

The Ghost of Wesley Vale: Environmentalists' Influence on Innovation in Australia's Pulp and Paper Industry*

David A. Sonnenfeld

Sociology Board, University of California, Santa Cruz, CA 95064, USA

This paper analyzes how a key conflict in Australia's pulp and paper industry became generalized to other sites through environmental action, government regulation, and industry initiative. From 1987-91, Australians debated construction of a new, world-class, export-oriented pulp mill in Tasmania. Rural residents, fishermen, and environmentalists, allied with the Australian Labor Party, succeeded in scuttling the project. Subsequently, the national government launched a major research program, state governments tightened regulations, and industry reduced elemental chlorine use. Any new mills constructed in Australia today would be among the cleanest in the world. This paper is part of a larger, comparative study of technological innovation in the pulp and paper industries of Australia, Indonesia, Malaysia, and Thailand. The author interviewed industry officials, government regulators, research scientists, and environmentalists; visited pulp and paper mills; attended technical conferences; and conducted archival work in these countries during a 12-month period.

Introduction

"We do what the environmentalists want us to do"
-- pulp company research engineer

A new, more environmentally-friendly, production regime has been established in Australia's pulp and paper industry in just the last few years. Manufacturers have eliminated or reduced elemental chlorine use at most pulp mills. Australia's major newsprint manufacturer, the Australian Newsprint Mills (ANM), has dropped all chlorine use. Kimberly-Clark Australia (KCA), Australia's leading tissue manufacturer, now uses oxygen-based bleaching for all products. Amcor, the largest manufacturer of pulp and paper in Australia, has implemented a simple but ingenious "peroxide injection" method at its Maryvale bleached kraft pulp mill, reducing elemental chlorine used in producing fine printing and writing papers.

How can these developments be explained? I argue they are a direct product of successful community and environmental organizing, beginning with the scuttling of a proposed new pulp mill at Wesley Vale, Tasmania, on the northcoast of Australia's smallest, and southernmost state, in the late 1980s and early 1990s. Unable to meet domestic demand for paper through building a new mill, manufacturers expanded production at existing sites. However, these expansion projects had to meet stringent environmental requirements demanded by public citizens and government officials educated through years of debate around the Wesley Vale project.

* *Competition & Change*, 1996 Vol. 1, pp. 379-401

These developments suggest that citizen activists can play an important role in inducing development of cleaner production technologies. This study's findings are consistent with those of the larger research project of which it is a part (Sonnenfeld forthcoming).

The fieldwork portion of my Australian research was conducted between January and June 1994. I visited seven pulp manufacturing sites, with formal tours at two. I interviewed officials of the three companies involved in the production of most virgin pulp in Australia; National Pulp Mills Research Program staff and board members; and environmental activists -- a total of 20 interviews. In addition, I attended several technical conferences; conducted archival research at the Australian National Library, and libraries of the Australian National University and the University of Tasmania; gathered over 400 documents and a film; and took hundreds of slides.

This article is organized in three sections. I begin by describing the historical context in which this innovation took place, including a brief statistical overview of pulp manufacturing in Australia, and a summary of the Wesley Vale affair. Then, I analyze how Australia's producers of virgin pulp 'cleaned up their act.' I conclude with a discussion of how environmentalists were able to induce to these changes.

Historical context

Industry overview

Despite exporting millions of tons of woodchips each year to Japan and elsewhere (see Figure 1), Australia imports approximately 30 per cent of its pulp and paper needs (see Figure 2). Paper consumption in Australia, as in other industrialized countries, is at high per capita levels (see Figure 3), reflecting general economic conditions and dynamics of technological change. Consumption of fine printing and writing papers has climbed significantly in Australia (see Figure 4), boosted by increased use of photocopying machines and computers.

When I commenced my field research in October 1993, three companies produced most of the virgin pulp in Australia: Amcor, ANM, and the Australian Pulp and Paper Manufacturers (APPM) (see Figure 5). Amcor owns 50 per cent of a fourth company, KCA. A fifth company, Bowater, which produced approximately four per cent of the virgin pulp in Australia in 1992, was not a focus of this study.¹

Place Figure 1 about here.

Figure 1. Australia: pulp production, effective consumption of pulp, and woodchip exports, 1980-91 (FAO 1993; Streeter and Imber 1991).²

Place Figure 2 about here.

Figure 2. Australia: source and relative composition of raw material inputs in pulp and paper products, 1980-91 (FAO 1993).³

Place Figure 3 about here.

Figure 3. Australia, Malaysia, Thailand, and Indonesia: per capita paper and paperboard consumption, 1965-1992 (*PPI*, various issues).

Place Figure 4 about here.

Figure 4. Australia: consumption of paper and paperboard, by product type, 1980-91 (FAO 1993).

Place Figure 5 about here.

Figure 5. Australia: company share of virgin pulp production, 1992 (Miller-Freeman 1992).⁴

*The Wesley Vale affair*⁵

A definitive history of the conflict at Wesley Vale has yet to be written. Several early accounts have been completed, however, including Dargavel 1989; Milne 1990; Chapman 1992; and Economou 1992. I will not duplicate these efforts; however, I do want to show the links between this conflict and subsequent developments in the industry -- something these articles weren't able to do. I will thus summarize some of the case's more salient points.

In 1987, North Broken Hill Ltd. (NBH), parent company of APPM, announced plans to build a large, new export-oriented pulp mill on the Tasmanian northcoast. Canada's giant

Noranda Forests Ltd.⁶ was to be NBH's partner in the project. Three sites in north and northwest Tasmania were considered (*Advocate* 1989).

The new mill was to have fulfilled APPM's commitments to the State of Tasmania, as part of a forest concession agreement made in the 1960s (Dargavel 1989). With high levels of unemployment, the State of Tasmania is interested in promoting higher value-added on-shore processing of Australia's natural resource wealth.

Local residents became concerned when Wesley Vale was designated as the site for the new mill. APPM had a small, integrated pulp and paper mill on-site already. But considerable prime agricultural land is nearby. Concerned that a large new manufacturing operation in the area would degrade these lands, farmers organized against the project. Calling themselves "Concerned Residents Opposed to Pulpmill Siting" (CROPS), they sought support from other northcoast residents, and from environmentalists from elsewhere in Tasmania and the Australian mainland, including Greenpeace Australia.

As they learned more from Greenpeace about the dangers of dioxin, and received belligerent responses from NBH/APPM to their concerns,⁷ CROPS activists redirected their campaign from contesting the Wesley Vale site to opposing the new mill *anywhere* until ecological conditions were better understood and NBH promised to adopt totally chlorine free (TCF) pulping and bleaching technology at the new mill.

The proposed new pulp mill was debated hotly across Australia.⁸ Among those touched by the debate were Bass Strait fishermen, who were concerned that the new mill would affect their livelihoods. APPM's reputation with respect to the environment was key: its mills were notorious for pumping untreated effluent into the Strait.

CROPS aimed some of its salvos overseas, to North America. In 1988, it launched a campaign of writing letters to the *Toronto Star*, aimed at Canadian pulp and paper manufacturer, MacMillan Bloedel, then a Noranda subsidiary and under attack for clearcutting forests on Vancouver Island. North Americans experienced in pulp mill environmental issues were brought to Australia to lend support to the anti-pulp mill effort.

Calls went out for a national inquiry following two damaging reports from the Commonwealth Scientific and Industrial Research Organization (CSIRO) raising questions about the proposed mill's environmental impacts (Johannes 1989; CSIRO 1989; Sanders et al. 1989; Sanders 1989a; 1989b; 1989c; 1989d).

Citing changed economic conditions, in March 1989, Noranda withdrew its participation, effectively killing the Wesley Vale project.⁹ Two months later, a record number of Green-Independent Party candidates, including CROPS leader Christine Milne, were elected to the Tasmanian State Parliament, helping bring down the Liberal government.

