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THE PULP AND PAPER INDUSTRY AND GEORGIA'S FOREST RESOURCE: AN ECONOMIC OUTLOOK

BY

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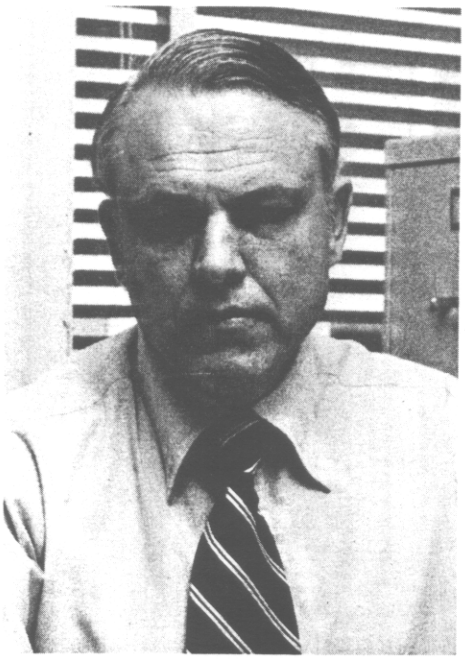

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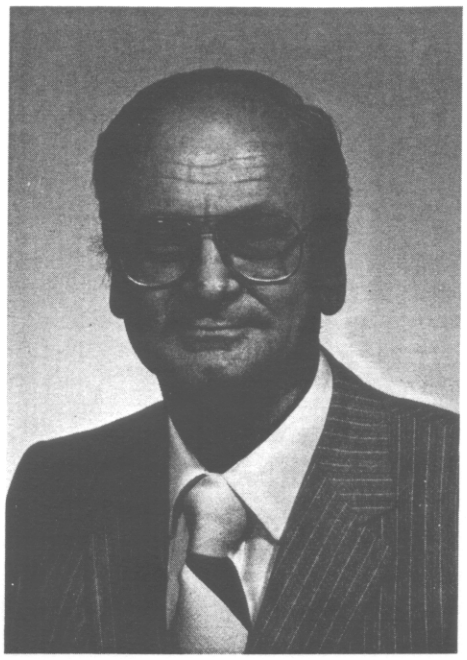

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PREPARED FOR

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HIGHLIGHTS

Georgia is the nation's leading producer of woodpulp and paper and paperboard products, and leads the south in shipments of converted products.

Georgia's pulp paper and allied products industry is comprised of 168 plants, employing 27,000 workers at wages 40 percent higher than paid all manufacturing employees in the state.

Georgia's 16 primary pulp mills have a pulping capacity of 16,457 tpd, up from 13,778 tpd in 1970. These mills are clustered in the Coastal Plain Region.

Georgia's paper and board industry consists of 28 mills with an output capacity exceeding 16,000 tpd. Integrated mills produce daily 15,200 tons of pulp and 14,600 tons of paper and board products. Nonintegrated paper and board mills produce about 1,000 tons of products daily.

Georgia's pulp and paper mills exhibit economies of scale that are incomparable with the competition in any region of the world. The Georgia industry claims seven mills with a pulping capacity of 1,000 or more tons per day. These mills have a replacement cost estimated at $300 million per 1,000 tpd of capacity.

Georgia's paper and paperboard converting industries consist of 124 plants, located mostly in metropolitan areas.

Georgia's dominance in world class mills is underpinned by the rapidly growing southern pine forest. Location economies dictates the siting of large mills close to the requisite wood supplies. The doubling of pine growth through improved forestry management will halve the wood supply areas of existing mills and shorten wood hauling distances by 30 percent.

Georgia's pulp, paper and board industries are dependent on nonindustrial forest lands for about 60 percent of present and future wood requirements. In turn, investment in expanded mill capacity is linked to investments by nonindustrial landowners in the future productivity of timberland.

Georgia's commercial forest can economically supply 909.5 million cubic feet of pine annually on a sustained yield basis at the average stumpage price of $335/MCF prevailing in 1977. Based on current wood demands and the feasible long-run supply of pine, the Georgia forest can support additional pulping capacity of 2,000 tpd. A future stumpage price of $350/MCF would generate a wood supply capable of supporting 2,600 tpd in expanded mill capacity.

Georgia's forest resource is capable of wood productivity gains of at least 10 percent, through restocking with superior seedlings and scheduled timber management improvements. At current stumpage prices of $335/MCF this more productive Georgia forest would support expanded mill capacity of 5,300 tpd, along with proportionate increases in the state's sawmills and plywood mills. This addition of 1.9 million tons annually to the state's pulp and paper mill capacity would generate $1.6 billion in industry investment and create 5,000 additional high paying jobs. National and international markets can readily absorb all the incremental pulp production that a managed more productive Georgia forest can sustain.

INTRODUCTION

This study evaluates the future of Georgia's pulp, paper, and board industries and the state's forest resource. The analysis focuses on the vital relationships between wood supply, improved forest management, and the potential expansions of mill capacity. The determinants of the future wood supply available to the industry are interpreted. Future markets for the products of Georgia's pulp, paper, and board industries are assessed. Most importantly, scenarios are developed to show how forest investment today can lead to the realization of long-run industry expansion potentials.

The most significant resource constraint upon the continued growth of Georgia's pulp and paper industry is the future pine timber supply. Continued industry investments in plant modernization and expansion indeed depends upon investments being made today by landowners in the regeneration and improved future productivity of the forest. At the rate at which forest management is currently accomplished by Georgia's nonindustrial landowners, it is problematical whether the future pine timber supply will support further industry expansion, even though the existing forest may be able to supply an expanded capacity for a time.

Realistically, far more investment in improved forest management may be currently economically feasible than is being accomplished by nonindustrial landowners. In turn, these investments will assure a future timber supply that would enable Georgia's pulp and paper industry to eventually expand its capacity by as much as 1.9 million tons annually beyond the 6.1 million ton annually already in place or coming on line in the immediate future.

ECONOMIC CHARACTERISTICS OF GEORGIA'S PULP, PAPER AND BOARD INDUSTRIES

The principal reason for the exceptional growth of the pulp and paper industry in Georgia is the unique affinity between this industry and the southern pine forest. In turn, the industry's potential for further economic growth depends in particular on the improved management of the southern pine forest as a renewable, multiple product, economic resource. But there are a number of other economic resource considerations which have affected this industry's growth, if not giving it a special economic advantage in Georgia and the South, and which stand as potential constraints on its future growth.

LABOR AND WAGES

In 1978, the average earnings of Georgia's paper and allied employees was $6.99 hourly, compared with a wage level of $6.52 an hour for workers in this industry throughout the United States. Moreover, the wages paid this industry's employees exceeded the wages paid to all Georgia manufacturing employees by more than 40 percent. The high wages of the paper and allied products industry reflects the high productivity of its employees, due not only to their exceptional skills but to the highly capital-intensive nature of the industry. At these premium wage rates, as justified by the industry's high productivity, an abundant supply of labor is available to accomodate any foreseeable level of industry expansion.

At the same time, these high wages and the implied high production value added per employee signify that the growth of this industry contributes much more to Georgia's economy than indicated by the number of its employees. Even so, paper and allied products ranks as Georgia's ninth and the Atlanta metropolitan area's sixth leading manufacturing employer; and its employment growth has been steady, if not spectacular. The industry employed 25,060 in 1970, 26,200 in 1974, and 27,000 in 1978 and is projected to grow to 29,530 in 1985.

WATER

Water is an essential, high-use resource in the manufacture of pulp, paper, and board products. A pulp and paper mill producing 1,000 tons of output per day may use as much water as the population of a city of one million. Although the quantity of water used in the manufacture of pulp and paper varies widely depending on the pulping process, this resource is a necessary input at every stage in the manufacture of pulp.

