated to be 403,000 tonnes without needing to log streamside and other reserves, which together comprise about 23% of the area of State Forests (SFNSW and BRS 1998). Over the 20 year life of the Eden RFA, the guaranteed minimum annual supply of 'quota' sawlogs from the EMA is 23,000 m³ per year, while another 23,000m³ of sawlogs of below 'quota' quality can be taken from HDA's supply of pulp logs (NSW 1999).¹⁵ Thus, the supply of these logs depends very heavily on the silvicultural system imposed on the forests.

The silvicultural system

When the woodchip scheme began, integrated logging to produce pulpwood and sawlogs resulted in the clearfelling of generally continuous compartments of about 800 ha within corridors of undisturbed forest. Compartment size was reduced to 200 ha, and in 1976 the FCNSW adopted an alternate small coupe (15 ha) logging system, so that half of the available forests would be cut in a chequerboard fashion after 20 years. In 1983, the size of a logging unit was increased to an average of 60 ha, comprising a group of small alternate coupes (FCNSW 1982, Bridges and Dobbyns 1991). In 1994, the average coupe size was 50 ha (Drielsma 1994) and logging of the previously unlogged, alternate coupes had begun.

¹⁴The volume of pulpwood was converted to tonnes using a conversion factor of 1.135m³ gross/tonne. 'Quota' sawlogs are those logs of a sufficiently high quality to meet the criteria used to define sawlogs for supply to local sawmills as part of their allocations from public forests. Logs of lower quality may also be supplied to sawmills as 'salvage' quality, or 'optional', sawlogs, but would supplement a sawmill's supply of 'quota' logs (FCNSW 1982). The definition of a 'quota' sawlog has changed since the woodchip scheme began (Penna 2002).

¹⁵The NSW state government must supply a minimum of 25,000 m³ of 'quota' sawlogs per annum to sawmills in the Eden region for the first 5 years of the current RFA and 24,000m³ of 'quota' sawlogs per annum to such sawmills for the remaining 15 years of the agreement (Australia and NSW 1999). Other sawlogs sufficient to raise sawlog allocations to 25,000 m³ for the first 5 years of the RFA and 24,000 m³ for the remaining 15 years of the RFA can come from other forests in southern NSW. The expected 'sustainable yield' of sawlogs from the EMA for the 20 years following the current RFA to 2040 is predicted to be 26,000 m³ (NSW 1999).

Changes also occurred within logging coupes. Initially, clearfelling took almost all trees, leaving unmerchantable mature trees and advanced regrowth. The amount of retained unmerchantable trees declined through the 1970s, but the number of trees left for other purposes - potential sawlogs, wildlife 'habitat' trees and seed trees - increased (Bridges and Dobbyns 1991). However, potential sawlog trees were only retained in coupes from the mid-1980s to 1990 (SFNSW 1996). Now, up to 30-40% of trees may be retained in a coupe, and soil disturbance is less (Jurksis 1999). For the first 10-12 years, coupes were left to regenerate naturally without any burning, but considerable amounts of branch wood and other dead organic matter remained on the site as a fire hazard. After a large fire in 1980, pre- and post-logging burning of coupes was introduced (Bridges 1983), and post-logging burning was still part of forestry operations over a decade later (Drielsma 1994).

It was expected that in the second logging cycle from 2013, pulpwood would be primarily supplied by thinning regrowth stands until they were cut at ages of 80 to 150 years (HDA 1986). This changed with the RFA. As the end of the first logging rotation approaches, an increasing volume of wood will be taken as thinnings from regrowth forests. Calculated future yields in the second cycle are based on a rotation of 70 years and thinning a smaller productive forest area (SFNSW and BRS 1998). However, the density and uniformity of regeneration has declined because of tree and understorey retention and reduced soil disturbance in logging coupes (Jurksis 1999). These regrowth forests will require protection from serious bushfires as they contain the future wood resources for local industry.

Fire protection

The Eden region is fire prone (Bridges and Dobbyns 1991), and destructive forest fires are a threat to the long-term viability of the HDA scheme. The early estimates of pulpwood yields did not consider the impact of fire (FCNSW 1982). It was calculated that about one-third (1,200 ha) of the regeneration from annual logging operations could theoretically be burnt each year by wildfire without affecting the capacity of the forests to supply committed volumes of pulpwood (FCNSW 1976).

