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One Engineer and a Dog: Technological Change and Social Restructuring in Alabama's Pulp and Paper Industry*

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ABSTRACT We apply a commodity systems analysis to examine a series of changes that are transforming Alabama's pulp and paper industry. Alabama is a critical area for investigation because it lies at the heart of North America's principle pulp and paper production zone. Industry restructuring is a complex process involving the reorganization of capital and corporate ownership, as well as changes in technologies, which affect the labor process. For example, a recent spate of corporate mergers has resulted in concentration of mill ownership and has accelerated the prevalence of sub-contracting. Indeed, the expansion of sub-contracting into new realms raises the fundamental question of what constitutes a core activity in this capital-intensive industry. The consolidation process has not proceeded in a unidirectional manner, however. For example, some corporations have expanded investments in forest land, while other firms have actively sought to divest themselves of direct ownership of such land, freeing capital for investment elsewhere. Placing Alabama mills in a broader regional context, we examine a set of environmental and economic pressures within the commodity system that have led to these changes.

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"One engineer and a dog" is a phrase used by a senior employee of a major pulp and paper mill to describe the workforce needed to run pulp and paper mills of the future. He went on to explain that the dog's role was to bite the engineer if he tried to do anything to alter the highly automated process. This image is fanciful but reflects the direction of technological change in this important sector of the rural South. In considering the restructuring of industry and society in the South, technological change is but the tip of the iceberg, though important in itself because displacement of labor by capital has significant social repercussions in areas experiencing job loss even as production increases. Our primary objective in this paper, however, is to specify the changes taking place in the organization of the industry and to uncover the causal forces that have been pushing this restructuring, rather than focus on its social impact. In particular, we draw attention to processes of consolidation and reorganization of work taking place in the context of market pressures and changing environmental policies. This work is part of a larger research project in which we apply a commodity systems approach to analyze Alabama's pulp and paper industry (Bailey, Dubois and Sinclair 2000). We extend our earlier work on this industry (Bailey et al. 1996) by sketching this consolidation and restructuring process with the help of a conceptual framework that points to interconnections among companies, labor, states, relevant social groups, and the physical environment.

In an earlier paper (Bailey, Sinclair and Bliss 1998) we adopted the concept of commodity chain to analyze the pulp and paper industry. This concept has some advantages in that it links macro and micro or global and local levels of analysis, points to nodes of action that are connected, suggests the importance of points of stress (such as where information flow is critical), permits comparison across commodities and time, and may direct attention to strategies for change. The commodity chain approach has been applied fruitfully to the analysis of various foods, textiles, clothing, and automobiles (Burch and Goss 1999; Gereffi and Korzeniewicz 1994; Le Heron and Roche 1999; Talbot 1997). McMichael (2000:xxxii) sees these commodity chains as networks of exchange that link stages of production from raw material to final product. Thus:

The chain metaphor illuminates the interconnections among producing communities dispersed across the world, and it allows us to understand that when we consume a final product in a commodity chain, we participate in a global process that links us to a variety of places, people, and resources. (McMichael 2000:xxxii)

Despite its advantages, we believe the commodity chain metaphor is limited because it implies that units in the chain are successive links, one following the other, but often this is not the case. Instead, multiple inputs from different sources are required at different stages of production and distribution. Thus a paper mill requires inputs of fiber, labor, chemicals, energy, and machinery, which come from different sources and often over a wide variety of distances. Each of these inputs has its own additional backward links. Consequently, we prefer the term commodity system to capture what we mean. Like the chain concept, the commodity system points us to consider the production process as a series of inputs, transformations, and outputs.

The commodity system may be understood as a network with core nodes and diverse links in which changes in any component call for changes in others. We assume the kind of system we are discussing is dynamic and does not tend toward a steady state. Moreover, the system functions in both socio-economic and natural environments that condition what actors in the system can do and on which their actions have significant impacts. In this paper we focus on how pressures from the political and economic environment of the pulp and paper industry have pushed corporate decisions makers to change how the commodity system operates in Alabama. Of course, the industry itself is a significant political and economic force and thus we do not wish to imply that it is helplessly shaped by that environment.

We develop our analysis, first, by briefly describing the social importance and physical characteristics of the pulp and paper industry, in particular its ecological impact. This leads to a consideration of environmental pressures as a stimulus to technological change and restructuring. Next we focus on the wider economic forces that have been driving changes in the commodity system.

Then we review the processes of corporate consolidation and the associated restructuring of the supply of labor and fiber. We conclude with some speculative comments on the impacts of these changes on rural Alabama.