Late in 1989, project managers at CSIRO's Division of Forest Products proposed an AUD \$8 million research project to (the national) Parliament. To these managers' surprise, the Australian Labor Party (ALP) -controlled body funded their request, as part of the "Pulp and Paper Industry Package," initiating the National Pulp Mills Research Program (Department of Industry, Technology, and Commerce, et al. 1989; Green 1991; Abel 1994).¹⁰

Many people in Australia learned about pulp industry production processes and pollution problems in the course of four years' debate over the Wesley Vale project. Greenpeace Australia and others were regularly quoted in the national news media warning about the dangers of chlorine and dioxin, and urging the purchase of chlorine-free paper products (cf. Young and McNamara 1989).¹¹

In the early 1990s, environmentalist opposition to new pulp mills based not only on the threat of increased pollution, but also on the mills' logging of native forests, left at least some Australian paper industry officials pessimistic about prospects for building new virgin pulp manufacturing capacity in Australia -- or even continuing existing operations. Investments in both physical and human capital in Australia's pulp and paper industry were deferred; production of woodchips for export was expanded, and manufacturers invested in manufacturing capacity overseas rather than at home. Only those projects touted as environmental improvements proceeded, including some using recycled paper as a fiber source.

Within months after the conclusion of a bitter strike at APPM's Burnie mill,¹² NBH decided to get out of the pulp and paper business altogether. NBH sold APPM to Amcor, at the end of 1993. In one fell swoop, Amcor became the dominant pulp and paper manufacturer in Australia.¹³ The APPM sale closed the book on the Wesley Vale affair in an immediate sense. It did not, however, stop the Ghost of Wesley Vale from living on.

Environmental innovation

There is a green lining to the cloud hanging over Australia's pulp and paper industry, however. While no new mills have been built to produce virgin pulp in Australia for a decade, the industry has made great progress modifying existing pulping and bleaching practices to eliminate or reduce use of elemental chlorine, and has increased its use of recycled paper. In addition, the National Pulp Mills Research Program (NPMRP) has developed sophisticated environmental impact assessment techniques useful to communities, regulators, and industry worldwide. In this section we take a look at industry leaders, ANM, KCA, and Amcor, and at the achievements of the NPMRP.

*ANM*¹⁴

Formed in 1938 by a consortium of Australian newspapers, including the publishers of *The Sydney Morning Herald*, *The Daily Mirror* [Sydney], *The Age* [Melbourne], and *The Herald* [Melbourne], ANM today is a joint venture of Rupert Murdoch's News Limited Corporation, "inheritor" of that newspaper consortium, and New Zealand's Fletcher Challenge Ltd. Fletcher Challenge purchased a 50 per cent, managing interest in ANM in 1988, as part of a rapid globalization strategy.¹⁵ Fletcher Challenge began rationalizing ANM's operations shortly after becoming joint venture partner. ANM was put on a cost basis; even its co-parent News Corporation Limited vowed to purchase the best product for the best price, regardless of origin.

ANM operates two integrated pulp and paper mills: its original, flagship mill in Boyer, Tasmania; and a newer newsprint mill in Albury, New South Wales. Corporate headquarters, and research and development laboratories are in Tasmania. Commissioned in 1941, "the Boyer mill is located on the Derwent River 36 km from Hobart," (GHD-Cowan Lavalin 1989) and today produces 240,000 adt/y¹⁶ of newsprint and coated printing and writing papers, from plantation pine (*P. radiata*), "regrowth eucalyptus," and market long-fiber kraft pulp.

ANM's process for producing newsprint at Boyer was unique, due to the mill's use of "old-growth" (more than 25 years old) native Australian hardwoods (eucalyptus). The wood was so hard that it had to be cut into "billets" -- small, rough boards of lumber -- and softened by pre-treatment with chlorine, to be mechanically ground. Billet-making was the most labor-intensive operation at the Boyer mill, employing approximately 300 people. Chlorine for the pre-treatment was produced on-site, through a mercury-cell-based, electrolytic operation.

The mercury cell plant was coming to the end of its productive life in the early 1990s, and ANM had to decide how to replace it. While the Wesley Vale affair raged on, ANM was notified that its exemptions to the 1976 Tasmanian environment law would cease, including for discharge of effluents into the Derwent River; and it came under pressure from environmentalists to cease using old-growth timber in manufacturing pulp and paper.

It was thus "easy" for ANM to make several important decisions at the same time: to stop using old-growth hardwood, shut down the billet mill and the mercury cell plant, and discontinue chlorine use. Environmentalists welcomed these changes. I was not able to ascertain the response of the 300 billet mill employees.

ANM continues to upgrade its Boyer mill's operations. In 1994, it filed a formal request with the State of Tasmania for permission to produce coated printing and writing paper at this site. When I visited in March 1994, the company was continuing efforts to improve environmental performance, including reducing the amount of suspended solids in its effluent. Solids from the sludge were being removed, dried, and shipped to a landfill.

The company was investigating productive uses for the dried sludge, including using it as a filler in cement, and as an agricultural mulching agent.

*Amcor*¹⁷

Amcor, the oldest and largest of the Australian papermaking companies, has roots going back to the 1860s (APM 1959; Sinclair 1990). It has gone through numerous transformations in its 130-year history. Amcor, known as the Australian Paper Manufacturers (APM), was primarily a forest products business for many years. Amcor was renamed in 1986, signaling its increasingly diversified range of products and globalized scope of operations (APM Maryvale Mill n.d.).

With sales of AUD \$4.8 billion in 1993, Amcor is one of Australia's "top dozen or so listed" corporations. Traded as a blue chip stock on the Australian Stock Exchange, many of Amcor's shares are held by banks, pension funds, and insurance companies.¹⁸ Amcor today views itself as primarily a packaging company, operating in three divisions, in more than a dozen countries, on four continents (see Figure 6). It claims to be "one of the 10 largest [packaging businesses] in the world" (Amcor 1993). While retaining linkages to the Australian forestry sector, the firm has targeted box-making and, where feasible, associated papermaking, including in the United States of America (USA), the United Kingdom (UK), France, Germany, Hong Kong, and Singapore.

Place Figure 6 about here.

Figure 6. Amcor corporate structure, late 1980s/early 1990s (Amcor 1993; Amcor Research & Technology Centre n.d.; Miller-Freeman Publications 1992).¹⁹

APM's flagship operation is its integrated "Maryvale" forestry, pulp, and paper complex near Morwell, in the Central Gippsland region of the state of Victoria, a resource extractive (coal, power) and agricultural area two hours by highway from Melbourne. APM's Maryvale complex has three pulp mills -- an unbleached kraft mill, built in 1987; a bleached kraft pulp mill; and a chemi-thermo-mechanical pulp (CTMP) mill -- and four paper machines. The bleached kraft mill is the only one in Australia; it uses both elemental chlorine and chlorine dioxide. Until recently, the elemental chlorine was produced on-site in a mercury cell plant. The complex's fiber sources include plantation pine (*P. radiata*), Australian hardwoods (*Eucalyptus var.*) from native forests, and wastepaper.

In 1989, responding to environmentalists' demands and tightening State of Victoria regulations, Amcor engineers began a series of bleaching sequence modifications, aimed at reducing the mill's elemental chlorine use.²⁰ Researchers soon "luckily stumbled" on a

"simple" pre-bleaching treatment, which they dubbed the "Mini-O" process, which helped them meet this objective. In the Mini-O process, non-toxic peroxide is injected into a pulp pipeline. APM ceased operating²¹ its mercury-cell chlorine plant, and now purchases chlorine commercially from Imperial Chemical Industries Australia, Ltd. (ICI), which trucks it to the Maryvale site from Melbourne.

Amcor researchers acknowledge that they would not have taken up their research on the Mini-O process without pressure from environmentalists and government regulators. They are happy to have found a solution which not only helps them meet regulatory requirements, but also saves Amcor money by allowing them to purchase less chlorine from ICI. At the time of my interviews, Amcor was considering patenting the Mini-O process for licensed commercial use elsewhere.