To help reduce the fire risk, fuel reduction burning was conducted in broad areas of old forest from 1969. However, post-logging burns were not conducted over the first 10 years, so regrowth contained high fuel loads. In 1976, the practice of burning debris on log dumps began, but was the source of 'escape' fires (CSIRO *et al.* 1997). One such escape started a bushfire in 1980 that destroyed regrowth equivalent to the first 10-year safety margin (Bridges 1983).

At the time of this fire, the FCNSW intended that fuel reduction burning for fire protection would not be used in the HDA licence area once the first logging stage of 20 years was complete because of the risk to young trees (Sneeuwjagt 1981, Bridges 1983). One fire analyst considered that

“(b)y that time it will be too late to bring in burning buffers, and slash removal burns alongside established regeneration will be too risky. As a result, the forest fuels will continue to build up to such an extent that even wildfires burning under mild conditions will present difficult suppression problems, and the possibility of the entire licence area being consumed by a series of massive conflagrations will increase with time” (Sneeuwjagt 1981: 11).

Unlike plantations, hardwood regrowth areas are not sufficiently productive to justify “intensive and effective fire suppression over vast areas” (Sneeuwjagt 1981: 1). The FCNSW then introduced a Fire Management Policy based on burning before and after logging and more fuel reduction burning in mature and regrowth forests that would be combined with detection and suppression using the region's extensive road network. The policy aimed at restricting the maximum loss of wood to the equivalent of the productive capacity of 40,000 ha of mature regrowth. Fire losses greater than this would mean the pulpwood commitment could still be met, but the capacity for producing other goods and values would be reduced (FCNSW 1982, Bridges and Dobbyns 1991).

The new policy was progressively introduced through the 1980s, and to assist its implementation, logging coupes were enlarged and seed trees retained for regeneration (Bridges 1983, Bridges and Dobbyns 1991). Post-logging burning continued into the 1990s. It reduced fuel loads, but also stimulated the growth of fine fuels such as grass and shrubs, so regular fuel reduction burning became increasingly important for protecting the regrowth resource (Bridges 1983, Drielsma 1994). The 1982 Management Plan stated that complying with the Fire Management Policy needed a 50% expansion in the forest service workforce (FCNSW 1982), but such an expansion would have increased the theoretical cost of producing sawlogs and pulpwood in public forests.

Pulpwood and sawlog interactions

The establishment of the woodchip scheme influenced the way logs from public forests were used commercially. Integrated logging helped increase access to previously inaccessible or hidden sawlog volumes (FCNSW 1982), but not all potential sawlogs have been used as such. Also, there have been changes to the region's sawlog and pulpwood criteria.

For the first decade or so, the difference between a sawlog and a pulplog in the Eden region was not only dependent on quality criteria, but also the financial ('royalty') value of a log to the FCNSW. A potential sawlog could be directed to the chipmill if its royalty value as a pulplog was higher than that as a sawlog. However, the value of a pulplog to the FCNSW was higher closer to the chipmill than further away because HDA received a distance allowance that reduced the royalty on pulplogs further from the chipmill. The interaction of the sawlog definition and the distance allowance meant that some logs classified as sawlogs far from the chipmill would be pulplogs if cut close to the chipmill. Also, at more distant locations, some lower quality 'non-quota' sawlogs could be directed to the chipmill for the same reason (FCNSW 1976, Thompson and Miller 1977).

By 1982, log criteria had changed to remove this anomaly, widen the definition of a pulplog and support the supply of high quality logs to sawmillers. Lower quality sawlogs with minimum royalty value could be rejected by a sawmill and chipped, and the permitted defect allowance was such that the royalty for the log was to be above the minimum for a sawlog, while the minimum length of a pulplog was shortened (FCNSW 1982). By the mid-1990s, sawlog specifications had become more complicated and royalty value was not listed as a factor to be considered, and the permitted defect allowance was to be decided with the sawmill. Some lower quality non-quota sawlogs became pulpwood (Drielsma 1994).¹⁶ Sawlog pricing also shifted from a 'flat' log royalty system to one that considers the value of recovered products (DPIE 1998). As logging proceeds, the quality of the remaining accessible native sawlog resource will change considerably - the proportion of small logs will increase, although logs will be more uniform (DPIE 1998). Thus, one of the most noticeable characteristics of these native forests - tree size - will change substantially.