At the time of this study, water consumption data were available for seven mills which produced 9,165 tons of pulp daily. The combined water requirements of these seven mills was almost 200 million gallons per day. Even with these large gallonages, Georgia mills are highly efficient in minimizing water requirements through the reuse of water withdrawn for manufacturing processes. Gallons of water used per ton of output ranged from a high of 48,000 down to a low of 3,125, depending on the type mill and the pulping process used.

The water requirements of Georgia mills are satisfied by withdrawals from wells and rivers and by purchase. Among the Georgia mills studied the most frequently used sources of water are captive wells and a combination of wells and river water. Based on processes characteristic of existing Georgia mills, an average net withdrawal of 21,800 gallons of water is required for each ton of pulp produced, apparently much less than the national average.

Water availability is not viewed as being a significant limitation on the location of new or the expansion of existing pulp, paper, and board mills in Georgia.Ground or river water supply considerations do, however, limit the choice of locations for future mill sites. Further, the cost of adequate water purification systems to meet effluent limitations guidelines will continue to be a major cost consideration in determining the economic feasibility of capacity additions.

ENVIRONMENTAL CONSTRAINTS

In real terms, the pulp and paper industry has been more extensively impacted by air, water, and solid waste pollution abatement regulations than most classifications of manufacturers. Between 1973 and 1978 total new plant and equipment expenditures by the pulp and paper industry ranged between 5.0 and 6.6 percent of capital spending by all manufacturing firms. Over this same period pollution abatement spending by the pulp and paper sector was equivalent to between 8.4 and 13.4 percent of abatement expenditures by all manufacturers. The year-to-year fluctuations in pollution control spending are influenced by government deadlines for compliance with pollution abatement standards.

Capital spending to meet pollution abatement standards represents a real cost to the pulp and paper industry that, for the most part, neither expands capacity nor increases productivity. The expenditures mandated to meet environmental standards alone increased the prices of paper products by an estimated 5.5 percent between 1975 and 1978. Irrespective of their merits, mandated standards do cause product costs to rise and can result in the closure of marginal high cost mills. Further, compliance with environmental standards increases the capital cost of new and expanded mill capacity. In constructing a 1,000 tpd pulping facility it is estimated that capital expenditures to meet EPA environmental regulations will represent 12 percent of total mill costs.

For its part, Georgia's industry has programmed $112.1 million in capital expenditures over the 1979-81 period for environmental enhancement, $69.8 million for water and $42.3 million for air pollution control. These expenditures for pollution abatement represent 13.5 percent of all programmed capital expenditures for Georgia mills, as compared with 9.9 percent of total capital expenditures nationally.

If these large investments in environmental protection and the uncertainty of future governmental standards seem daunting for the growth prospects of the Georgia pulp and paper industry, it should be kept in mind that the environmental constraint applies generally to the industry in the Nation and World. Insomuch as industry growth in Georgia and the South is advantaged by other factors, environmental costs will not be an important limitation, per se. Rather, the economic impact of these costs will fall most heavily on competing regions, where mills are less efficient and of marginal profitability.

ENERGY

The pulp and paper industry is energy intensive. Each ton of output from a pulp and paper mill requires about 35 million Btu's of energy. Thus, a 1,000 ton pulp and paper mill uses each day the energy equivalent, alternatively, of 5,600 barrels of oil, 1,300 tons of coal, 34 million cubic feet of natural gas, or 4,000 tons of bark or wood.

Confronted with rapidly rising energy costs and with the threat of interruption of purchased fuels and electricity, the pulp and paper industry has made substantial efforts both to conserve energy and to lessen its dependence on purchased energy. The use of hogged fuel derived from wood residues by the U.S. pulp and paper industry increased from 5.5 million in 1972 to 12 million tons in 1978. In

consequence, the share of the industry's energy requirements accounted for by self-generation with wood residues increased to 45 percent in 1978 from 41 percent in 1972. Concurrently, the industry's use of fossil fuel and purchased energy declined by 16 percent.

Following this national trend, Georgia's industry has been investing in fossil fuel conservation and in-plant generating facilities. Based on data from 13 major Georgia pulp mills, representing 92 percent of the state's pulp output, the Georgia industry is nearly 60 percent self-sufficient in electrical generation. Thus, over the long run, the availability of energy, per se, would not appear to be an important constraint on the industry's expansion. By the same token, the Georgia industry would not appear to be at a regional disadvantage even if the cost of energy continues to rise in the face of industry's investments in conservation and self-sufficiency.

CAPITAL INVESTMENT

Georgia's pulp and paper industry enjoys no material regional advantage or disadvantage with respect to the availability of water, environmental, energy, and labor inputs. The industry does benefit from two distinct locational assets: the forest resource and the concentration of its productive capacity in large world class mills.

The Georgia pulp and paper industry is incomparable with its competition in any region of the world in that nowhere else is there concentrated in a comparable area so many of the world's largest pulp mills. The state has no less than seven mills with a pulping capacity of 1,000 or more tons per day, including two mills larger than 2,000 tons per day. Equally important, Georgia pioneered world class pulp and paper mills. Except for periodic modernization, expansion, and annual two-week shutdowns for maintenance, some of these large Georgia mills have been operating continuously, 24 hours a day, for five decades. This history of operating success has yet to be matched by the newer large mills in locations outside of Georgia.

The economies of scale enjoyed by Georgia's pulp and paper mills give the industry an important regional economic advantage over the typically smaller mills of the competition. The economic advantage of a large mill is that the required volume of resource inputs into the pulp making process does not increase in proportion to the size of the mill. A 1,000 tpd mill may require no greater number of production workers than a mill proing one-third its output. Thus, the large mill will have lower labor costs per ton of output. Similarly, a large mill will have lower energy costs per ton because of large-scale boiler economies and the economies of large settling ponds and air pollutant precipitators.

In order to recover the enormous capital costs associated with a large efficient mill (estimated at about $300 million per 1,000 tpd of capacity), the production facility must be run continuously for as long as possible. The longer the time period over which the mill can be operated, the lower the capital costs per ton of output. This is because the costs of maintenance, modernization, and expansion at an existing mill will be less than for "green" mill capacity in new locations.

Moreover, the prospect of a mill remaining indefinitely at a fixed site enables it to be profitably integrated with related economic activities. It will be recalled that the Georgia industry is highly integrated not only between pulp mills and paper and board mills, but vertically through the production of converted paper and board products. Georgia mills also evidence horizontal integration between pulp making, the production of wood chemicals, and lumber products. Integration enables the sharing of capital costs and enhances the profitability of an array of forest products.

Finally, there is the advantage of integrative economies that are external in the industry, particularly if there is a cluster of large mills in the vicinity. Given long operating periods at fixed sites, an industry comprised of large mills will attract industry suppliers and other support activities, enhancing capital recovery and economic returns over the long run. This support includes, importantly, the public and private investments necessary to develop the forest resource base of the industry.

REGIONAL STUMPAGE PRICES AND FOREST MANAGEMENT

The pulp, paper, and board industries in Georgia enjoy real wood cost advantages, despite higher pulpwood stumpage prices, especially in the Coastal Plain Region. Lower wood costs at the mill are attributable to economies associated with year-round harvesting, mechanized logging operations, an extensive transportation network, the high specific gravity of the southern pine, and the rapid annual growth of the pine forest.

From seedlings to pulpwood size in 15 years and sawtimber size in 30 to 35 years, the rapidly growing southern pine forest can sustain a large volume of annual timber supply close to the mill. These distinct wood cost advantages underlie the location and long history of successful operations by world class pulp mills in Georgia. In turn, the sustained pulpwood productivity of Georgia's pine forest has made possible a high degree of industrial integration between pulp mills, paper and board mills, and converted products plants in the state.