A further twist of the Maryvale story comes with the involvement and cooperation of the Latrobe Valley Water and Sewerage Board in developing and implementing wastewater treatment practices at the mill complex. There are two separate waste streams. In one, wastewater from the bleached kraft mill, wood yard, and paper machines goes through "a three stage treatment" on-site, before being released into the Latrobe River (APM Maryvale Mill 1991). In the other, "high-salt" wastewater from the two other pulp mills and the chemical recovery plant is piped directly to the Water and Sewerage Board's Dutson Downs facility, where it is treated biologically for "up to 3 months" in aeration lagoons before being released into the ocean via the Latrobe Valley Outfall Sewer (LVWSB n.d.-b; n.d.-a; APM Maryvale Mill 1992). According to Amcor officials I spoke with, the Water and Sewerage Board finds that the mill's wastewater stream helps it process domestic and agricultural waste in the system, and has lobbied hard over the years to retain APM Maryvale's participation in their facility.

Amcor has not stopped with developing the Mini-O process. It has since adopted a "Best Practice Environmental Management" (BPEM) program for all manufacturing operations, including the Maryvale mill. Each operation sets annual targets for pollution reduction, delineates programs for achieving those goals; and submits a related capital expenditures budget to divisional headquarters. Amcor is proud of its achievements at the Maryvale site, exceeding regulatory requirements, and resulting in significant annual reductions in air- and water-borne emissions.²²

KCA

KCA, though relatively small and specialized, is still Australia's fourth largest manufacturer of virgin pulp. KCA is a joint venture between Amcor (50 per cent), and the USA-based Kimberly-Clark Corporation (50 per cent), with Amcor as the managing partner. KCA's wholly owned subsidiary, Apcel Limited, operates a tissue pulp mill and converting facility near Millicent, South Australia. Apcel started up in 1958, progressively expanding operations over the next four decades from tissue paper production, to conversion, to expanded pulping and papermaking.

Under attack for years for polluting nearby Lake Bonney, KCA in 1992 launched a new, chlorine-free pulp mill at its Millicent site, utilizing a "deep-steep" oxygen bleaching process developed by Amcor's Research and Technology Centre. The new mill is one of the most remarkable success stories in Australia's pulp and paper industry. After years of losing market-share to lower-cost, "recycled paper" tissue manufactures, KCA dramatically reversed its fortunes in the marketplace, in part by trumpeting its "environmental friendliness." All this is directly attributable to spill-over from the Wesley Vale controversy, including an active campaign by Greenpeace Australia against KCA.

Useful background information about environmental concerns involving the Apcel operation is contained in a draft report submitted in late 1989 by Philippa Kneebone to *Chain Reaction*, magazine of Friends of the Earth (FoE), an Australian environmental organization, excerpted below:

Lake Bonney is the largest permanent naturally occurring freshwater lake in south Australia. It is situated on the South East coast in an area that was once a vast area of wetlands. Drainage channels have resulted in most of the land becoming available for agriculture.

In 1958 the South Australian Government signed an indenture agreement with the Millicent Council thus allowing two pulp and paper mills APCEL and Cellulose Australia to "discharge all effluent from the mills into the snuggery drain". From the drain all effluent flows into Lake Bonney. The Lake itself is approximately 30 km in length and generally shallow (2-3 metres). When the lake level rises its contents are then channeled into the sea at Carpenter Rocks, a fishing community 40 km South West of Mount Gambier....

For many years local residents have protested at the despoilation [sic] of the lake and of the offensive gaseous emissions from the APCEL factory. APCEL uses a chlorine bleaching process to produce much of its tissue product. The byproducts of this process are chlorinated compounds, substances which are often described as the most deadly on earth.

Greenpeace focussed on APCEL through their pulp and paper campaign and gave support and impetus for the formation of a Friends of Lake Bonney Group to be formed.... APCELS' [sic] parent company Kimberley [sic] Clark have discussed with the [Friends of Lake Bonney Group] their concerns and have moved to plan the phasing down of the chlorine bleaching process and to substitute a hydrogen peroxide bleaching process. Consumer demand for unbleached and 'less white' products has helped to bring this change about.

... One of the major factors in the issue being responded to by the company and the Government was of course ECONOMICS. When the crayfishing industry became aware of the real dangers posed by the effluent flowing out to the sea into the crayfish feeding and breeding grounds they were very vocal in their calls to stop the effluent being channelled [sic] into the sea. The crayfish industry is a multi million dollar [industry] for Australia and a problem in any crayfish area would affect the export industry nationally.

.... The campaign [to clean up the lake and stop effluent from entering the sea] reached a peak in November [1989] when Greenpeace focussed action on the outlet at Carpenter Rocks as part of their Clean Oceans Campaign. Greenpeace activists moved quickly to block the outlet and stop the effluent reaching the sea. Many locals including many of the people employed in the Crayfishing industry went along to support the action. The media coverage was good and the [State of South Australia] Minister for the Environment, Ms Susan Lenehan agreed to the demand that the outlet not be reopened this season.... (Kneebone 1989)

Apcel has a somewhat different story to tell. Their story is one of expanded business opportunities; a desire to substitute domestically produced hardwood pulp for pulp imported from overseas; as well as meeting local and state environmental requirements (Kinhill Engineers 1990). Kinhill Engineers describes KCA's as a model approach to gaining public approval for expansion of industrial production -- at a time when many projects are held up or defeated on environmental grounds (Jenkins 1994).²³

Some industry technicians downplay Apcel's accomplishments, noting it is easier for tissue manufacturers to abandon chlorine use, than for producers of fine printing and writing papers. There is no question that KCA has made significant accomplishments, however, nor that subsequently they have done everything possible to recoup the "[AUD] \$500 million and thousands of hours ... spent over the past 10 years on making sure its manufacturing processes do not compromise the environment" (*Australian Women's Weekly* 1994; see also Kimberly-Clark Australia 1993).

Bathroom tissue packages marketed in 1994 in Australia under the Kleenex brand name contained advertising on the back regarding KCA's "chlorine-free" manufacturing process (see Figure 7). The company launched what Household Products General Manager, Mr. Simon Tregoning suggested was Australia's first cooperative environmental marketing campaign, with KCA and the Australian National Parks and Wildlife Federation teaming up to create and promote "National Rock Wallaby Month" (Burbury 1994a).

Place Figure 7 about here.

Figure 7. Back panel of bathroom tissue wrapper, Kimberly-Clark Australia, c. May 1994.

Environmentally-conscious Australian consumers, who had been purchasing increased amounts of off-brand recycled tissue products, were reportedly happy to give up "the environmentally responsible but scratchy" and foreign-sourced recycled tissue for KCA's soft, new, "chlorine-free" premium tissue:

To March 1994, the toilet paper market grew in volume by 5.5 per cent and in value by 4.6 per cent to become a A\$400 million market annually. Within it, branded products

grew 12.5 per cent in volume and 8 per cent in value, while generic products fell 14.4 per cent in volume and 8 per cent in value.

The premium segment of the market, dominated by Kimberly-Clark's Kleenex brand and Bowater's Sorbent, now accounts for 40 per cent of market volume and 50 per cent of value. (Burbury 1994b)

Price also was significant. The same report suggests that "It all changed in 1992 when Kimberly-Clark and Bowater reduced their prices by about 15 per cent - but also reduced the size of each roll by 7 per cent - which helped drag volume from generic to premium brands" (Burbury 1994b).

*NPMRP*²⁴

Founded in 1989, the National Pulp Mills Research Program's direct links to the Wesley Vale affair are explicitly documented in a 12-minute videotaped history, *The Mills of Tomorrow*, which opens with a scene from a Wesley Vale protest rally (NPMRP 1993). The NPMRP was funded by both the Commonwealth of Australia and industry, and was overseen by a "National Pulp Mills Research Board," made up of representatives from government, industry, and the public. It was managed by the CSIRO.

In its five year history, the NPMRP supported dozens of research projects, in two broad areas: developing environmental impact assessment techniques suited to Australia's particular marine environments, and modifying elementally and totally chlorine free (ECF and TCF) pulping techniques, developed for Northern hemisphere softwoods, for use with Australian hardwoods.

Among the program's first assignments was to assess the global "state-of-the-art" with regard to pulp mill environmental technology and regulation. Some staff members had participated in an earlier fact-finding trip to Sweden, Finland, and Canada, reported on in (Fandry et al. 1989). To further these observations, the NPMRP assembled experts from around the world in an "International Conference on Bleached Kraft Pulp Mill Technology" in Melbourne, in 1991 (see (NPMRP 1991).