Implications of woodchipping for the region's forest fauna

Prior to the woodchip scheme's establishment, neither the region's fauna nor the likely impact of the scheme on that fauna were well understood. Early analyses of the impacts of integrated logging were based on short-term observations and inferences from other areas (Scott 1975). The first research on the impacts of the woodchip operation on terrestrial vertebrates began in 1975 and was a cooperative study between the Australian Museum and the FCNSW. This research concluded that then national parks and nature reserves in the Eden area were inadequate by themselves to ensure the survival of the region's wildlife. Researchers decided that a continuation of then logging patterns in public forests could be expected to reduce the abundance of animals dependent on mature forest, possibly leading to regional extinctions (Recher *et al.* 1980).

Forest-dependent fauna were considered to be the most vulnerable animals because integrated logging and planned rotation times would remove critical forest features upon which they depend, including large trees and tree hollows for nesting. Such forest-dependent fauna include the koala, several species of forest bats, and a variety of gliders, possums and birds. The research also argued that the logging would reduce the abundance of nectar feeding birds because of changes in the patterns of flowering and abundance of nectar, while favouring birds and mammals suited to open and low vegetation (Recher *et al.* 1980).

Based on the assumption that the woodchip industry would continue, Recher *et al.* (1980) sought short-term and long-term changes in the management regime governing the public forests. These desired changes included: logging-free buffer strips at least 40 metres wide along either side of watercourses, extending to 50 metres in major catchments; retention of 'habitat' trees,

and where necessary surrounding vegetation, in logging coupes; selective logging of coupes important for fauna (rather than clearfelling); and an extension of the logging cycle in fauna-rich forest patches.

The FCNSW introduced a wildlife management policy for the Eden region based on this work in 1979, and established the Preferred Management Priority classification system in 1981 (FCNSW 1982, Bridges and Dobbins 1991, Drielsma 1994). Wildlife corridors were created and more 'habitat' trees left in coupes. While these changes provided benefits, doubts on their long-term effectiveness were identified (Recher *et al.* 1987, Pyke and O'Connor 1991, SEFA 1992). Further research supported and extended the conclusions and recommendations of Recher *et al.* (1980).

Braithwaite (1983, 1984) and Braithwaite *et al.* (1983a, 1983b) identified the importance of forests on rich soils for possums and gliders. Such forests provide high nutrient food sources, and are predominantly located at higher elevations in the Eden region where commercial exploitation has been limited. Consequently, a high proportion of arboreal marsupial species and individuals occur in a relatively small area of forest. Lunney and Leary (1988) concluded that the clearfelling used for integrated log supply was having significant impacts on local fauna, particularly on those species dependent on mature forest, such as gliders. A decline in such dependent species would also impact on their predators, such as owls, which need a high abundance of prey.

Lunney *et al.* (1988) found large trees in gullies were important as roosting sites for bats, while Lunney and O'Connell (1988) found logged or burnt areas were not favoured by wallabies and wombats because of lack of cover. The numbers of kangaroos, wallabies and potoroos were expected to fluctuate, and there were concerns that the size of some populations may fall to extinction levels (Lunney 1989). The White-footed dunnart was recognised as vulnerable to disturbance because of its high habitat specificity (Lunney and Ashby 1987), and three of the region's most common lizards are comparatively rare in regrowth forests because of too much shade for these sunshine-dependent species and the lack of large rotting logs and old trees (Lunney *et al.* 1991). Clearfelling was also considered to have the potential to push remnant local koala populations to extinction (Reed and Lunney 1990). Jenkins and Recher (1990) concluded that there was no evidence to show that the Preferred Management Priority classification system or that the Native Forest Preservation Program used in Eden's production forests were sufficient to conserve the region's species and communities.