PULPWOOD

The nonindustrial landowner in the Coastal Plain is assured of a future pulpwood market because of the large industry capacity in place. In contrast, the future demand for pulpwood stumpage in the Piedmont Region is not expected to approach that of the Coastal Plain until there is a significant expansion of mill capacity in the region. It is a fundamental economic principle that the pulpwood stumpage price decreases as the distance from the mill increases, because of the incremental cost of transporting wood to the mill.

This principle is illustrated by the data on pulpwood stumpage prices by region in 1977:

PULPWOOD STUMPAGE PRICE

Region	MCF	Cord
Coastal Plain	$211	$20
Piedmont	168	16
Mountain	100	9

These stumpage price differentials are directly related to the accessibility of wood to existing mills. At the same time, the mill-delivered pulpwood prices vary but slightly between the three regions, averaging about $350/MCF or $33 per cord.

Because of lower pulpwood stumpage prices and higher acre costs of site preparation and planting, nonindustrial landowners in the Piedmont have been more reluctant to practice improved forest management. The 1977 plantation costs pertinent to nonindustrial lands were $87 per acre in the Piedmont and $77 per acre in the Coastal Plain. These market facts do not imply, however, that investment in site preparation and planting is economically unfeasible for the Piedmont landowner. Over a pulpwood rotation a planted stand in the Piedmont will yield twice the harvestable timber volume of an unmanaged stand. Indeed, in the absence of improved forest management investment, cutover pine timberland will likely revert to virtually useless hardwoods.

SAWTIMBER

Considering regional variations in management costs and stumpage prices, it is probably not economically feasible to

manage the Georgia pine forest under a pulpwood rotation regime. Under current market conditions it is feasible, however, to manage the pine forest in a multiple product context, including sawtimber and plywood logs as well as pulpwood. This is indicated by the price of sawtimber pine stumpage in 1977:

Region	Sawtimber Stumpage Price per MCF
Coastal Region	$614
Piedmont	464
Mountain	313

On the average, then, sawtimber stumpage is priced at about three times the receipts from pulpwood stumpage.

Multiple product cutting has a large impact on the economics of pine forest management in Georgia. Assume a pine forest mix of 40 percent sawtimber and 60 percent pulpwood, and wood volume of 1,000 cubic feet per acre. The timber sales proceeds from cutting this multiple product forest would be $286 per acre, compared with $168 from a pulpwood rotation. In turn, the investment in site preparation and planting to assure future wood supplies would require but 34 percent of the multiple product timber sales proceeds, as compared with a 58 percent requirement from a pulpwood cutting.

Georgia's pulp, paper, and board industries will benefit from the multiple-product management of the state's pine forest. The higher return to the landowners will accelerate forest management practices and enhance total wood supplies. A part of industry's pulp roundwood needs will be available because of the value of thinning as a sawtimber management practice. Notwithstanding longer hauling distances, the flow of chips and residues as sawmill and plywood byproducts can be delivered to pulp mills as cheaply as pulp roundwood.

FOREST MANAGEMENT AND THE LOCATION OF PULP MILLS

The economics of locating and sustaining pulping capacity dictate that mills be sited close to the requisite wood supplies. Indeed, the margin for profit is small in the assembly and hauling wood to the mill. The value adding characteristics of the industry are accomplished by large reductions in the weight and bulk of the wood fiber input. A ton of pulp weighs less than one-fourth of the wood input. In turn, the finished pulp is valued at more than 13 times the stumpage value of the pulpwood used in its manufacture.

Improved forest management is critical in renewing the wood requirements of Georgia's pulp mills. The managed pine forest can assure continuing wood cost advantages to Georgia mills by locating the wood resource nearer to the industry's large mills.

PULP MILL WOOD SUPPLY AREAS

The relationship between pine forest management and the economics of mill location are depicted on Map 1. The common points for the concentric circles represent existing mill sites, except for the cluster of mills along the Georgia coast. In determining the pulp mill wood supply areas it was assumed that the indicated daily pulping capacity was operated 350 days per year and that 1.25 cords of wood are processed to produce one ton of pulp output. It was further assumed that 57 percent of the pine growth volume was harvested as pulpwood and 43 percent as sawtimber. In turn, about 30 percent of the sawtimber harvest is available to pulp mills as sawmill chips and residues.

The inner supply circle illustrates the shortened mill logging distance under a plantation management regime that harvests 1.0 cord per acre per year. The outer supply circle encompasses the land area required to supply indicated mill capacity assuming an unmanaged pine forest yielding an annual harvest of .5 of a cord per acre per year.

This wood logistical illustration shows that a doubling of pine growth through forest management would halve the wood supply areas of existing mills and reduce wood hauling distances by almost 30 percent. As a corollary implication, improved forest management makes it possible to log a larger more economically viable mill at competitive wood costs with a much smaller mill.

EFFECTS OF SHORTENED WOOD-HAUL DISTANCES ON INDUSTRY EXPANSION

The wood-haul shortening effects of forest management on the economic growth of the industry in Georgia are profound. Existing mills can expand pulping capacities without increasing the average distance of wood hauls and, thus, without incurring rising wood costs per ton of output for an increasing volume of wood supply. If existing mills do not expand capacity to utilize fully the increased productivity of the pine forest, opportunities are created for the location of new mills at the extremities of existing wood supply areas.

A significant expansion of mill capacity and Georgia's forestry economy is dependent on the future supply of wood from lands at the extremities of the wood supply areas of existing mill sites. In truth, the inclusion of all industrial and nonindustrial pine land in the Coastal Plain under sustained yield, plantation management would not provide sufficient wood to log permanently the existing pulp mill capacity in the region. The expansion of pulping capacity in Georgia, then, is dependent on investment by nonindustrial landowners located at considerable distances from existing mills, especially in the Piedmont Region of the state.

INDUSTRY OWNED AND LEASED FOREST LAND

Industry owns or holds under long-term lease about 3.5 million acres of pine land in Georgia. The goal of a sustained yield, even-age management on this industry acreage has been about two-thirds realized and can be accomplished within a decade.

Industry owned acreage alone, however, does not assure Georgia mills of a future wood supply. Pulp and paper companies are managing increasingly their woodlands on longer sawtimber rotations. This is an outgrowth of the accelerating integration of pulp, paper, and board mill operations with lumber, plywood and other forest products plants. In light of these development patterns, industry lands are capable of supplying only about 40 percent of the existing wood fiber requirements of Georgia mills.

Georgia's pulp, paper, and board industries are dependent, then, on nonindustrial forest lands for about 60 percent of present and future wood inputs. In turn, investment in expanded mill capacity is linked inextricably to investments by nonindustrial landowners in the future productivity of their timberland.