NPMRP research was conducted in public and private institutions. CSIRO's Division of Oceanography developed sophisticated, computer-based techniques for modeling ocean currents and projecting dispersion of ocean-discharged effluent (cf. Pearce 1992). This work was complemented by CSIRO's Division of Coal and Energy Technology's work on techniques for using algae as a biological indicator of effluent toxicity (Stauber et al. 1994). Pulping research was carried out in CSIRO's Forest Products Division; at the Australian Pulp and Paper Institute, at Monash University; at other Australian universities; and at Amcor's Research and Technology Centre.

Findings were presented at a "national forum on bleached eucalypt kraft pulp mills in Australia"; published in a series of technical reports; and summarized in a draft report to

the Minister for Industry, Science and Technology (cf. NPMRP 1994; Nelson 1994; Pulp and Paper Research Advisory Board 1995).²⁵

Some NPMRP research results have yet to be implemented, as no new bleached kraft mills have been built in Australia since the Wesley Vale controversy. Other findings were immediately useful, however, in reducing elemental chlorine use in today's pulp mills. And Australia is well-prepared to estimate environmental impacts of any newly proposed mill.²⁶

Conclusion

On the surface, each story of eliminating chlorine use in Australia's pulp and paper industry is unique -- related to its particular operations, social and physical environments, and products:

ANM officials saw the use of chlorine at their Boyer mill necessary to their production of newsprint only so long as they depended on old-growth eucalyptus for their primary feedstock. Once "new ways of achieving the same paper properties became available, it was a fairly simple decision to cease manufacture of groundwood pulp" (Richardson 1994). The economic, political, and environmental advantages of discontinuing use of old-growth eucalyptus, the 300-person billet mill operation, mercury cell production of chlorine, and use of chlorine in pulping and bleaching were so overwhelming that ANM officials did not even feel a need to conduct a feasibility study -- they just authorized and funded mill officials to make the changes. ANM's decision-making was conducted in dialog with environmentalists, and under notice from the State of Tasmania that the mill's grandfathered exemptions to the 1974 Environment Act would soon be ended.

Amcor's Maryvale complex is unique in the environmental, regulatory, and social context in which it operates. Its liquid wastes follow two separate processing routes, and are combined with agricultural and human wastes, to be processed in the Latrobe Valley Water and Sewage Board system. It is the largest manufacturer of virgin pulp operating in the Victoria, under state forestry and environmental regulations; and under the oversight of -- and not infrequently, direct confrontation with -- some of Australia's most active environmentalists. As the Australian pulp and paper manufacturer most dependent on native hardwood forests, Amcor has the most to lose from falling behind on the environmental front.

KCA/Apcel was losing market share as a result of successful consumer-oriented environmental campaigns; and was the target of direct action by environmentalists for contributing to the pollution of Lake Bonney and ocean crayfishing grounds. Under the political and environmental conditions in which it operated, KCA/Apcel could expand operations only by concomitantly improving its environmental performance. KCA was fortunate that their product and production process allowed them to discontinue chlorine use relatively inexpensively; and that having chlorine-free products gave them a valuable marketing edge.

The NPMRP was established, in part, as a result of successful entrepreneurial efforts by managers of CSIRO's Division of Forest Products. The Research Project was a much appreciated financial boost for the Division, at a time of sharp economic downturn in Australia, of growing influence of economic rationalism and government downsizing, and pressures to put CSIRO on a more "self-supporting," i.e. commercial, footing.

Yet there are similarities as well as differences between these cases. All of them occurred within a few years of each other, shortly after the Wesley Vale affair; under common conditions of weak national environmental regulations, a strong environmental movement, and a society with a strong, social-democratic, corporatist tradition.

Environmentalists' role

None of the abovementioned changes would have happened without active encouragement from environmental forces. Not one, but two, generalized campaigns focused on the pulp and paper industry in Australia at this time: Greenpeace's pulp and paper campaign, focused on elimination of chlorine; and the preservationist campaign against the industry's continued use of native forests. In all cases, support from governmental as well as nongovernmental actors also played an important role, as did cooperation by industry officials, researchers, and managers. Australian environmentalists, government regulators, research scientists, and industry officials all benefited from years of efforts by European and North American counterparts.

Environmentalists influenced innovation in environmental technology in Australia's pulp and paper industry through multiple avenues; this was an important strength of their efforts. Tactics included coalition-building, direct action, lobbying governmental agencies, consumer education, women's campaigns, and international networking. Environmentalists made valuable use of their electoral influence. Other contextual factors helped as well.

Tactics

Several strands of environmentalism combined successfully in Australian pulp mill politics. Highly educated rural residents provided the first spark at Wesley Vale, drawing together local stakeholders whose livelihoods were threatened by industrial pollution and middle-class, urban nature-lovers. Sympathetic natural scientists, research engineers, government regulators, and even industry officials provided the technical expertise and institutional influence to legitimate concerns, and to develop technical research programs to address those concerns.

Greenpeace's Australia branch and international affiliates played an indispensable role in many arenas: Greenpeace scientists raised "hard science" questions about toxicity of pulp mill discharges. Direct action, such as at the KCA Millicent mill, helped Greenpeace keep the issues in the news even after the Wesley Vale affair had receded

from the front pages. Greenpeace contacts with environmentally advanced Nordic pulp manufacturers provided demonstrable evidence that pulp mills did not need to use chlorine to produce bleached white paper. Greenpeace's activist contacts around the world were able to share experience from their campaigns.

With some 90 per cent of its 16 million people in six cities, Australia has one of the most urbanized populations of any country in the world. Its consumers are ideally situated for consumer education campaigns. As mentioned in the Kimberly-Clark case, above, "green" environmental values have been proven to have substantial influence in Australians' personal consumption habits. Greenpeace made effective use of these factors in bringing women's environmental activists from the UK on a tour of Australia to talk about their concerns about the health impact on women and children of residual toxins from chlorine contained in women's sanitary products and paper diapers (nappies).²⁷

The environmentalists' hand was strengthened considerably by having sympathizers in Australia's regulatory and scientific communities. Promoting itself as "the smart country," Australia attempts to position itself as a regional leader in science and technology. In fact, it has one of the most educated publics in the world, and devotes considerable resources to developing its scientific and technical human resource base.

Even the pulp and paper industry is not monolithic. One pulp official I talked to suggested that "some of our harshest critics are inside our own company." Environmental issues have been one of the top topics in recent years in the annual meetings of the Australia-New Zealand Pulp and Paper Industry Technical Association (APPITA), with researchers from both public and private institutions reporting findings and addressing issues.

In the late 1980s and early 1990s, Australia did not have a uniform national environmental code. The ministerial task force which preceded the NPMRP helped Australia move towards that, however, with the writing of "National Bleached Kraft Mill Guidelines" (Australia. Departments of Industry 1989). Those guidelines set a benchmark not only for new mills, but also for already-operating mills, and for governments of Australia's six states.

The National Bleached Kraft Mill Guidelines served as a tool for environmentalists, regulators, and industry officials alike to measure and work for the improvement of current pulp mill environmental performance. Though often not seeing eye-to-eye, representatives of these groups did effect change together, through discussion, debate, and even confrontation in a variety of formal and informal institutional forums.

Little of this was accomplished via litigation. Unlike the USA, Australia's legal system does not encourage a plethora of individual and class action law suits. What Australia has in lieu of "litigant power," is a structure of *political* power and influence whereupon environmentalists wield considerable regulatory as well as electoral influence.

Political influence

The structure of politics in Australia contributed to environmentalists' ability to influence government policy and industry practices. In the early 1990s, the balance of power between the two dominant political parties, the ALP and the Liberal Party, rested on the delicate balance of just a few urban voting districts. Environmental issues, drawing out the "green vote," were a decisive factor in ALP victories. Environmentalists thus had substantial (though not uncontested) influence within the ALP.

Environmentalists' importance in "government-making" in these years was underscored by victories of Green Party candidates in national elections; and the growing strength of Green-Independents in Tasmania. Just a few Green Party senators were able to hold up the 1994-95 national budget-making process until the ALP met some of their budgetary demands. The Australian Democrats, another small national party, also has taken quite strong stands on environmental issues, including those related to the pulp industry.