Recommendations continued to be made to advance fauna conservation in the region's forests, and were of three main kinds. As with those of Recher *et al.* (1980), they were based on the assumption that a woodchip scheme would continue in some form. The first general recommendation proposed much larger areas of forests,

¹⁶Although the Eden RFA allows for the annual supply of up to 23,000 m³ of non-quota sawlogs from the guaranteed annual supply of pulpwood (Australia and NSW 1999), in 1995-96, public and private forests in the region only produced 1,695 m³ of non-quota sawlogs (DPIE 1998).

especially old forests, be reserved from logging (Pyke and O'Connor 1991). The second sought changes in the management of forests available for logging, so that the silvicultural regimes, fire management regimes and buffer zone width "all be specifically related to habitat quality and ecological values in each coupe" (Jenkins and Recher 1990: Summary p.iv). Such changes included: wide buffer strips along gullies and drainage lines; exclusion of logging and heavy machinery from these strips; a prohibition on the felling of uncommercial tree species; a lengthening of logging cycles; and sophisticated fire management plans. The third recommendation promoted more research on the impacts of logging and fire on wildlife.

Discussion

The establishment of the Eden woodchip scheme and its commitment from the New South Wales government for 530,000 tonnes of pulpwood each year required radical restructuring of State Forests in south east NSW. The resultant forest management regime imposed new priorities on those forests and generated new relationships between their commercial wood values and other non-wood values that impacted on forest fauna.

The logging of forests to supply pulpwood was based on rapid clearfelling that allowed loggers to enter more economically inaccessible forests and to fell trees of lower economic value. This assisted sawmillers by improving the supply of sawlogs, but some lower quality potential sawlogs were sent to the chipmill. Changes to the criteria for logs from public forests reflect attempts of the forest managers to generate a supply of quality sawlogs from a limited resource. However, interactions between log criteria and supply commitments helped restrict the potential to manipulate log supply to protect non-wood values, such as fauna.

The FCNSW resisted pressures for such manipulations and reservations of commercially valuable forests. The critical importance of the pulpwood supply commitment for this stance was shown in the late-1970s, when it argued to the NSW government that:

"there appears to be no safety margin in these (pulpwood) yield estimates, and at this stage it would seem that significant further constraints upon the operation, by way of retention of more trees or by reduction in the area available for logging will make it impossible to meet the annual commitment on a sustained basis" (FCNSW 1977: 3).

The history of streamside reserves in the EMA until the late-1990s illustrates the problem of limited wood resources. As Lunney (1987) identified in a study of possums and gliders, forests in gullies were important for wood supply because they tended to have more trees and higher volumes of wood than ridges. When the woodchip scheme began, streamside reserves were not prescribed, but were established in 1971. The specifications first prohibited logging, but were then

modified so that streamside reserves could be logged (Miller undated, FCNSW 1982), with some discretion in the management of streamside reserves being given to supervising foresters (Drielsma 1994).

The logging and management regimes employed to supply pulpwood also created large areas of fire sensitive regrowth with high fuel loads that threatened the future of the resource itself. In attempting to reduce the risk of destructive fires, a new fire management policy created a dependency on a regime of fuel reduction burning aimed primarily at protecting property and wood resources. A regime that also reflects other priorities and broader concerns would have different outcomes.¹⁷

As loggers penetrated the State Forests, older forests became more and more fragmented by a patchwork of young regrowth and recently logged sites. Consequently, the region's forest fauna became increasingly squeezed between the impacts of logging and fuel reduction burning. Research concluded that continuation of the dominant wood production regime could be expected to significantly change the abundance and distribution of the region's forest fauna. Some populations would be depleted, some perhaps to the point of regional extinction. Forest dependent vertebrate fauna are particularly sensitive. The Australian Heritage Commission also "commented, over many years, on the significant adverse impact of the Harris-Daishowa operation on the national estate significance of the forests of south-east New South Wales" (AHC 1994: 1).

The changes to forest management in the Eden region made through the 1990s were ratified in the Eden RFA in 1999 (Australia and NSW 1999). However, the adequacy of the parks is challenged by community conservation organisations (Plumb 1998). Within the production forests, the calculations of future log supplies made in the late-1990s and used in the RFA are based on a smaller area of accessible State Forests and assume the existence of unlogged streamside reserves (SFNSW and BRS 1998). However, this smaller area of accessible forests will need fairly intensive management to maintain assumed growth rates and achieve predicted wood outputs.