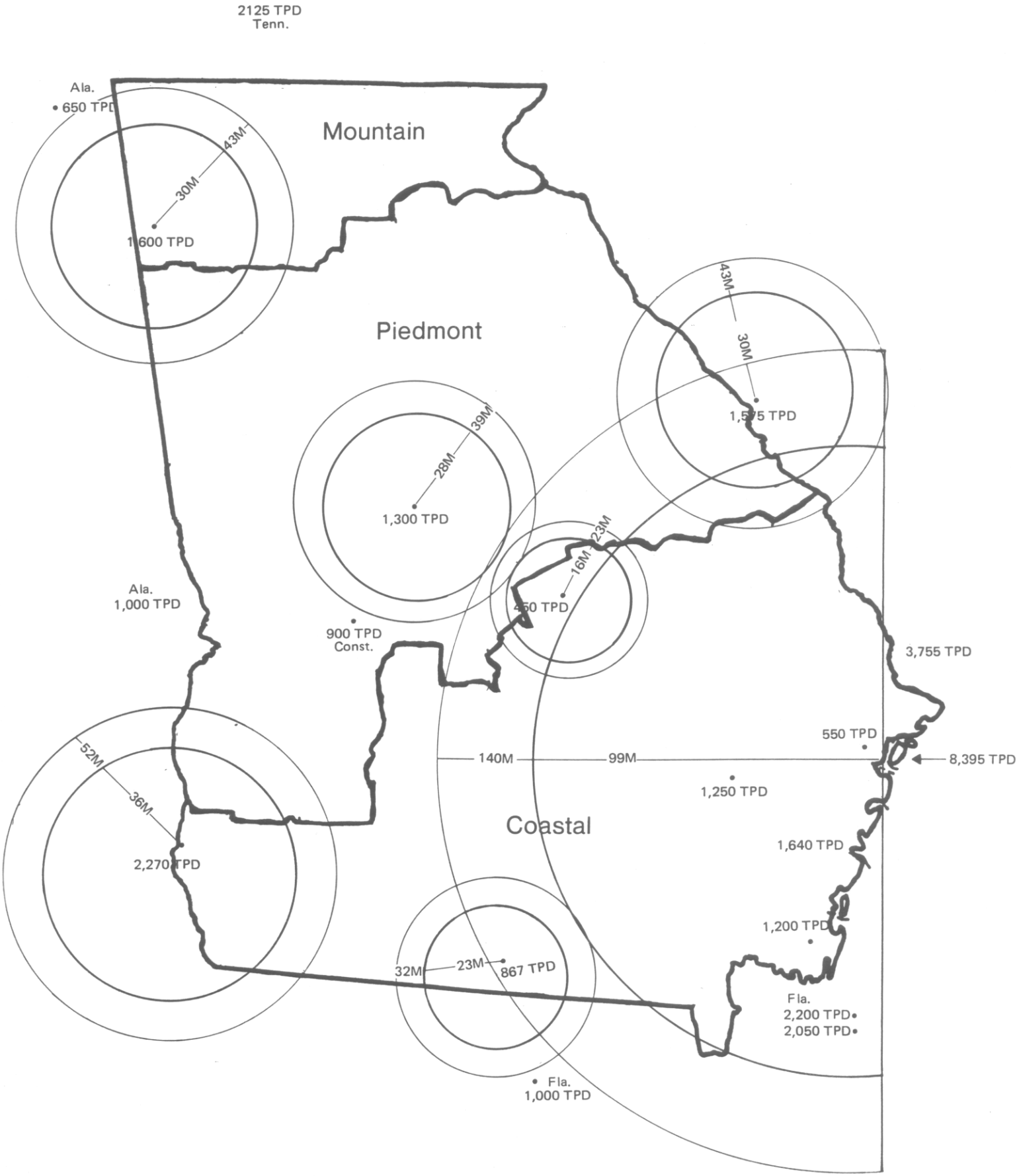
DETERMINANTS OF THE FUTURE WOOD SUPPLY

The pulp, paper, and board industries are wood resource dependent. Because of the ownership distribution of the forest land resource, the future of these leading Georgia industries hinges on whether nonindustrial landowners expand the wood supply through forest management. The variables that will determine future wood supply include:

1. The expected stumpage price.
2. The current costs of forest management. Management costs include site preparation, planting, and other forest practices. The alternatives to plantation management are natural stand forest management.

Map 1

Hypothetical Pulp Mill Wood Supply Areas



3. The rate of interest or capital cost imputed to forest management costs. Capital cost will differ by public, industry, and nonindustrial land ownership classifications.
4. The ad valorem property tax applicable to private forest lands.
5. The timber yield from pulpwood thinnings and final harvest. In turn, yields will vary by the choice of rotation lengths and management plans applied to timberlands lying in various forest types, productivity and physiographic classes, regions, and ownerships.
6. The availability of land for pine forest management in each geographic region of the state. The availability of land is dependent on existing conditions of operability and accessibility, existing forest types, and the loss of timberland to competing land uses.

Indeed, the large number of factors determining the economic potential for profitably managing Georgia's forest resource are so complex that it was necessary to utilize the "Computer Model of the Long-Run Timber Market and Forest Management" developed for Georgia by the Contract Research Division of the College of Business Administration at Georgia State University.

LONG-RUN PINE TIMBER SUPPLY CURVE AND THE STUMPAGE PRICE LEVEL

CURVE S_1

Georgia's long-run supply curve for pine timber projected by the model takes the positive slope of the classic supply curve. As shown in Figure 1, the annual volume of pine forest growth that can be supplied to the stumpage market in the future at an acceptable profit to landowners is greater as the stumpage price rises.

At a real price level equal to the 1977 average stumpage price of $335/MCF, it is economically feasible for landowners to supply 909.5 million cubic feet of pine annually on a sustained yield basis. This long-run pine supply potential compares with 687.4 million cubic feet of pine volume removed for all industrial uses in 1971, the year of the last Forest Survey. At 1977 management costs and stumpage prices, it is feasible to make current investments in cutover timber land that will ultimately yield 222.1 million cubic feet of additional pine volume over that removed in 1971.

What do these summary data mean in terms of the availability of wood to support expanded mill capacity? In 1971, the pulp and paper industry in Georgia consumed an estimated 479 million cubic feet of wood, equal to 70 percent of pine roundwood removals in the state. The supply of pine was augmented by 62.5 million cubic feet of hardwoods. Since 1971, however, the pulping capacity of Georgia mills has increased from 13,880 tpd in 1971 to 16,457 tpd currently. Further, a new mill with a pulping capacity of 900 tpd is under construction. Since 1971, the pulping capacities of Georgia mills has increased a substantial 25 percent. An analysis of current wood demands by Georgia mills and the feasible long-run supply of pine, considering current forest management costs, stumpage prices, and mill delivered prices, indicates that the Georgia forest can support additional pulping capacity of only 2,000 tpd.

However, the positive slope of the long-run timber supply curve means that a rise in the real stumpage price will bring forth a larger supply. If the future stumpage price rises to a level of $350/MCF it becomes economically feasible to manage Georgia's pine forest for a 937.5 million cubic feet pine supply. This sustained level of wood supply is capable of supporting about 2,600 tpd in expanded mill capacity. At higher stumpage prices the supply curve becomes increasingly inelastic, meaning that the pine supply required to support larger pulp mill capacities would require sharply higher delivered wood costs for all forest products industries in Georgia.

CURVE S_2

Supply curve S_2 is the result of a second run of the model for this study. It differs from supply curve S_1 only in that it assumes pine plantation yields rise by 10 percent, a wood productivity gain that should be realizable through restocking with superior seedlings and scheduled timber management improvements. Representing an increase in supply, S_2 lies to the right of S_1. Further, supply curve S_2 indicates that it is economically justified to manage the pine forest to supply greater volumes of sustained yield at all prospective levels of stumpage prices.

At the current price level of $335-MCF, an annual pine supply of 1.07 billion cubic feet is feasible under the S_2 assumption. This supply level exceeds that which is feasible at current prices under the lower plantation yield assumption of supply curve S_1 by 164.7 million cubic feet. The added volume of pine supply available at the current price level under supply curve S_2 would support an expansion of mill capacity by 5,300 tpd, as well as proportionate increases in the capacities of the state's sawmills and plywood mills.

The data generated by the model showing the sustained annual pine timber supplies under S_1 and S_2 management practices at varying stumpage price levels are presented in Table 1. The timberland management prescriptions that would make feasible the S_1 and S_2 long-run curves are described in the unabridged study.