The Socioeconomic Significance of the Pulp and Paper Industry

The implications of restructuring in the pulp and paper industry are particularly significant in the southeastern United States, which contributed nearly three-quarters of national pulpwood harvests in 1996 (Table 1). Within the region, over 40 percent of all timber harvested is pulpwood (Table 2). Alabama is an especially critical area for investigation because it lies at the heart of North America's principle pulp and paper production zone (Johnson 2001). In the 1990s, sixteen pulp and paper mills operated in Alabama, but recently, two mills in Mobile closed. Most of the remaining mills operate in rural areas and represent the most important source of scarce high-wage employment.

Using 1990 data, Howze, Bailey and Bliss (1994) found that 18 out of 31 rural non-metropolitan counties in Alabama could be classified as timber dependent (defined as 25 percent or more of manufacturing employment in forest-based industries). By 1996, timber dependency had increased from 18 to 24 of these rural non-metropolitan counties (Robinson, Howze and Norton 2000). The pulp and paper industry is the single largest contributor to this dependency, representing the most important market for timber owned by the many thousands of non-industrial private forest landowners in the state and region. Two-thirds of Alabama is forested, and over 60 percent of this total is owned by private individuals (Bliss, Sisock and Birch 1998). Both directly and indirectly (i.e., through mill jobs and in associated activities such as logging and driving log trucks), the pulp and paper industry is a major source of employment. In rural Alabama, pulp and paper mills are often the only place where high wages and attractive benefits are available (Bailey et al. 1996). Clearly changes that affect how this industry does business are likely to have significant impacts in rural Alabama.

Table 1. Volume of Roundwood Products by Region and Type of Product, million cubic feet, 1996.

Region	Total Roundwood	Percent U.S. Total	Pulpwood	Percent U.S. Total
South	9,592.8	58.4	3,894.0	74.3
Northeast	1,772.4	10.8	523.9	10.0
North-Central	1,736.6	10.6	739.2	14.1
Rocky Mt	687.7	4.2	26.2	0.5
Pacific Coast	2,641.5	16.1	59.4	1.1

Source: Johnson (2001).

Table 2. Volume of Roundwood Products by Product Type in the South, in million cubic feet, 1996.

Product	Volume	Percent
Saw logs	3,680.7	38.4
Veneer logs	825.0	8.6
Pulpwood	3,894.0	40.6
All other	1,193.1	12.4

Source: Johnson (2001).

Pulp and Paper's Ecological Footprint

Pulp and paper mills are physically imposing, representing enormous capital investments made by such well known corporations as International Paper, Weyerhaeuser, Boise-Cascade, and Georgia-Pacific. Capital investments for physical plant alone often exceed \$1 billion, and many pulp and paper corporations also operate parallel land management units which own hundred thousands of acres. Indeed, the pulp and paper sector is more capital-intensive than any other manufacturing sector in the U.S. economy (M. Smith 1997).

Processing logs into pulp and pulp into paper involves a long sequence of mechanical, chemical, and thermal activities, the exact nature of which will vary from mill to mill depending on their product mix (M. Smith 1997). The purpose of these activities is to transform wood into strands of fiber with the required characteristics of strength and color (or lack thereof). Various

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products are manufactured in the region's pulp and paper mills, including high quality white paper, filler material for disposable diapers, packaging materials for retail marketing, and corrugated materials for boxes. In addition, many mills produce market pulp, the raw material of paper making which is sold to other mills. Each product entails a different production system involving different chemical compounds.

Notwithstanding this diversity, the pulping component of most integrated (pulp and paper) mills involves the production of bleached pulp. All but three mills in Alabama produce pulp through the "kraft" process where water, wood chips, sodium hydroxide, and sodium sulfide are mixed in a heated pressurized vessel called a digester (M. Smith 1997). The end product of this chemical process is strong-fiber wood pulp the color of a brown paper shopping bag. Chemicals used in the digester are recovered and reused in an elaborate system that accounts for a large share of the substantial capital outlay of a pulp mill. The process of kraft pulp production forms and releases various gases, including sulfur compounds, which produce the characteristic rotted eggs odor of a pulp mill. Besides their noxious odor, some of these stack emissions, including hydrogen sulfide, are toxic. Nitric and sulfuric acids, along with carbon dioxide and other by-products of high temperature combustion, also are emitted in large quantities (M. Smith 1997).

Alabama's mills are prodigious consumers of raw materials in the form of water and fiber, as well as of energy and industrial chemicals used in the process of converting pulpwood to paper products. Pulp and paper mills run continuously, 24 hours a day and 7 days a week, with minimal downtime. On average, Alabama's pulp and paper mills consume 25 million gallons of water each day (Table 3), indicating one very good reason why mills tend to be located along rivers. Until the late 1990s, most bleached products were produced through the use of elemental chlorine, a significant source of environmental concern due to the generation of dioxins and other chemical compounds (M. Smith 1997).