Sawmillers will have to add value to smaller, more uniform logs taken from intensively managed production forests that will primarily produce pulpwood. Their dependency on the woodchip scheme for access to logs will continue. Greater tree retention and less soil disturbance may lower the quality of the regeneration and growth rates upon which yields depend. The difference between calculated yields and the guaranteed minimum annual pulpwood supply provides some flexibility in case of fires and/or lower growth rates. However, an important issue is whether the management regime for these production forests is sufficient to supply wood commitments and protect other values within production forests, such as native fauna.

Also, regional fire management policies now have to consider the expanded area of parks, as well as the impacts of fuel reduction burning and bushfires on various forest values,

¹⁷The submission of the New South Wales National Parks and Wildlife Service to the SFNSW on the 1994 Environmental Impact Statement for proposed forestry operations in the EMA illustrates the importance of fire policy for nature conservation (NSWNP&WS 1995).

while trying to ensure that fires do not destroy sufficient forests to prevent the pulpwood supply commitment being met. Questions arise as to what priorities will dominate in these policies and their implementation, and how much of their financial cost will be paid for by pulpwood and sawlog sales. Conflicts between wood production and non-wood values - and between those people concerned with their expression and protection - will predictably escalate if the wood production regime imposed by the RFA fails to provide desired volumes of pulpwood and sawlogs, and/or to protect the forests and surrounding human communities. A strong research effort needs to be sustained across all issues impacting on forest growth and management in the region, including fauna protection, while research results, wood resource data and related economic information should be published regularly.

The political and economic strength of the wood-based industries in the region meant that it took almost 30 years to gain recent changes in forest management. However, several factors underlie this outcome: campaigning by Australian 'conservationists' against the woodchip scheme; the availability of pulpwood in eastern Victoria; and Daishowa's decline during the 1990s.

There has been almost continuous campaigning against woodchipping by conservation groups and individuals across all political levels since the HDA woodchip mill began. This campaigning included promotion of alternative forest management regimes and timber industry structures that would help protect non-wood forest values while providing logs for commercial processing and employment (Thompson and Miller 1977, SEFA 1989a, b, Formby 1991, SEFCC undated). However, it has also involved physical obstruction of logging and HDA's operations. This occurred particularly around the time HDA's export woodchip licence and pulpwood supply agreement were to be renewed. During 1989, more than a thousand protestors were arrested in the region (Hinchey 1991) trying to stop the logging of what they considered as 'wilderness' forests for "the most wasteful and least beneficial of all timber products - woodchips" (Salmon 1989: 12). Such actions continue to occur sporadically (Chipstop 2003).

Daishowa's poor financial and market positions were also important to the RFA outcome. During the 1990's, Daishowa was able to manipulate the fibre intake for its limited production between various woodchip and pulp suppliers to minimise resource costs and meet other corporate objectives (Penna 2002). Its use of hardwood chips was restricted and its demand for HDA's chips declined. Consequently, the pressure on the NSW government to maintain pulpwood supply levels declined and its options for reserving forests increased.

The availability of wood from East Gippsland added to the NSW government's flexibility, and helped it minimise the adverse political and economic consequences of reducing the supply of wood from forests in the Eden region. The sale of pulpwood from East Gippsland provided HDA with

wood of equal or better quality for papermaking to that available around Eden. It also partly satisfies the long-term desire of the managers of Victoria's State Forests for the sale of large volumes of trees of low commercial value from East Gippsland to a pulpwood industry (Morgan 1997).¹⁸

Thus, while conservation campaigns created a climate for change in the management of Eden's forests, the political opportunity to implement change was created by domestic and foreign industrial factors that also heavily shaped the general conditions defining that change. Such forces within international pulpwood markets will also help shape the balance between HDA's wood demands on eastern Victoria and south east NSW, the management of those forests available for logging in both states and the revenues each state receives from the sale of pulpwood.