Table 1

GEORGIA'S LONG-RUN PINE TIMBER SUPPLY
(Constant 1977 Dollars)

Stumpage Price Level $/MCF	Sustained Annual Yield Supply 1 M Cu.Ft.	Supply 2 M Cu.Ft.
50.00	356.7	356.7
100.00	356.7	356.7
150.00	40636.8	41656.6
200.00	253651.8	278641.8
250.00	355896.1	419418.6
300.00	744994.6	910432.6
335.00	909453.9	1074191.0
----------Current Price Level----------		
350.00	937498.3	1086042.0
400.00	1017136.4	1148199.0
450.00	1078549.0	1201772.0
500.00	1112335.0	1290636.0
550.00	1135843.0	1341085.0

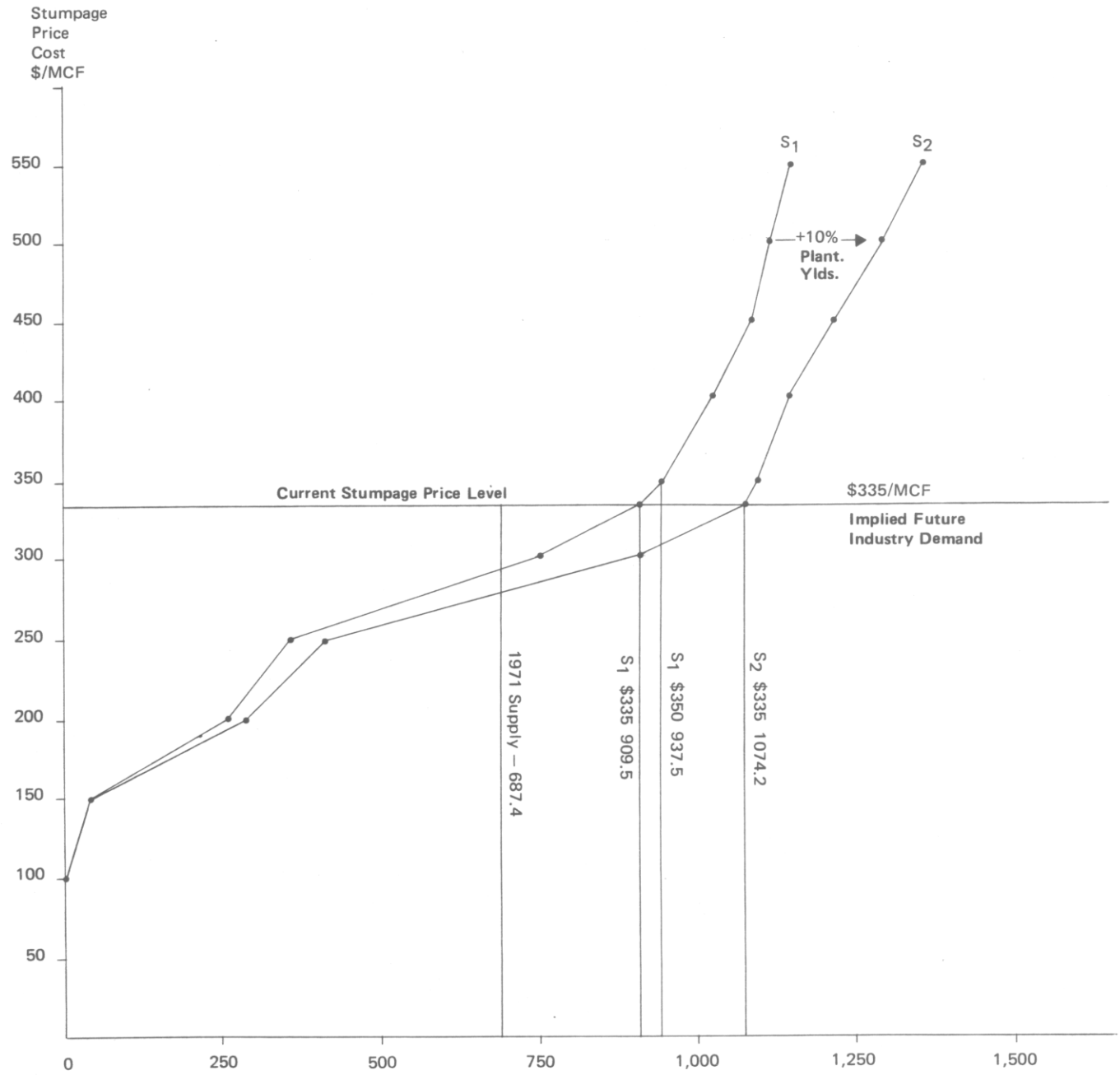
Source: Economic Model from Southeast Forest: An Economic Outlook, Montgomery, Robinson, and Strange.

INDUSTRY AND STATE BENEFITS FROM INCREASED TIMBERLAND PRODUCTIVITY

The economic benefits accruing from the increased productivity of the Georgia forest are substantial. The employment and income gains flowing from the primary industry expansion and the management of the forest resource would help ameliorate rural poverty in Georgia. At present costs it is estimated that the direct expansion of pulp and paper mill capacity entailed by the feasibility of forest management would add 1.9 million tons annually, generate $1.6 billion in industry investment, and create 5,000 additional skilled high paying jobs. Importantly, a large fraction of this potential pulp and paper industry expansion potential can be realized in the near future, provided industry has the assurance that this realizable vision of the future

Figure 1

Georgia's Future Pine Timber Supply
Alternative Economic Outlooks
(1977 Constant Dollars)



Sustained Annual Yield
(Million Cubic Feet)

Georgia forest is supported by landowners, state and federal policy makers, and the public.

FUTURE MARKETS FOR GEORGIA'S PULP, PAPER AND PAPERBOARD PRODUCTS

Georgia's pulp, paper, and board industries serve both national and international markets. While the pulp mills located in the state are integrated extensively with paper and board mills, Georgia produces a significant share of the Nation's market pulp supply.

PULP IMPORTS

The United States imported 4.1 million short tons of pulp in 1979. While these imports constituted 7.7 percent of the total pulp supply available for domestic use, imports represented 57.6 percent of the new market pulp supply. Based on the realization of a mill expansion potential of 1.9 million tons of woodpulp per year, Georgia produced pulp could substitute for 46 percent of current national imports if all potential increased production were marketed nationally. It should be noted that domestic converters and specialty mills are especially dependent on pulp imports and would constitute a primary market for expanded production by Georgia mills.

PULP EXPORTS

In 1979, the United States exported 2.7 million short tons of pulp. Were the entire 1.9 million tons of Georgia's pulp expansion capacity exported it would increase the Nation's current pulp exports by 70 percent. Even if, as today, relatively little of the expanded Georgia output were to be sold as market pulp, the greater production would help to narrow the Nation's trade deficit in woodpulp. In 1979, this excess of market pulp imports over exports amounted to 1.4 million short tons.

FUTURE MARKETS FOR THE PRODUCTS OF GEORGIA MILLS

The products of Georgia's pulp, paper, and board industries have significant market penetrations in virtually every activity associated with the industrial, commercial, governmental, and household sectors of the economy. Consequently, the change in constant dollar gross national product is conventionally used as a surrogate in projecting the demand for paper and paperboard products.

Between 1967 and 1973, the national consumption of paper and board products maintained a relationship at about 53,700 tons per billion dollars of real GNP. Since 1973, the United States has experienced a slowing of growth in constant dollar GNP. In turn, a downward shift has taken place in the relationship between paper and paperboard consumption and the level of real economic activity to about 50,100 tons per billion dollars of GNP. Nevertheless, the annual consumption of paper and paperboard products in the United States exceeds 600 pounds per capita, which is the highest standard in the world.

This apparent weakening in the level of national demand for paper and board products in relation to economic activity is, in part, related to the rapid rise in the market price for woodpulp. Since 1967 this price has more than tripled, with the price index standing at 322.5 in September 1979. The inflation in the price of wood pulp is, in turn, symptomatic of increasing cost pressures confronting the industry nationally and internationally.