Pulp and paper mills have significant impacts on forest resources. One of the most dramatic changes has been the increase in loblolly pine monocultures, especially in the southern half of Alabama, to supply these mills. The procurement radius of most mills varies from season to season. Due to transportation costs,

Table 3. Selected Characteristics of Major Pulp and Paper Mills in Alabama

Mill	Primary Products	Daily Production (tons)	Daily Water Consumption (million gal.)
Alabama Pine Pulp	Bleached softwood kraft market pulp	1,250	n.a.
Alabama River Newsprint	Newsprint (up to 40 percent recycled)	680	5
Alabama River Pulp	Bleached hardwood kraft market pulp	1,150	20
Boise Cascade	Bond, book & writing papers	1,300	20
Bowater	Newsprint (40 percent recycled), pulp	1,500	36
Fort James	Napkin, toilet, tissue, toweling, cup stock, food board, packaging	1,100	45
Gulf States Paper	Coated and uncoated papers, packaging board, bleached kraft market pulp	950	20
International Paper Courtland	Writing papers, envelopes, printing papers, bleached hardwood pulp	2,670	55
Prattville	Kraft linerboard	2,660	23.7
Selma	Printing paper, bleached market kraft pulp	2,240	22
MeadWestvaco Cottonton	Containerboard, coated unbleached	2,600	20
Stevenson	Recycled corrugating medium	500	0.3
Smurfit-Stone Container	Clay-coated and uncoated SBS packaging, unbleached kraft linerboard	1,500	36
Weyerhaeuser	Unbleached kraft linerboard (25 percent recycled), semi-chemical corrugated medium	2,100	20

Source: Lockwood-Post (2000).

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most mills prefer obtaining fiber from a radius of 50 miles or less, though during rainy weather when working in the woods becomes difficult, some timber procurement officers report they have had logs trucked in from 125 or more miles from the plant. In addition, some companies have greatly expanded their procurement radius by establishing satellite chip mills linked to their main mill by rail or truck. Table 4 demonstrates that the ecological footprint of Alabama pulp and paper mills extends well beyond state borders, with net imports from surrounding states of approximately 78 million cubic feet of pulpwood (9.3 percent of fiber used in Alabama's mills) during 1997.

Clearly the pulp and paper industry is critical to social and economic life and to the condition of the environment of rural Alabama. It is thus no surprise that environmental regulations have been a source of great contention between the industry, governments, and citizen groups. In the following section we review the impact of this process on the functioning of the pulp and paper industry.

The Restructuring Impact of Environmental Issues

A major source for change in the pulp and paper industry is the growing concern about its impact on the environment and human health. Referring to our systems approach, the connection between mills and state regulatory agencies has become critical. For the United States as a whole, political pressure from environmental organizations and ultimately from state and federal regulatory agencies has played a significant role in technological change.

However, change in response to environmental problems caused by the pulp and paper industry has taken place in Alabama only after great resistance. The federal Environmental Protection Agency (EPA) has delegated enforcement of key federal environmental regulations (e.g., Clean Air and Clean Water Acts) to the Alabama Department of Environmental Management (ADEM). Functioning as part of a government anxious to be attractive to business, ADEM has been permissive and accommodating in matters of compliance (Bailey et al. 1998). The example of dioxin, a highly toxic by-product of the bleaching process, is instructive.

Table 4. Pulpwood Volume by Destination, Source and Species Group, Alabama, 1997 (in thousand cubic feet).			
Destination and Source	All species (total)	Softwoods	Hardwoods
<i>Alabama (retained)</i>	633,933	365,494	268,439
Exports to:			
Arkansas	306	2	304
Florida	31,681	19,690	11,991
Georgia	52,791	46,142	6,649
Louisiana	576	574	2
Mississippi	20,240	14,345	5,895
Tennessee	25,322	16,347	8,975
Texas	57	2	55
Total	130,973	97,102	33,871
Imports from:			
Arkansas	2	1	1
Florida	8,284	6,645	1,639
Georgia	48,175	27,173	21,002
Kentucky	148	128	20
Louisiana	343	29,012	88,573
Mississippi	117,585	29,012	88,573
South Carolina	458	82	376
Tennessee	34,286	6251	28,035
Texas	1	1	0
Virginia	2	0	2
<i>Total</i>	<i>209,284</i>	<i>69,299</i>	<i>139,985</i>
Source: Howell, Gober and Nix (1999:18).			

Critics point out that ADEM issued dioxin discharge permits to pulp and paper mills that were 46 times higher than federal EPA recommendations. When challenged, ADEM claimed that the permitted levels posed no threat to human health because nobody ate fish downstream from those mills. Subsequent research proved this was not the case (FIMS 1994) and ADEM ultimately revised its standards over the active opposition of the pulp and paper industry (ADEM 1994).