Environmentalists' political strength is indicated financially, as well as electorally. In 1990-91, the Commonwealth government gave a total of AUD \$1,295,000 in direct grants to environmental organizations, including those listed in Table 1; in addition, the Australian Conservation Foundation (ACF) and World Wildlife Fund for Nature (WWFN), received AUD \$800,000 "to enable them to participate in consultations on ecologically sustainable development" (Papadakis 1993, 118).

Australian Conservation Foundation	AUD \$175,631
Keep Australia Beautiful Council	68,783
The Wilderness Society	54,481
World Wildlife Fund for Nature	50,000
Friends of the Earth	15,748

Table 1. Selected federal grants to voluntary conservation organizations, Australia, 1990-91 (Department of the Arts, Sport, the Environment, Tourism, and Territories, in Papadakis, *Ibid.*).

Environmentalists have been incorporated effectively, if incompletely, into the structure of governance in Australia. This corporatist environmentalism is reflected also in the plethora of government-sponsored commissions and working groups, including representatives of government, industry, labor, community, and environmentalists.

This does not apply equally to all Australian environmental organizations. Even the ACF, the organization most closely aligned with the ALP, retains an independent streak, such as when it resumed sit-down strikes against logging of "environmentally sensitive areas" in 1994, and threatened to abandon the ALP electorally. Greenpeace is among the least involved in corporatist bodies of Australia's major environmental organizations;

although it does engage in bilateral negotiations with industry, government, and research officials.

Other factors

Timing was in environmentalists' favor. Coming soon on the heels of European and North American campaigns against pulp industry pollution, and after positive government and industry response to those campaigns, activists in Australia had other examples to point to, and other experience to draw from in their efforts.

Australia's unique flora and fauna, and fragile ecology is another part of what makes environmental politics so salient. Australia is the driest continent on the planet; and untouched by the last ice age, has species with biological lineages of millions of years. Australia's forests grow on no more than nine per cent of the continent (Carron 1985; Dargavel 1995), especially coastal areas, where most people also live. Environmentalism draws strength also from Australia's social landscape, including well-developed science education and institutions; an alienating, highly-urbanized lifestyle; and a rebellious, social democratic heritage.

Fifty years ago, transportation and communication to Australia from Europe and North America was cumbersome and expensive. Not so today, as Australia boasts regular airline connections and advanced telecommunications systems. These links proved to be very useful in activists' pulp mill campaigns. Technical developments in Europe, or political developments in North America were "telegraphed" by facsimile or other means almost immediately to Australia. Industry officials remarked, for instance, that in the Wesley Vale affair, the one thing they were unable to counter was environmentalists uncanny ability to know about these developments and bring them into the discussion, often times even before they did themselves.

All told, environmentalists have wielded considerable influence over innovation in environmental technology in the Australian pulp and paper industry, even while living and working in conditions "not entirely of their choosing." The social forces, commissions, projects, and reports put into play in the course and aftermath of the Wesley Vale controversy have developed into an increasingly "green" manufacturing culture, which, while not hard-cast into law, nevertheless has been irrevocably set into place for all Australian pulp and paper manufacturing operations. The Ghost of Wesley Vale.

Notes

¹Bowater's Australian operations were recently purchased by Carter Holt Harvey (CHH), New Zealand's largest pulp and paper manufacturer, itself currently being taken over by USA papermaking giant, International Paper (*Appita Journal* 1994; 1995b; 1995a; Koncel 1992; Orgill 1995; Turner 1994).

²I calculate "effective consumption of pulp" as the net domestic consumption of virgin pulp, plus net imports of paper and paperboard; or more precisely:

$$EFFECTIVE CONSUMPTION = (P1 + I1 - E1) + (I2 - E2)$$

where:

E1 = pulp exports
 E2 = paper and paperboard exports
 I1 = pulp imports
 I2 = paper and paperboard imports
 P1 = pulp production

Woodchip export figures are for fiscal years ending in the captioned years; e.g. the statistic for "1981" is 1980-81.

³Here, "imports" includes pulp imports and net paper and paper board imports; "pulp and paper products," is the combined sum of paper and paperboard production, net imports of paper and paperboard, and pulp exports, or more formally:

$$\begin{aligned} P\&P PRODUCTS &= VIRGIN PULP + RECYCLED PULP + P\&P IMPORTS \\ &= [(P1)] + [(P2 + E1) - (P1) - (I1)] + [(I1) + (I2 - E2)] \\ &= (P1) + (P2 + E1) - (P1) - (I1) + (I1) + (I2 - E2) \\ &= [(P1) - (P1)] + [(I1) - (I1)] + (P2 + E1) + (I2 - E2) \\ &= (P2) + (I2 - E2) + (E1) \end{aligned}$$

where

$$\begin{aligned} VIRGIN PULP &= (P1) \\ RECYCLED PULP &= (P2 + E1) - (P1) - (I1) \\ IMPORTS &= (I1) + (I2 - E2) \end{aligned}$$

and where

E1 = pulp exports
 E2 = paper and paperboard exports
 I1 = pulp imports
 I2 = paper and paperboard imports

 P1 = pulp production
 P2 = paper and paperboard production

⁴Amcor purchased APPM in November 1993. Including KCA, Amcor now produces about 70 per cent of all virgin pulp in Australia.

⁵This section is based in part on interviews with the Hon. Christine Milne, Devonport, Tasmania, March 21, 1994; and Robert Cartmel, Greenpeace Australia, Sydney, May 18, 1994.

⁶In 1992, Noranda Forest was Canada's largest forest industry company, with sales of CAN \$4.5 billion, CAN \$1.5 billion greater than its closest "competitor," MacMillan Bloedel, at the time owned 49% by Noranda (Simon 1993).

⁷NBH became North Broken Hill Peko Ltd. in 1988, following its acquisition of Peko Wallsend (Dargavel 1989).

⁸On many matters, including economic development and environmental regulations, Australian states have traditionally and constitutionally had a great degree of autonomy. The Commonwealth had a constitutional right to intervene in the Wesley Vale case, however, due to the participation of a foreign-owned company - Noranda -- in the venture.

⁹NBH did not formally withdraw its proposal until two years later. Regulatory guidelines were clarified; state and Commonwealth governments proclaimed their willingness to see the project to fruition; however, market conditions changed, leaving NBH unable to find a new partner. In 1994, industry analysts suggested, only half-jokingly, that environmentalists had done NBH a huge favor, saving them from losses due to a steep global decline in pulp prices.

¹⁰Interviews, CSIRO Division of Forest Products, Melbourne, February 9, 1994.

¹¹Interview, Mr. Robert Cartmel, Greenpeace Australia, Sydney, May 18, 1994.

¹²Dr. Lucy Taksa, University of New South Wales, an expert on the strike, writes: "The [1992] dispute [at APPM's Burnie mill] was triggered when the Company decided to alter traditional award payments and conditions without referring ... them to the relevant unions. This unwillingness to negotiate with the unions was the main issue of the dispute, as far as the Australian labour movement was concerned. Up until March of that year combined union and management committees had been jointly negotiating on workplace reforms. These committees were disbanded by APPM" (Taksa 1995).

¹³NBH retains its Tasmania forestry and woodchipping operations, and does not rule out future pulp and paper manufacturing ventures. For Amcor, the APPM purchase was a return to domestic investment, the plum being APPM's domestic paper distribution networks, more than its neglected manufacturing operations. (News accounts.)

¹⁴This section is based in part on an interview in Boyer, Tasmania, on March 23, 1994, and subsequent correspondence with Dr. Des Richardson, ANM.

¹⁵Fletcher Challenge is "New Zealand's largest publicly traded corporation" (*Asia Paper* 1994). In 1991, the Employee Share Purchase Schemes, Pension Plan and Unit Trust held a 23.4 per cent interest in Fletcher Challenge (Australia. Resource Assessment Commission 1991). In 1991, Fletcher Challenge was 188th on *Fortune Magazine's* "Global 500" list; had assets of US \$15 billion, and operated in 20 countries - - "more ... than International Paper" (*International Papermaker* 1993). Even after cutbacks, in 1993, Fletcher Challenge was the world's second largest producer of newsprint, and fifth largest producer of market pulp.