Several factors will influence the future of the HDA woodchip mill (and other Australian woodchip schemes) in international pulpwood markets. The first two are the quality and price of its woodchips. HDA's wood supply is at the lower end of the quality scale for papermaking (Bills pers. com. 2001), and the export price of HDA's woodchips compensates for this. The use of wood from young regrowth forests in East Gippsland helps improve chip quality, but HDA expects strong competitive pressures on the price and quality of its woodchips (Phillips 2000).

The other related consideration is how the demands of papermakers in Asia for new fibre will balance out against the expanding pulpwood supplies from maturing plantations in Asia, South Africa and the Pacific Rim, and the extent to which these supplies will replace woodchips from native forests. Japanese papermakers have been increasing their use of fibre recovered from waste domestic paper/board and fibre from their own and others' foreign hardwood plantations (JPA 2001a). Nippon Paper Industries, which subsumed Daishowa to form NUH, wants to increase its own area of foreign hardwood plantations to 100,000 ha and have them supplying more than one million Bone Dry Tonnes of woodchips by 2008.¹⁹ It also wants to be using only plantation wood and 'certified' wood for new fibre by the same time (Nippon 2003a). HDA's place in NPI's fibre supply strategies may then revolve around NPI's attitude to the conditions that the Eden and East Gippsland RFAs and respective state governments impose on logging in relation to potential forest certification standards.

Chinese pulp and paper companies may also increase their demands from domestic plantations in China currently supplying export chips to papermakers in Japan (Neilson and Flynn 2003). Japanese papermakers are expanding their own plantations in China (JPA 2003), establishing production facilities there and are targeting China's paper markets (Oji 2002, Nippon 2003b). Large Indonesian pulp and paper manufacturers are also targeting China's growing paper markets (Barr 2001, WRM 2002), but there is an expected imbalance between Indonesia's pulpmill capacity and plantation pulpwood supplies (Stafford

¹⁸Eucalypt woodchips from eastern Victoria are also exported to Japan from Geelong (FoE-FN 2001, Neilson and Flynn 2003).

¹⁹Approximately two tonnes of green wood are needed to supply one Bone Dry Tonne of wood (Neilson and Flynn 2003).

1999, Barr 2000). During the late-1990s, HDA's owners gave the company permission to sell its chips to other customers, and HDA regards Indonesian manufacturers as such a market (Phillips 2000).

These changing pressures will influence HDA's survival and place in international woodchip markets. They will be transferred down the fibre supply chain to influence HDA's wood demands in terms of quality and volume, as well as the price it is prepared to pay for wood and labour. How these pressures and demands impact on the management of forests supplying pulpwood to HDA and their non-wood values, including fauna, will depend on the form in which the state governments want the export woodchip scheme to continue and whether they can control any adverse political consequences from providing wood under conditions that suit HDA.

As the continuing resource and environmental impacts of the changed forest management regime in both states are analysed and described, the critical issue for fauna conservation will be the need and potential to modify respective resource regimes during the life of the current Eden and East Gippsland RFAs. The conditions of the RFAs and related legislation work against the creation of new reserves and reductions in wood supplies in ways that detrimentally impact on companies with guaranteed wood supplies (Australia and NSW 1999, Australia 2002).

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Conclusions

The integration of public native forests in south east New South Wales into the Japanese paper industry was based on the physical restructuring of large areas of those forests to meet the fibre demands of Japanese papermakers and the economic priorities of the owners of the HDA woodchip mill. The relationships between wood and other values in these forests had to be reorganised to suit the state government's responsibility for pulpwood production. Research showed that fauna populations were being restructured by these pressures, and forest-dependent fauna in particular were being detrimentally impacted.

Concern over the environmental and resource management impacts of the woodchip scheme generated political pressure for changes in forest management. However, the technical opportunity for recent changes that helped gain greater protection for forest fauna was generated by Daishowa's poor financial and market position in Japan and the ability of HDA to expand its pulpwood intake from eastern Victoria. These factors also helped define the limits of potential changes.

While the Eden woodchip scheme continues to operate, the 'political ecology' of forest fauna in south east Australia will be shaped, at least in part, by the way regional forest management regimes interact with increasingly complex international pulp and paper markets.

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