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Bailey and Newland (2000) documented the environmental and health hazards of pulp and paper by-products in Alabama in the 1990s. In 1997, Alabama's 16 pulp and paper mills generated over half of all carcinogenic wastes released into air and water from Alabama's entire manufacturing sector. A wide range of non-carcinogenic health risks also was reported to be associated with discharges from these mills. Many (but not all) of these health risks were associated with the use of chlorine. Promulgation in 1997 of the Cluster Rules by the EPA has forced pulp and paper mills to stop using elemental chlorine in favor of a more expensive alternative, chlorine dioxide, as the main bleaching agent in the production of white paper. Chlorine dioxide is often manufactured on site and requires added plant capacity and significant retrofitting of facilities. An expert respondent in chemical engineering noted that total chlorine coming into the plants is about half that of the past and that harmful air emissions have been radically reduced. Alternatives to chlorine in any form, but much more expensive, are double oxygen and peroxide. Bleaching with double oxygen is more technologically advanced and requires new equipment (there are some examples in Sweden and Finland). Some mills, like International Paper's mill in North Alabama, combine chlorine dioxide and oxygen.

Studying the use of chemicals provides a good example of the value of a systems approach because it makes us aware that some changes in the production process take place only when external pressure from powerful sources, in this case the federal government, is brought to bear. Left to themselves, it is highly unlikely that pulp and paper companies would have acted to reduce use of chlorine, despite knowing that less harmful chemicals were available.

For the United States as a whole, we can point to evidence that capital spending to meet the technological requirements of new environmental regulations has been substantial in recent years. Alabama mills have certainly not escaped this economic pressure, which may have contributed to restructuring within the industry. In the early 1990s, capital spending by U.S. pulp and paper companies to deal with environmental problems exceeded one billion dollars (\$1.34 billion in 1991) and approached 20 percent of total capital spending. By 1998, expenditure had dropped to \$582,000 (Pulp & Paper News and Information Services 2000:72) as the industry

awaited the impact of new environmental regulations first proposed in 1993. It is no surprise that the pulp and paper industry mounted a campaign of resistance to regulations. The principle gain by the industry in this regard was the 1995 law that prohibited the federal government from passing laws that required funding by industry or lower level governments (Pulp & Paper News and Information Services 2000:75). The industry also argued strongly that its forest lands, which absorb carbon dioxide, should be considered as offsetting its greenhouse gas emissions. However, compliance with the Cluster Rule was expected to cost the industry from \$1.8 to \$2.6 billion and industry spending plans indicate an allocation of \$3.2 billion up to 2005 (Pulp & Paper News and Information Services 2000:77).

Another critical environmental issue has been the impact of mills on the forests and waterways affected by harvesting operations. Clear-cutting and the resulting impact on natural habitats have been widely criticized in Alabama and the Southeast in general (D. Smith 1997). Alabama has no regulations that require adherence to any standard designed to minimize environmental impacts of forest operations.

Public concern for the condition of streams and lakes spurred Congress to pass the Clean Water Act in 1972. The Act gave primary responsibility for enforcement of water quality standards to the EPA. The EPA in turn delegated authority for state enforcement to state-level agencies. In 1987, Congress included non-point source pollution, the type of pollution often generated by forest operations, in the Clean Water Act's mandate, and required each state to assess non-point source pollution and implement a control program. In Alabama, ADEM is the lead agency responsible for enforcement of the Clean Water Act. However, ADEM sought to involve the Alabama Forestry Commission to coordinate the actions of a committee of forestry stakeholders, including representatives from forest industry and forest scientists from Auburn University, in the drafting of "best management practices." The meetings became so polarized between those wanting more rigid and comprehensive guidelines and those favoring more lax guidelines that some committee members considered withdrawing. The EPA rejected the first guideline proposal for best management practices as insufficient. Alabama faced the possibility of federally

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enforced "mandatory" standards. Eventually the EPA accepted a set of voluntary best management practices in 1993.

On the heels of implementing best management practices came forest certification standards for forest management. Forest certification represents a proactive market approach by environmental organizations to influence forest owners to achieve sustainable forestry. A goal of forest certification is to lead consumers toward purchasing wood products grown and harvested in an environmentally sensitive and sustainable manner, and in doing so, affect the manner in which the owners of forests grow and harvest timber (Newsom 2000).