¹⁶Air-dried metric tons per year.

¹⁷Data in this section are from interviews with Mr. Gordon Groth, Mr. J.R. "Angus" Pollock, and Mr. Jeff Landels, Australian Paper, Maryvale, May 10, 1994; and Bruce Allender, Amcor Research and Technology, Alphington, May 9, 1994.

¹⁸As of August 31, 1993, major Amcor shareholders included:

National Nominees Limited	(6.4%)
Westpac Custodian Nominees Limited	(5.9)
Australian Mutual Provident Society	(5.9)
ANZ Nominees Limited	(5.1)
State Authorities Superannuation Board	(4.5)
Queensland Investment Corporation	(2.8)
National Mutual Life Association	(2.1)
Chase Manhattan Nominees	(1.8)
MLC Life Limited	(1.8)

(Amcor 1993)

¹⁹Number in parentheses are annual production figures, in metric tons. Percentages are ownership, where less than 100 per cent.

²⁰An Amcor Research and Technology Centre engineer stated flatly, "we do what the environmentalists want us to do."

²¹... though, as of my site visit, in May 1994, had not yet dismantled ...

²²The Victoria Environmental Protection Agency's 1990 water discharge license for Maryvale permitted Amcor to discharge 1.0 kg of adsorbable organic halides (AOX) per air-dried metric ton (admt). Amcor averaged 0.75 kg AOX/admt during the year preceding my visit, and had targeted 0.5 kg AOX/admt by 1996. (Interview, Mr. Gordon Groth, Maryvale, May 10, 1994.)

²³Kinhill Engineers Pty Ltd wrote Apcel's Environmental Impact Assessment document and managed the new mill's regulatory application process.

²⁴Data in this section are from interviews with Ms. Kay Abel, CSIRO INRE Project Office, Canberra, June 20, 1994; and Drs. Warren Hewertson, Peter J. Nelson, and Geoffrey Gartside, all of the Division of Forest Products, CSIRO, Melbourne, February 9, 1994.

²⁵Technical reports and conference proceedings are available from the CSIRO INRE Projects Office, P.O. Box 225, Dickson, ACT 2602, Australia; fax +61 6 281 8473.

²⁶I asked NPMRP representatives about the possibility of CSIRO's making its pulp mill environmental impact modeling and assay technology available internationally. There was some interest, but also

hesitance to move precipitously in that direction. Staff members explained that part of the NPMRP's charter -- and funding -- came from the Australian pulp and paper industry. Divisional management did not want to do anything that might assist the Australian industry's competitors.

²⁷Interview, Mr. Robert Cartmel, Greenpeace Australia, Sydney, May 18, 1994.

References

- Abel, Kay M. 1994. "The National Pulp Mills Research Program: origin, direction, scope, development and future." in *National forum on bleached eucalypt kraft pulp mills in Australia*, CSIRO INRE Project Office, Canberra.
- Advocate, The*. 1989. "Burnie is a mill option." July 27, p. 6.
- Amcor. 1993. "1993 annual report." [annual report], South Melbourne.
- Amcor Research & Technology Centre. n.d. "Amcor R&T centres of excellence." [overhead slides] Alphington, Victoria.
- APM. 1959. "From water mill to industrial giant." Australian Paper Manufacturers Ltd., February.
- APM Maryvale Mill. 1991. "Waste water treatment program." [handout] March.
- APM Maryvale Mill. 1992. "Environmental statement - Maryvale mill." [handout] Maryvale, Victoria, August 28.
- APM Maryvale Mill. n.d. "Maryvale mill: part of the valley landscape." [pamphlet] Maryvale, Victoria.
- Appita Journal*. 1994. "Moves in ownership of CHH." 47 (4), July, p. 270.
- Appita Journal*. 1995a. "Carter Holt Harvey acquires Bowater Tissue." 48 (2), March, p. 95.
- Appita Journal*. 1995b. "Carter Holt Harvey: a new corporate identity." 48 (2), March, pp. 84-85.
- Asia Paper*. 1994. "Tasman moves ahead in the international arena." 9, Singapore, March, pp. 18-21.
- Australian Women's Weekly*. 1994. "National rock wallaby month." , July, p. 264.
- Burbury, Rochelle. 1994a. "Australia: Kleenex campaign for green consumer." *Reuter News Service*, July 16.
- Burbury, Rochelle. 1994b. "Australia: premium toilet paper makes a comeback." *Reuter News Service*, June 18.
- Carron, L.J. 1985. *A history of forestry in Australia*. Canberra: Australian National University Press.
- Chapman, Ralph J. K. 1992. *Setting agendas and defining problems: the Wesley Vale pulp mill proposal*. Geelong, Victoria: Centre for Applied Social Research, Deakin University.
- CSIRO. 1989. "CSIRO paper on the Wesley Vale pulp mill." Canberra, March 13.
- Dargavel, John. 1989. "The other Wesley Vale tales." *Australian Society* 11 (5), May, pp. 24-27.
- Dargavel, John. 1995. *Fashioning Australia's forests*. Sydney: Oxford University Press.
- Departments of Industry, Technology and Commerce; Arts, Sport, the Environment, Tourism and Territories; and Primary Industries and Energy; with assistance from CSIRO. 1989. "Pulp and paper industry package." Ministers Senator John Button, Senator Graham Richardson and Mr. John Kerin, Canberra, December.
- Economou, Nick. 1992. "Problems in environmental policy creation: Tasmania's Wesley Vale pulp mill dispute." Pp. 41-57 in *Australian Environmental Policy*, Ken Walker, ed. Kensington, NSW: New South Wales University Press.
- Fandry, C. B., R. E. Johannes, and P. J. Nelson. 1989. "Pulp mills: modern technology and environmental protection." Senator John Button, Minister for Industry, Technology and Commerce, June.
- FAO. 1993. "Forestry products data series." [via STARS database] United Nations. Food and Agriculture Organization, Rome, May.
- GHD-Cowan Lavalin. 1989. "Proposed light weight coated paper machine at Boyer." ANM, Hobart, November 29.
- Green, Roy. 1991. "Pulp mill guidelines and research program." Pp. 3-10 in *International conference on bleached kraft pulp mills: technical and environmental issues*, NPMRP, ed. Melbourne: CSIRO INRE Project Office.
- International Papermaker*. 1993. "Life after debt: the second coming of Fletcher Challenge." 56 (8), August, pp. 32-35.