These trends bode well for the expansion of the pulping capacities of Georgia mills. The rising price of woodpulp is an economic signal that capacity should be expanded in regions where pulp can be manufactured profitably at the market price.

Georgia mills enjoy a pulp manufacturing cost advantage due to the scale economies of world class mills and the wood cost advantages of the southern pine forest. These pulp cost advantages, in turn, bestow distinct economies on the production of paper and board products by Georgia mills. Coupling these locational assets and cost advantages with an expanded future timber supply, Georgia mills can enhance their dominant position in the manufacture of pulp, paper, and paperboard products, and thus greatly increase the dollar value of the industry to the state economy.

STRUCTURE AND CAPACITIES OF THE PULP, PAPER AND BOARD INDUSTRIES IN GEORGIA

Comprised of 168 plants, the pulp, paper, and allied products industry in Georgia is broadly diversified. Georgia ranks first among the nine states that claim an annual woodpulp production capacity in excess of 2.5 million tons. Considering the annual capacity to produce paper and paperboard products, Georgia again claims first position among the 14 states with output in excess of 2.5 million tons yearly. Georgia holds top position among southern states in shipments of converted products and ranks among the ten leading states nationally. Georgia is thus positioned as the nation's largest and most extensively integrated producer in the pulp, paper, and allied products industry.

PULP MILLS

The pulping capacity of Georgia's 16 primary pulp mills stood at 16,457 tons per day in 1978, up from a total of 13,778 tons per day in 1970. This pulping capacity is largely concentrated in the sulfate or kraft process, as follows:

PULP PRODUCTION BY PROCESS IN GEORGIA, 1978

Process	Production Tons per Day	Distribution
Total Production	16,457	100.0%
Sulfate (Kraft)	13,927	84.6
Groundwood/ Mechanical	1,750	10.6
Semi-Chemical	780	4.8

Between 1970 and 1979 Georgia mills added 2,679 tons of daily pulping capacity. These capacity additions were concentrated 64.8 percent in the sulfate (kraft) process.

An examination of the pulping processes employed by Georgia mills indicates that 12 mills produce pulp using a single process and four mills manufacture pulp by more than one process. The following processes are used by the 16 primary pulp mills located in Georgia:

PULPING PROCESSES USED BY GEORGIA MILLS, 1970

Process	Number of Mills
Single Process:	
Sulfate	8
Groundwood/Mechanical	3
Semi-Chemical	1
Multiple-Processes:	
Groundwood/Mechanical --Sulfate	1
Sulfate --Semi-Chemical	2
Thermomechanical-Recycled Newsprint	1

A well-defined geographical pattern has emerged in the location of Georgia's pulp mills and the associated paper and board mills. As is generally characteristic of capital intensive firms producing a product (wood pulp) from relatively low value, high weight inputs (pulpwood),

pulp mills have located close to wood sources. Additionally, pulp mills in Georgia are typically integrated with a primary paper and board mill. Because of the economies of scale inherent in mill integration, the geographical location of paper and board capacity is similar to that of pulping capacity. Converting plants that fabricate paper and board into industrial and consumer products tend to cluster in manufacturing centers and are more geographically dispersed.

The geographical location of Georgia's primary mills by daily tonnage is presented on Map 2. As illustrated, pulp mills are clustered in the coastal counties and in the Coastal Plain Region of Georgia. Chatham County leads the state with four mills which have a combined pulping capacity of well over 3,000 tons per day. As shown on the map, one additional pulp mill is currently under construction in Macon County.

Georgia pulp mills are typically very large, world class mills, as illustrated by the following distribution of the daily pulping capacities of individual mills:

Pulping Capacity (Tons per Day)	Number of Mills
2,000 and over	2
1,000 to 1,999	5
500 to 999	4
Under 500	5

This pronounced tendency toward large mills is an outgrowth of the economies inherent in expanding mill capacity at existing sites and in product and process integration.

In 1980, the manufacture of wood pulp in Georgia celebrated a golden anniversary. The first of today's primary mills was located in Chatham County in 1930. During the 1930's, an additional three mills located in Georgia's coastal counties. These four mills dating from the 1930's have a current output capacity of 4,695 tons per day. The 1940's witnessed the addition of four new mills which now have a combined capacity to produce 3,200 tons of pulp per day. The decade of the 1950's ushered in three more mills with a current capacity of 3,717 tons per day. The 1960's was a significant growth period in which four "green" mills were added that now produce 4,395 tons per day.

During the late 1970's one additional mill was completed and another was under construction that will have a combined initial production capacity of 1,350 tons per day. It was typical in Georgia during the decade of the 1970's that significant capacity additions arose from investment in mill modernization and the addition of onsite capacity at existing mills. As an example, the Great Southern Paper Company in Cedar Springs, Georgia, completed a $25 million investment in mill upgrading in 1978 that increased the output of unbleached kraft linerboard and corrugating medium by 300 tons per day.

PAPER AND BOARD MILLS

Georgia's paper and board industry consists of 28 firms, 15 of which are integrated pulp, paper, and board mills. The paper and board industry has an output capacity exceeding 16,000 tons per day. This capacity is concentrated in the integrated pulp, paper, and board mills, which represent more than 90 percent of total capacity.

The geographical dispersion of Georgia's 21 leading paper and board mills by tons per day of capacity is presented on Map 3. Paper and board mills in Georgia are typically large scale, capital intensive operations, as illustrated by the following distribution of production capacities.

Paper and Board Capacity (Tons per Day)	Number of Mills
2,000 and over	2
1,000 to 1,999	3
500 to 999	6
Under 500	10

All paper and board mills in Georgia that are not integrated with a pulp mill have a daily production capacity of under 500 tons. These mills have clustered in metropolitan areas since World War II and typically serve a regional market. The scale of employment in unintegrated mills is substantially less than is generally found in integrated pulp, paper, and board mills.

Using a combined industry classification, the county location of employment in Georgia's pulp, paper, and board mills is depicted on Map 4. Because of the widespread integration of paper and board mills with pulp mills, employment is concentrated in those counties with an established wood pulping capacity.

Georgia's integrated mills currently produce daily an estimated 15,200 tons of pulp and 14,600 tons of paper and board products. The nonintegrated pulp mills produce an estimated 1,250 tons of pulp daily, and the nonintegrated paper and board mills in Georgia produce 44 major classifications of products. Certain of these products enter final markets, while others provide inputs to manufactured products by converted paper products plants and container and box plants.