Two organizations have emerged as leaders in the competition for legitimacy and recognition in the U.S. market of forest certification. One organization, the Forest Stewardship Council, a non-governmental, international organization funded by the Worldwide Fund for Nature, was founded in 1993. The Forest Stewardship Council certifies organizations that evaluate forest operation for adherence to Council principles. The American Forest and Paper Association (AF&PA), a national trade association of the forest, paper and wood products industry, responded to public concerns and the founding of the Forest Stewardship Council by developing the Sustainable Forest Initiative (SFI) in 1995. SFI member companies (14 of which have Alabama operations) agree to abide by a set of criteria in managing and harvesting their forest resources. Until recently, these criteria were labeled as "principles and implementation guidelines." Recently, the AF&PA relabeled their initiative as "SFI Standards." With "standards" the AF&PA can offer their members the option of an independent third-party verification process to "certify" that a member company is complying with the SFI Standards (Moore 2001).

Development of the SFI Standards was a direct response to the more comprehensive Forest Stewardship Council's certification standards. Indeed the Forest Stewardship Council and AF&PA can be likened to chess players of contrasting styles. The Council makes an aggressive play in the quest for market acceptance. AF&PA responds with a move that will do nothing else but protect for a draw in the certification competition. To date, the Forest Stewardship Council (2004) has certified approximately 21.4 million acres in North America and 99.8 million globally. By

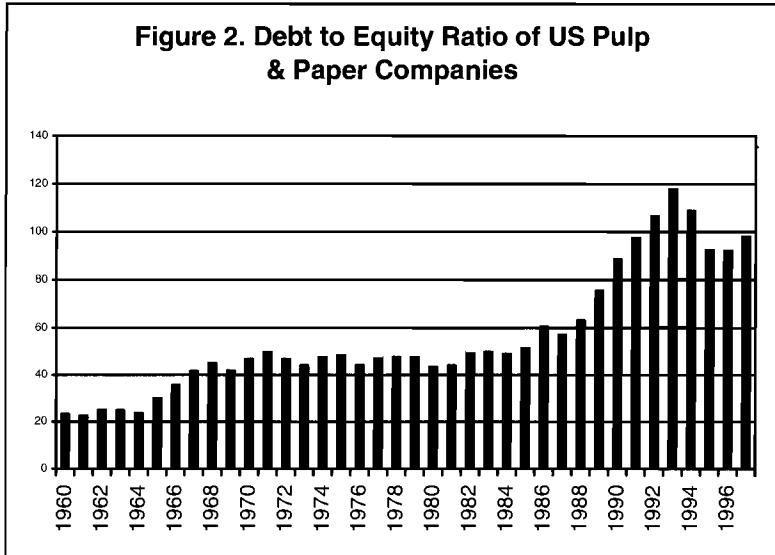
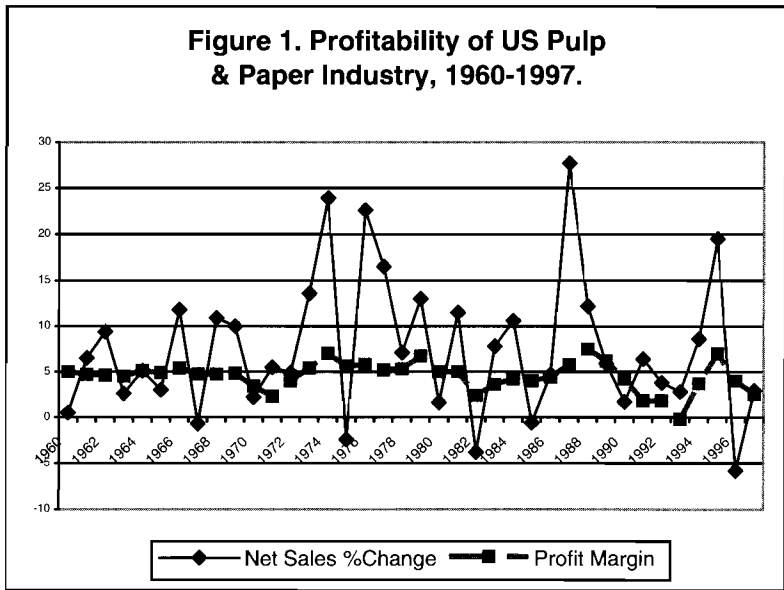
September 2003, AF&PA (2004) had certified 103 million acres in North America. However, one must look beyond acres certified to gain a clearer picture of the chess match. The Forest Stewardship Council has the clear lead in the number of retail companies announcing their choice of Council certification, giving the Council leverage in getting certified products to consumer markets.