- Jenkins, Bryan. 1994. "Pressures for achieving cleaner production." Paper presented at Economic Growth with Clean Production, Melbourne, Australia. CSIRO/UNIDO, 7-10 February.
- Johannes, R.E. 1989. "A note on the possible impact of the effluent from the proposed Wesley Vale pulp mill on the marine environment and fisheries in Bass Strait." . Department of Primary Industries and Energy, Canberra, February 15.
- Kimberly-Clark Australia. 1993. "Caring for the environment." [corporate brochure] Milsons Point, New South Wales, January.
- Kinhill Engineers Pty Ltd. 1990. "APCEL pulp mill redevelopment project: draft environmental impact statement." Adelaide, June.
- Kneebone, Philippa. 1989. "Lake Bonney environmental conflict." December.
- Koncel, Jerome A. 1992. "Growth through acquisitions: world's largest producer sees no boundaries to global business." *International Papermaker* 55 (1), November, pp. 22-25.
- LVWSB. n.d.-a. "Biological treatment at Dutson Downs." [fact sheet] Latrobe Valley Water and Sewerage Board, Traralgon, Victoria.
- LVWSB. n.d.-b. "The Board." [brochure] Latrobe Valley Water and Sewerage Board, Traralgon, Victoria.
- Miller-Freeman Publications. 1992. *International pulp & paper directory, 1992-93*. San Francisco.
- Milne, Christine. 1990. "Exposing the inadequacies of ad hoc decision-making." *Canberra Bulletin of Public Administration* (62), October, pp. 84-89.
- Nelson, Peter J. 1994. "Dioxin measurements in relation to the Australian pulp and paper industry." Technical Report Series, No. 6, National Pulp Mills Research Program. CSIRO INRE Project Office, Canberra, August.
- NPMRP. 1991. *International conference on bleached kraft pulp mills: technical and environmental issues*. Proceedings, Melbourne, February 4-7. CSIRO INRE Project Office, Canberra.
- NPMRP. 1993. "The mills of tomorrow" [film]. VHS, 12 min 36 sec. CSIRO Information Services, East Melbourne.
- NPMRP. 1994. *National forum on bleached eucalypt kraft pulp mills in Australia*. Proceedings, Melbourne, October 4-6. CSIRO INRE Project Office, Canberra.
- Orgill, Brian. 1995. "Carter Holt Harvey to increase exposure in Australia." *Tappi Journal* 78 (2), February, p. 30.
- Papadakis, Elim. 1993. *Politics and the environment: the Australian experience*. St. Leonards, NSW: Allen & Unwin.
- Pearce, Alan. 1992. "Review of oceanographic processes off the southwestern coast of Western Australia." Technical Report Series, No. 1. . National Pulp Mills Research Program, Dickson, ACT, Australia, December 18.
- Pulp and Paper Research Advisory Board. 1995. "Advice on updating the technical aspects of the Commonwealth Government environmental guidelines for new BEK mills." DRAFT edition. Senator Cook, Minister for Industry, Science and Technology, Canberra, January 31.
- Resource Assessment Commission. 1991. "Corporate linkages in the Australian wood & wood products industry." H.A. Simons Ltd. and Toronto Dominion Australia Ltd. Forest and Timber Inquiry Consultancy Series, No. FTC91/15. Canberra, June.
- Richardson, Des. 1994. Personal communication, April 18.
- Sanders, Norm. 1989a. "Democrats renew call for pulp mill enquiry." [media release] Canberra, October 26.
- Sanders, Norm. 1989b. "Democrats welcome opposition support for pulp mill inquiry." [media release] Canberra, March 22.
- Sanders, Norm. 1989c. "Pulp mill enquiry move by Democrats." [media release] Canberra, March 9.
- Sanders, Norm. 1989d. "Sanders calls for pulp enquiry support." [media release] Canberra, February 23.
- Sanders, Norm, John Coulter, and Janet Powell. 1989. "Democrats call for Senate pulp mill enquiry." [media release], Canberra, February 22.
- Simon, Bernard. 1993. "Bureaucrats test Japanese patience: problems of, and opportunities for, foreign investors [in Canada's forest products sector]." *Financial Times* [London], May 7, pp. IV-3.
- Sinclair, E.K. 1990. *The spreading tree: a history of APM and Amcor, 1844-1989*. Sydney: Allen & Unwin.

- Sonnenfeld, David A. 1996 (forthcoming). "Conflict and innovation: social movements' influence on adoption of environmental technology in the pulp and paper industries of Southeast Asia and Australia." Ph.D. Thesis, University of California, Santa Cruz, Sociology.
- Stauber, Jennifer L., *et al.* 1994. "Algae as indicators of toxicity of the effluent from bleached eucalypt kraft pulp mills." Technical Report Series, No. 3. National Pulp Mills Research Program. CSIRO INRE Project Office, Canberra, May.
- Streeting, Mark and David Imber. 1991. "The pricing of Australian woodchip exports." Research Paper No. 4, Resource Assessment Commission. Australian Government Publishing Service, Canberra, September.
- Taksa, Lucy. 1995. Personal communication, November 15.
- Turner, Clare. 1994. "Slim-line CHH." *World Paper* 219 (1). Benn, Tonbridge, Kent, UK, January, pp. 22-23.
- Young, Leith and Marie McNamara. 1989. "Government seeks buyers for 'off-white' paper." *Age* [Melbourne], May 9, p. 10.

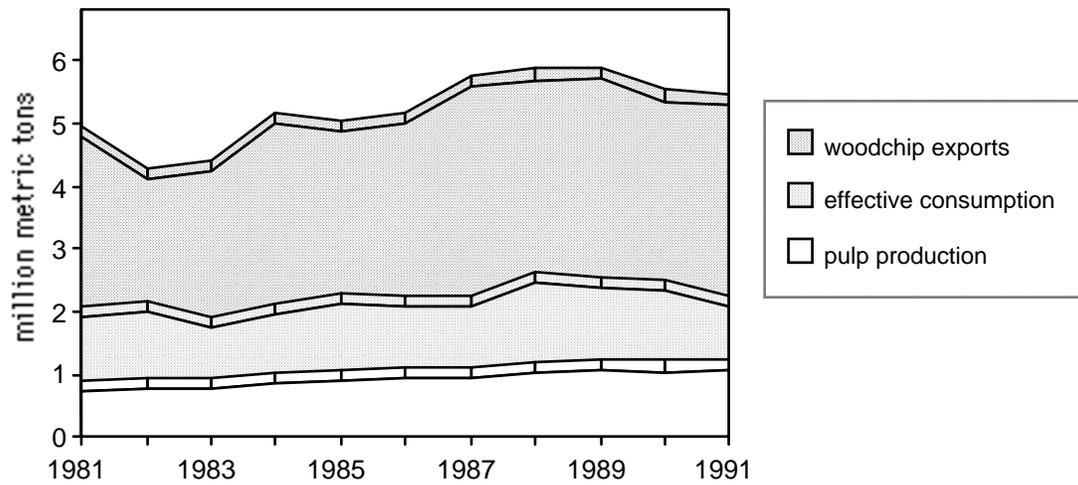


Figure 1. Australia: pulp production, effective consumption of pulp, and woodchip exports, 1980-91.

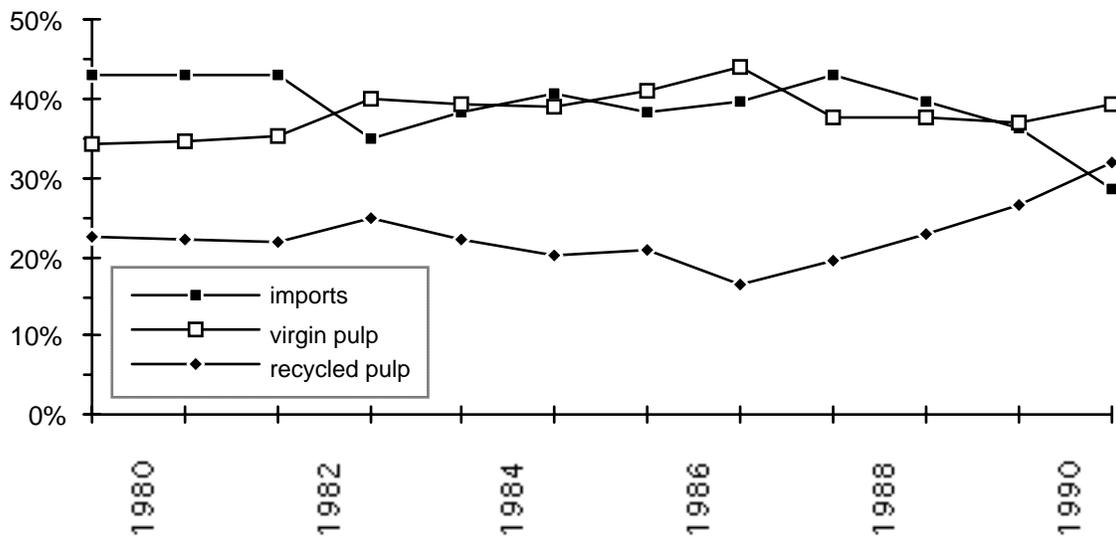


Figure 2. Australia: source and relative composition of raw material inputs in pulp and paper products, 1980-91.