CONVERTING PLANTS

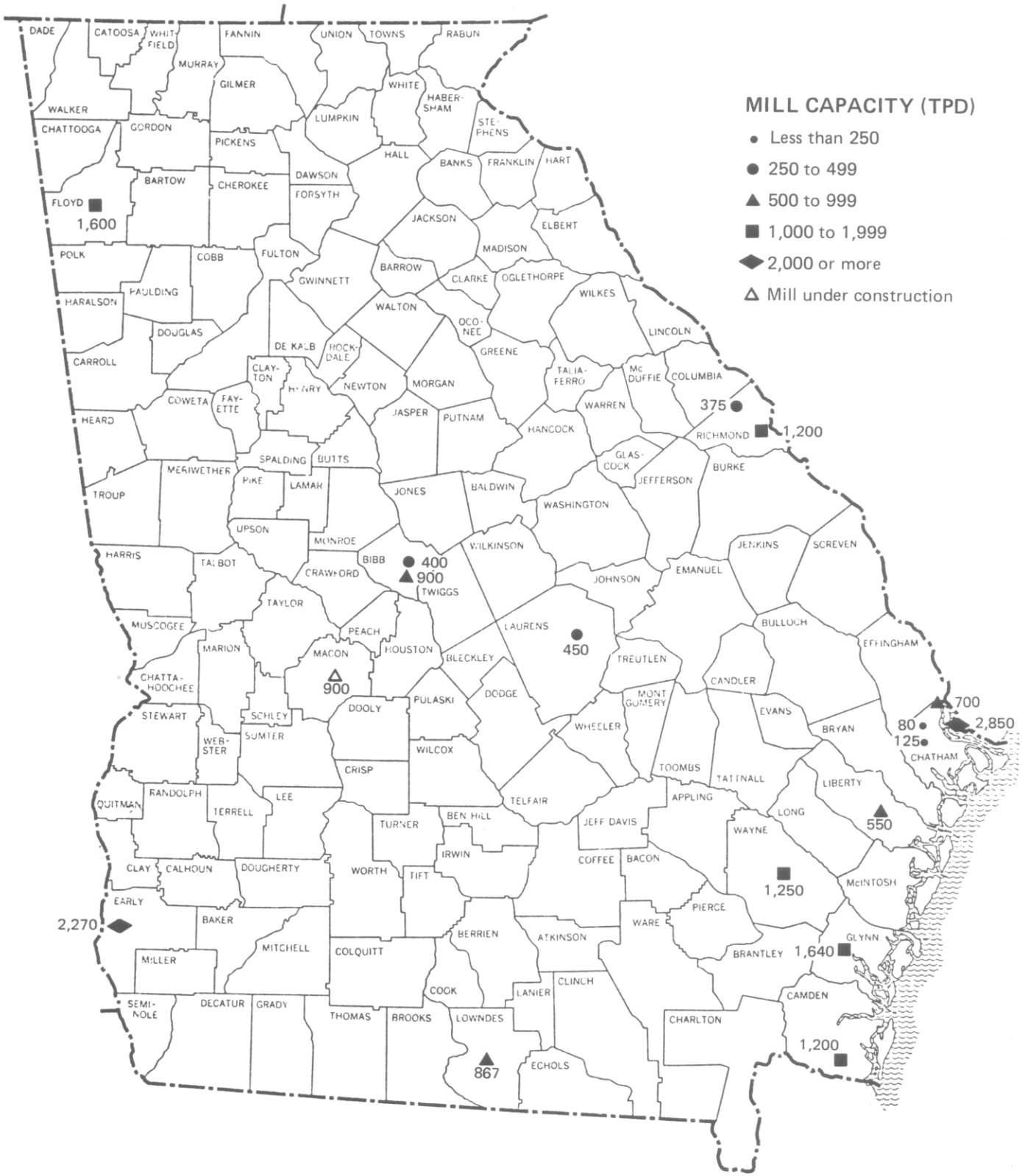
The paper and paperboard converting industries in Georgia represent a complex structure of 60 converted paper and paperboard products plants, 62 paperboard container and box plants, and 23 plants that manufacture both converted and other paper and allied industry products. Specifically, Georgia plants manufacturing converted paper and paperboard products produce 42 standard products and paperboard container and box plants produce 17 product classifications.

The distribution of employment in converted paper and paperboard plants by county is presented on Map 5. A few counties with very limited employment and usually a single plant are not included to avoid disclosure. Employment in the converting industries is markedly concentrated in metropolitan areas. It is noteworthy that 22 firms in this industry classification are located in Atlanta and five are situated in Macon.

The distribution of paperboard container and box plants is more diffused geographically than the scatter of converted paper and paperboard plants. This is illustrated in the location of the 18 Georgia counties with significant employment in the industry, as shown on Map 6. Interestingly, nine of the counties with significant employment in the container and box industry are dually listed as having significant employment in the converted paper and paperboard industry. Again, a pronounced urban location tendency is illustrated by the container and box industry, since proximity to industrial customers is a meaningful location determinant.

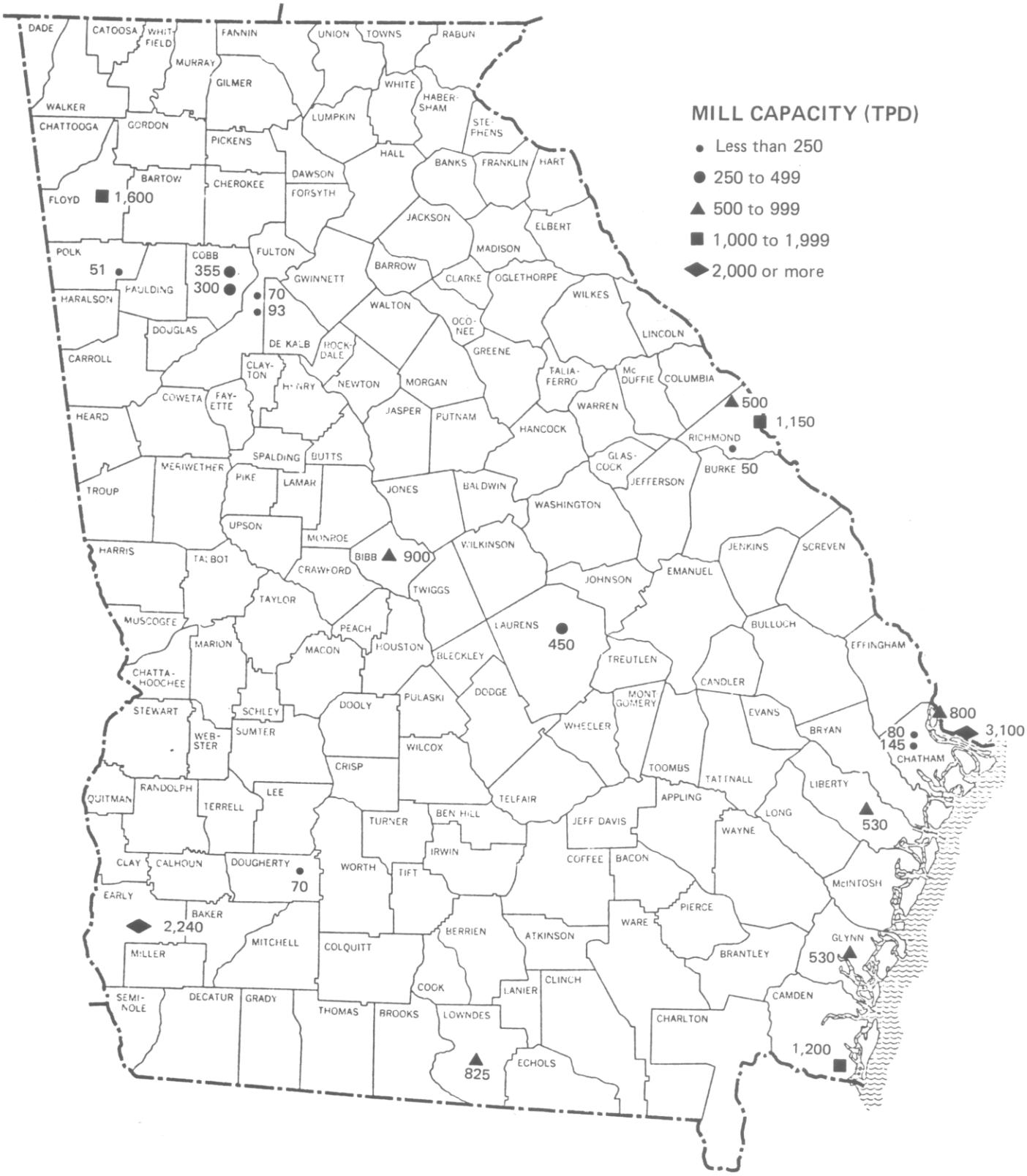
Map 2

Georgia Pulp Mill Production Capacities
(Tons Per Day)