The extent to which forest landowners agree to adhere to SFI and Forest Stewardship Council certification standards, or similar standards set by other organizations in the future, will determine the character of Alabama's future forest landscape. Consumer demand for certified forest products will play a key role in determining the market for such goods and it is too early to tell whether such demand will lead to significant reorientation of forest management practices. Pulp and paper mills, as well as plywood and lumber mills, furniture manufacturers, and other users of forest products are going to be the key actors requiring that the material they purchase comes from timber stands that meet the necessary management criteria. These companies will do so if it is to their economic advantage, either in the form of a price premium or in the form of more limited market opportunities for non-certified products.

While environmental regulation by state agencies and pressure from environmental organizations have brought about changes in the technology of production in many plants and may change forest management practices in the future, economic pressures have been the most critical force driving restructuring of the industry in the 1990s and into the twenty-first century.

Economic Pressures Driving Change

Market forces are providing critical impulses to change. Pulp and paper is a highly cyclical industry in which, typically, improved prices generate increased investment in expanded production capacity. This leads to increased supply of paper products in the market, which typically cannot be sustained for long periods at prices profitable for the producers. During times of general economic contraction, demand is reduced, prices fall and profit margins are squeezed. We present data for U.S. companies on percent change in net sales, year to year, to indicate the cycles since 1960 (Figure 1). The decline in 1996 was the most severe on record and this turbulent time



Source: Calculated from raw data in Pulp & Paper News and Information Services (2000:24).

of economic stress surely contributed to the high pace of consolidation as some companies became weaker and others searched for cost effectiveness through acquisition of competitors. Figure 2 also illustrates the low profit margins during most of the 1990s.

In this decade the dramatic rise of indebtedness relative to equity as a result of leveraged acquisitions and small profit margins (Figure 2) may be taken as an indicator that the industry contains many companies with weak balance sheets that will force them to restructure. This restructuring process may involve corporate consolidation, technological change, partial sales of resources, or some combination of these three. The desire to control persistent problems of over-capacity appears to be a major motivating factor behind recent corporate consolidations within the pulp and paper industry, discussed below.

Restructuring I: Corporate Consolidation

Consolidation is a public and vital dimension of the restructuring process. Focusing on ownership at the point of paper production in Alabama, we observe increasing consolidation, which is ultimately rooted in decisions about how best to make profit in the capitalist marketplace. Ownership is important because it encompasses the right to determine investments, to benefit from profits when they can be made, and to decide what actions to take during downturns of the business cycle.

In 1999, the pulp and paper industry remained organizationally diverse in the United States, with a total of 381 companies and 779 establishments, although this total did include subsidiaries of parent companies (Lockwood-Post 2000:10). Nevertheless, the most notable feature of the organization of pulp and paper production in the 1990s, and stretching into the twenty-first century, was a string of mergers and acquisitions that produced several giant corporations, often with an international dimension. Several of these corporate reorganizations affected mills operating in Alabama. Among the most prominent developments from 1997 to 2001 were the following (Pulp & Paper News and Information Services 2000:39-47,100):

- The merger of Canada's Abitibi-Price with Stone Consolidated in 1997 to form Abitibi-Consolidated, the world's

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largest newsprint company. This company now owns 50 percent of Alabama River Newsprint Co. along with Parsons and Whittemore.

- Ireland's Jefferson-Smurfitt containerboard division merged with Stone Container in 1998. This giant owns the Brewton, Al. packaging plant.
- In 1997, Alliance Forest Products from Canada purchased Kimberley-Clark's newsprint mill at Coosa Pines. Bowater bought Alliance in 2001.
- Kimberley-Clark closed its mill in Mobile, laying off 450 workers and selling off 460,000 acres of forest land in Mississippi, Alabama, and Tennessee.
- In 1999 Weyerhaeuser bought out Canada's MacMillan-Bloedel, including its linerboard mill at Pine Hills.
- Georgia-Pacific agreed to buy Fort James during 2000, giving Georgia-Pacific two Alabama mills.
- International Paper, the world's largest forest products company, bought Union Camp in 1999, a sale that meant new ownership for the linerboard mill in Prattville,
- International Paper also purchased Champion International in 2000, becoming the owner of the fine papers mill at Courtland, adding a fourth mill to its holdings in Alabama but closing down one of the four large paper machines operating at that mill, thus reducing the workforce by 400.
- Also in 2000, International Paper closed its 70-year old mill in Mobile, laying off 790 workers.
- South Africa's Sappi purchased the former Warren mill in Mobile, which it closed down in 2001.
- Finally, in 2001, Mead and Westvaco merged.

The result of consolidation to date is that 11 companies now own the 14 major paper mills in Alabama. This total excludes the closed International Paper mill in Mobile, which the company refused to sell to its workers. Industry workers with whom we spoke speculated that their offer was rejected because International Paper wanted to remove production capacity. The mill recently shut down by Sappi is also excluded.