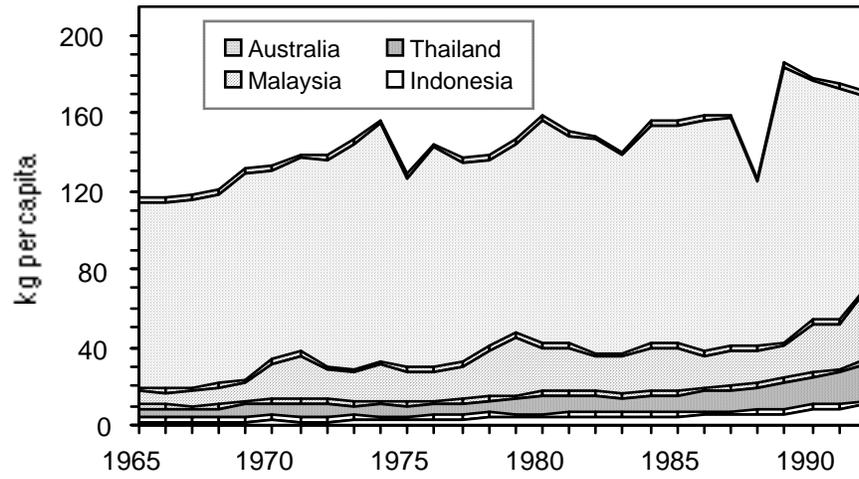


Figure 3. Australia, Malaysia, Thailand, and Indonesia: per capita paper and paperboard consumption, 1965-1992.

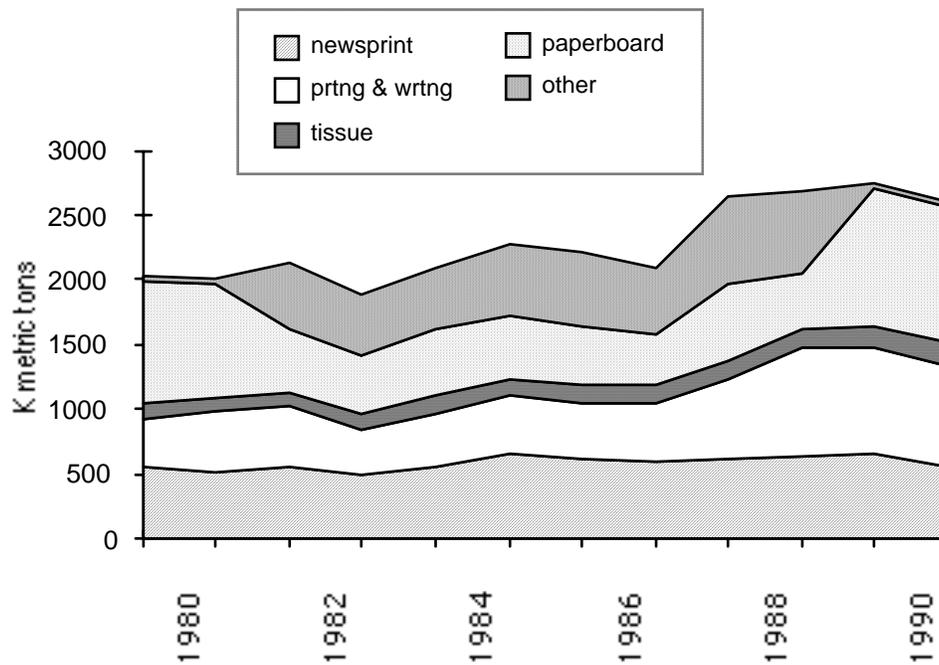


Figure 4. Australia: consumption of paper and paperboard, by product type, 1980-91.

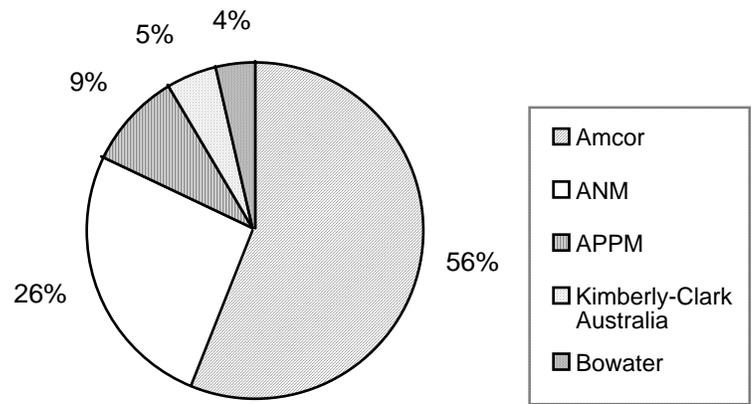


Figure 5. Australia: company share of virgin pulp production, 1992.

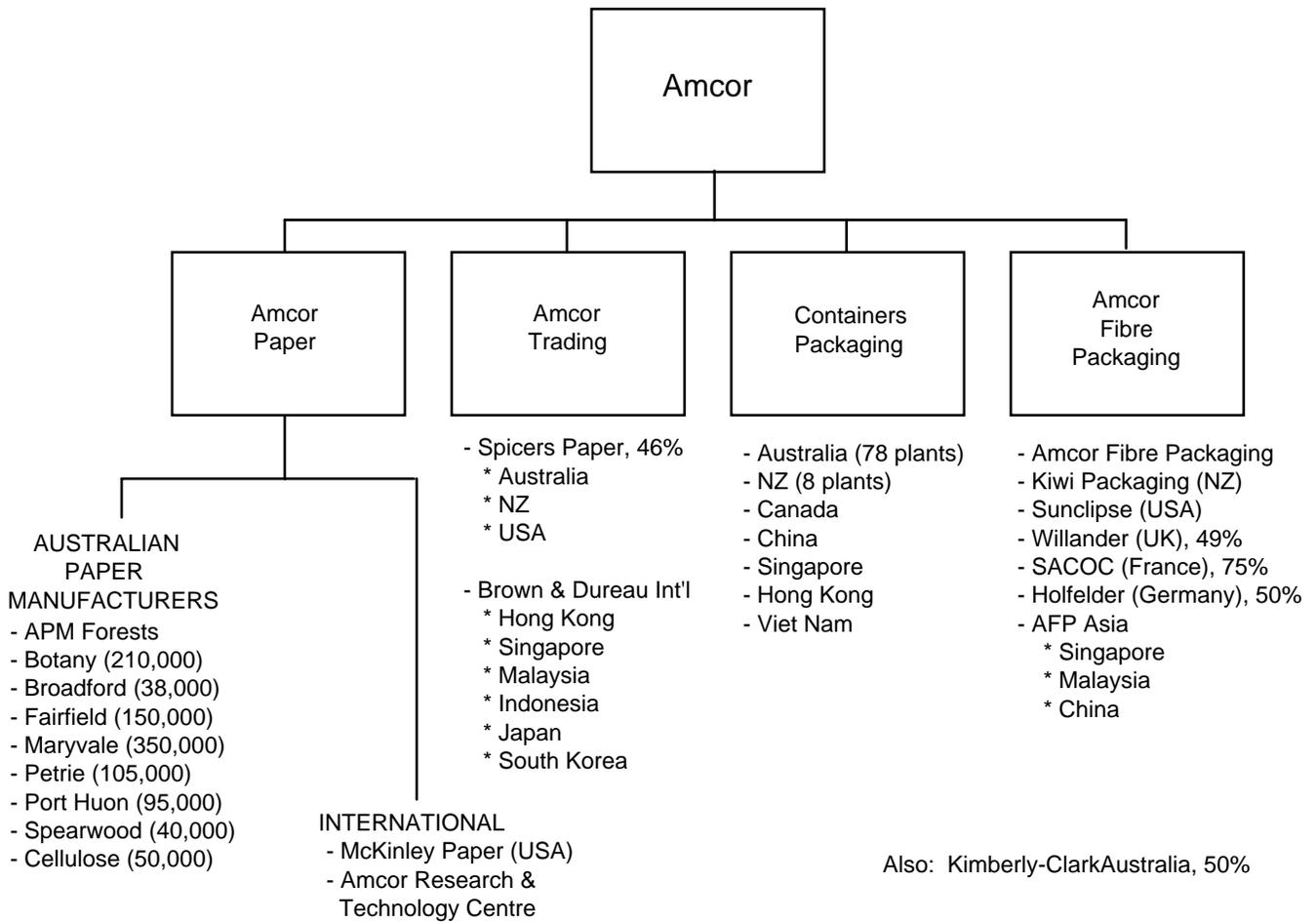


Figure 6. Amcor corporate structure, late 1980s/early 1990s.