What difference does consolidation make? Respondents in one plant taken over by another firm perceived minimal changes that could be attributed to new ownership. However, we cannot

safely accept this casual observation when considering the state as a whole. Certainly one reason for mergers is to reduce capacity in the industry and raise labor productivity, which can involve closing mills or paper machines. That means jobs are lost at all levels with the most likely candidates to close being those with old technology or whose products are in relatively low demand. In this latest round of consolidation, as previously mentioned, International Paper shut down its old mill in Mobile, probably because it was too expensive to upgrade, and also eliminated one machine in the Courtland plant. These changes contributed to a significant loss of jobs within Alabama's pulp, paper and paperboard mills between 1998, when there were 13,873, to 2001, when this figure had dropped by 21.5 percent to 10,888 (U.S. Census Bureau 2001).

Restructuring II: Supply of Labor and Fiber

Restructuring is taking place in significant ways other than through change of ownership. Under pressure to protect profits, corporations have evaluated costs and sometimes reorganized how they deal with provision of inputs. Essentially, these changes have meant reducing the core labor force of direct employees (usually relatively well paid and enjoying substantial benefits compared with those in other businesses) and sub-contracting tasks to other companies in the area. We suspect that the range of activities counted by pulp and paper companies as core to their performance, and thus requiring direct control, is decreasing, as it is in many other industries (Bailey et al. 1996). Independent local companies under contract increasingly provide maintenance and security. Some firms retain a core maintenance staff, but contract out maintenance and repair operations that are not routine. In this way the corporation avoids paying for labor that is not consistently employed. One corporation even contracts out daily operation of its computer control system to a company that was involved in its installation. Initially, this company did not have appropriately trained staff, but the contracting arrangement worked sufficiently well that the relationship has been allowed to continue. This same mill has an arrangement with a chemical input supplier to provide chemical engineers to assist in running pulp mill operations. If running chemical processes associated with the manufacture of

pulp can be sub-contracted, there is little that could not be done this way.

In procuring wood supply, the mills have always relied on either dealers or producers rather than their own labor force, even when they own the timber land. While it is obvious that a mill cannot function without fiber (or chemicals, water, machinery, energy and labor), corporations can obtain fiber without actually owning the timber land.

In the realm of forest land ownership and timber procurement, different corporations adopt different approaches. International Paper, for example, is the largest landowner in Alabama and the United States, with no evident plan to change. International Paper's recent purchase of Champion International and Union Camp led to significant expansions of holdings in the woodshed serving their mills. The second largest company in this industry, Georgia-Pacific, created a separate timber land unit in 1997 and was in the process of selling its lands in 2001. The Alabama River Companies, a complex of three mills in Monroe County, which own no land and rely entirely on the market, adopted another approach. A variety of factors must be considered by corporations in determining which approach best suits their needs. Large holdings of forest land represent major capital investments and continuing expenditures for management. The advantages of owning a significant source of fiber to run the mills is that when market prices rise, the company has an alternative source of supply. Ownership of well-drained land, easily accessible to roads, is particularly valuable during the winter, when heavy rains limit logging operations and mills become increasingly desperate (and willing to pay high prices) for logs.

In the past, timber procurement offices associated with pulp and paper mills were actively involved in scouting and purchasing timber stands, and would then arrange for loggers to harvest the timber. At one time those loggers may even have worked directly for the mill, though this practice has long been abandoned (Bailey et al. 1996). Preliminary information indicates that mills may be taking a less active role in acquiring stumpage, preferring to let others find, purchase, and arrange for harvesting of available timber. This reduces costs for the mill, pushing those costs onto the brokers or loggers who supply the mill. A large mill we studied used as many

as 100 suppliers, but depended on perhaps 20 of these for 80 percent of its input. No logger worked exclusively for this company, but some relationships were long-lasting because the company felt that it could depend on the supplier.

Increasingly, pulp and paper companies try to operate on a just-in-time inventory basis rather than maximize production. Essentially, this means that mills want to carry as little inventory as possible. Inventory may be checked daily. One buyer indicated that most arrangements with suppliers are on a week-to-week basis, but the company attempts to give about three weeks notice of needs. In this way, some companies at least have pushed the pressure of organizing and financing access to trees down the supply chain. Another strategy for securing wood supply has been to build satellite chip mills with a life of about 10 years. These chip mills will then acquire wood in the same way as that which moves fiber directly to the pulp mill.

Concluding Remarks

We have reviewed important pressures for change in the technology, organization and practices of pulp and paper production in Alabama. Company managers are inevitably influenced by a wide range of factors from events in the international market place to local environmental and community issues. Changes occur as managers attempt to control as much as possible in the interest ultimately of increasing profits. Pulp and paper companies are not helpless actors in this system; rather they are the most powerful interest group when considered as a whole; and at the local level, where the individual plant operates, they are usually the dominant participants. In conclusion, we discuss possible implications of the changes we have documented, especially corporate consolidation.

Corporate consolidation leaves the remaining firms with greater power in the marketplace. Through closure of less productive mills, the industry not only is cutting costs but also supply to the market, with the intended effect of improving prices (and price stability) for their products in the long-term. This strategy is being played out in the context of highly cyclical demand for paper products. Whether corporate consolidation can affect what to this point appears to be the fundamental instability in paper markets remains

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to be seen. The enormous capital expense required for newcomers to enter this industry may have the effect of limiting new investments, at least in North America. Nonetheless, the number of corporate actors still in the field, the potential for international suppliers to affect markets currently dominated by those actors, and the cyclical nature of most paper markets argue for limited ability to control fundamental supply-demand imbalances. Continued imbalances are likely to be precipitated by battles over market share between those actors.

Corporate consolidation is likely to affect the economic fortunes of those rural communities in Alabama and the South where the pulp and paper industry is a key actor. These effects are likely to be felt through gradual limitations of employment opportunities and lower prices paid to landowners for timber.

Corporate consolidation is likely to speed the process through which labor is displaced by capital. To this point, most significant reductions in employment have been associated with the two mills in Mobile that were closed. These mills were located in a metropolitan area that offers a diversified labor market for workers who were laid off. The process of downsizing the workforce through capital investment or through sub-contracting is having an effect on mills in rural Alabama as well, and here the consequences are likely to be more serious because alternative employment is scarce and usually lower paying.

Corporate consolidation is also likely to limit options available to individual landowners interested in selling timber. Through its purchase of Champion International, International Paper has become the dominant buyer in northern Alabama. Likewise, through purchase of Union Camp, International Paper has come to dominate the market for timber in central Alabama. The former Union Camp mill in Prattville and the International Paper plant in Selma both source timber for their operations, but instead of directly competing they now share a common coordinator of timber procurement. International Paper is not the only potential buyer of timber in central Alabama, but the second most important buyer is nowhere near International Paper in market power. The possibility exists that corporate consolidation could lead to lower prices for timber under certain circumstances. Whether this has any effect on prices available to local landowners remains to be seen; the

purchase by International Paper of the Union Camp mill at Prattville and the generally depressed market for stumpage make it impossible to judge at this point. From discussions with timber procurement people around the state, however, it is clear that a degree of communication and mutual assistance takes place. If a mill is running short on material, timber procurement staff from other mills will try to help out. Similarly, if a mill obtains access to a stand of timber closer to another mill, an exchange might be arranged to help cut transportation costs. It is not a far stretch from this corporate cooperation to imagine a situation where a common approach to pricing might emerge.

Earlier in this paper the point was made that regulatory pressures forced the pulp and paper industry to improve its environmental record, chiefly through elimination of elemental chlorine in the bleaching process. Evidence from the EPA's Toxic Release Inventory data system clearly indicates that a wide range of chemicals is present in mill effluent and that air and that water releases from these mills have serious health consequences for surrounding populations. We should consider the possibility that consolidation of corporate power may also have some effect on the future of regulatory efforts affecting the pulp and paper industry. The industry successfully fought off elimination of chlorine from the bleaching process, arguing that adoption of a chlorine-free paper standard would not be cost effective. The shift to chlorine dioxide, industry claimed, would achieve over 97 percent of the possible reduction in chlorine releases compared to the more costly chlorine-free approach. A smaller number of larger, more powerful corporate actors could translate into more effective lobbying ability when future regulations are considered.

Industry consolidation may mean less innovation. The pulp and paper industry in the United States is not noted for its support of research or innovation. Such innovation as does take place through research and product development occurs as a result of efforts made by chemical input suppliers or manufacturers of equipment used by the industry. As fewer corporations come to dominate the scene, the pace of technical innovation may be impeded. Fewer small companies will be present to adopt innovative new technologies. Instead, the process unfolding appears to represent the next stage of maturation in what is already considered to be a mature industry.

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Notwithstanding the largely pessimistic portrait developed so far, corporate consolidation may provide substantial scope for consumer pressure. As consumer campaigns against such retail outlets as Home Depot, Lowes, and Staples indicate, large corporations are vulnerable to public pressures to reform their practices. If such a campaign is successful in forcing one corporate actor to adopt socially and environmentally certifiable standards, others may feel it necessary to follow suit. Industry consolidation, by limiting the number of corporations whose activities are to be affected, may facilitate the process of linking these companies to a set of best management practices designed to support ecosystem sustainability and the equitable distribution of economic benefits to communities where mills are located.

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