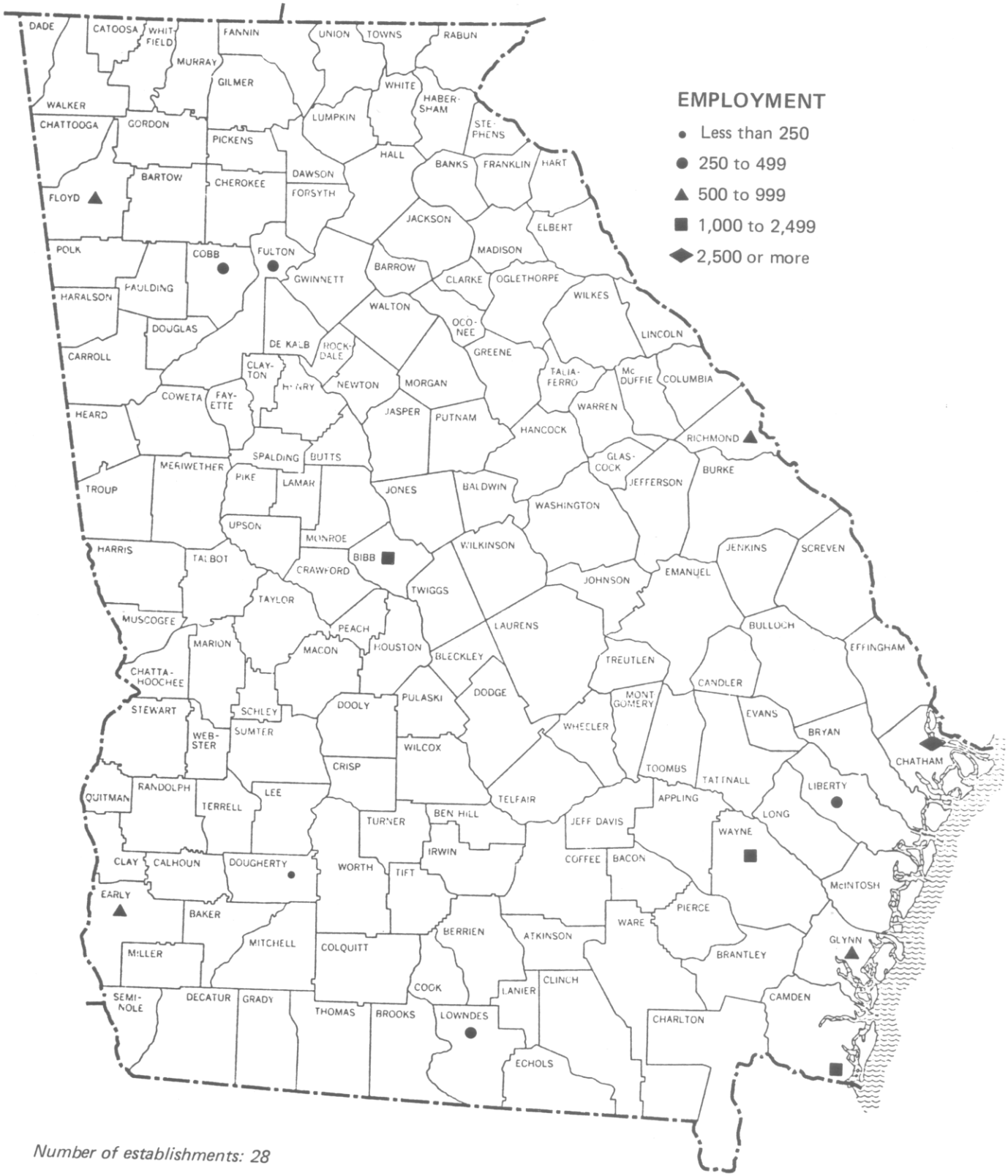
Map 3

Georgia Paper and Board Mill Production Capacities
(Tons Per Day)



Map 4

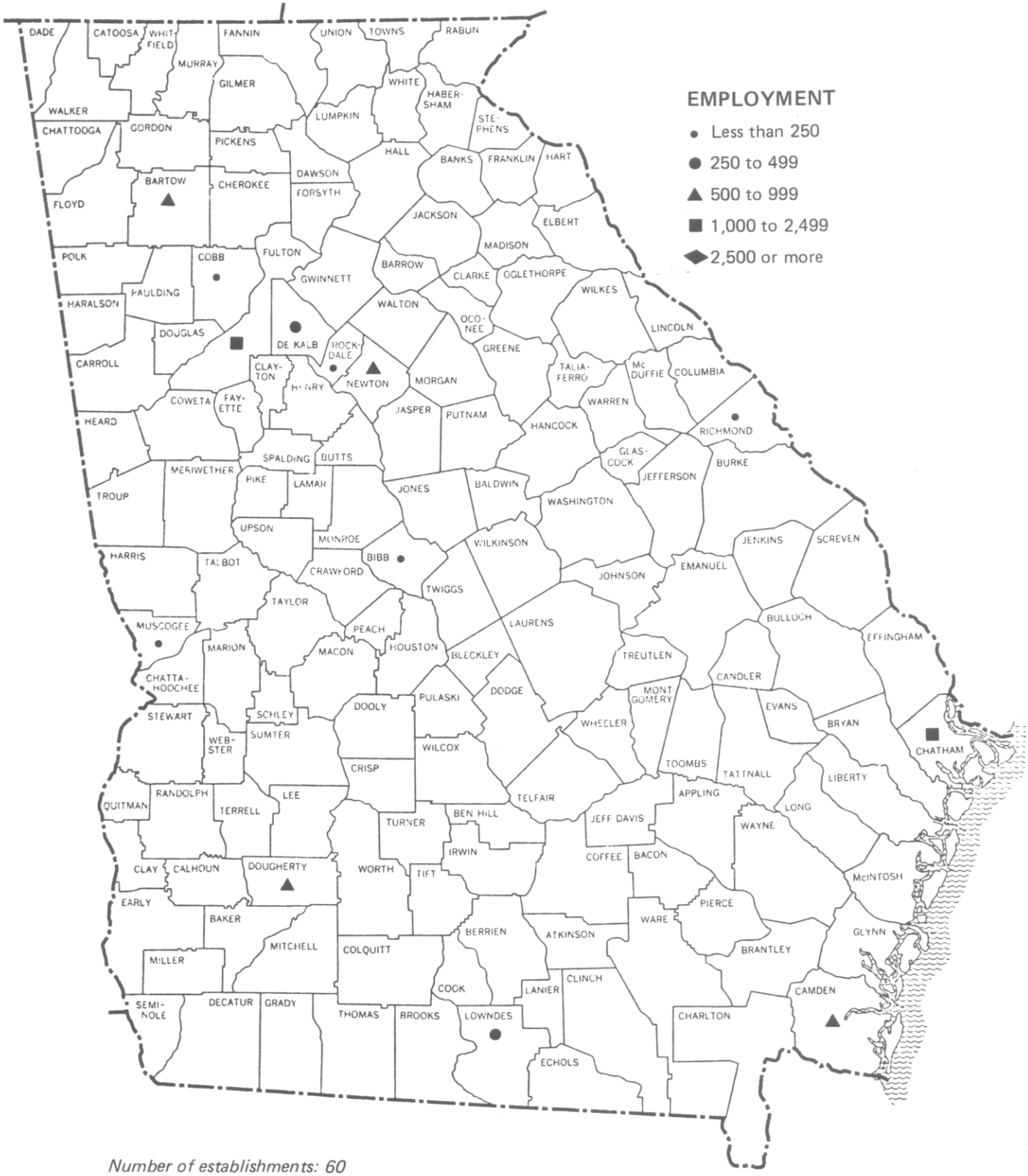
Georgia Employment In Pulp, Paper, And Board Mills
(By County)



Number of establishments: 28

Map 5

Georgia Employment In Converted Paper And Paperboard Products
(By County)

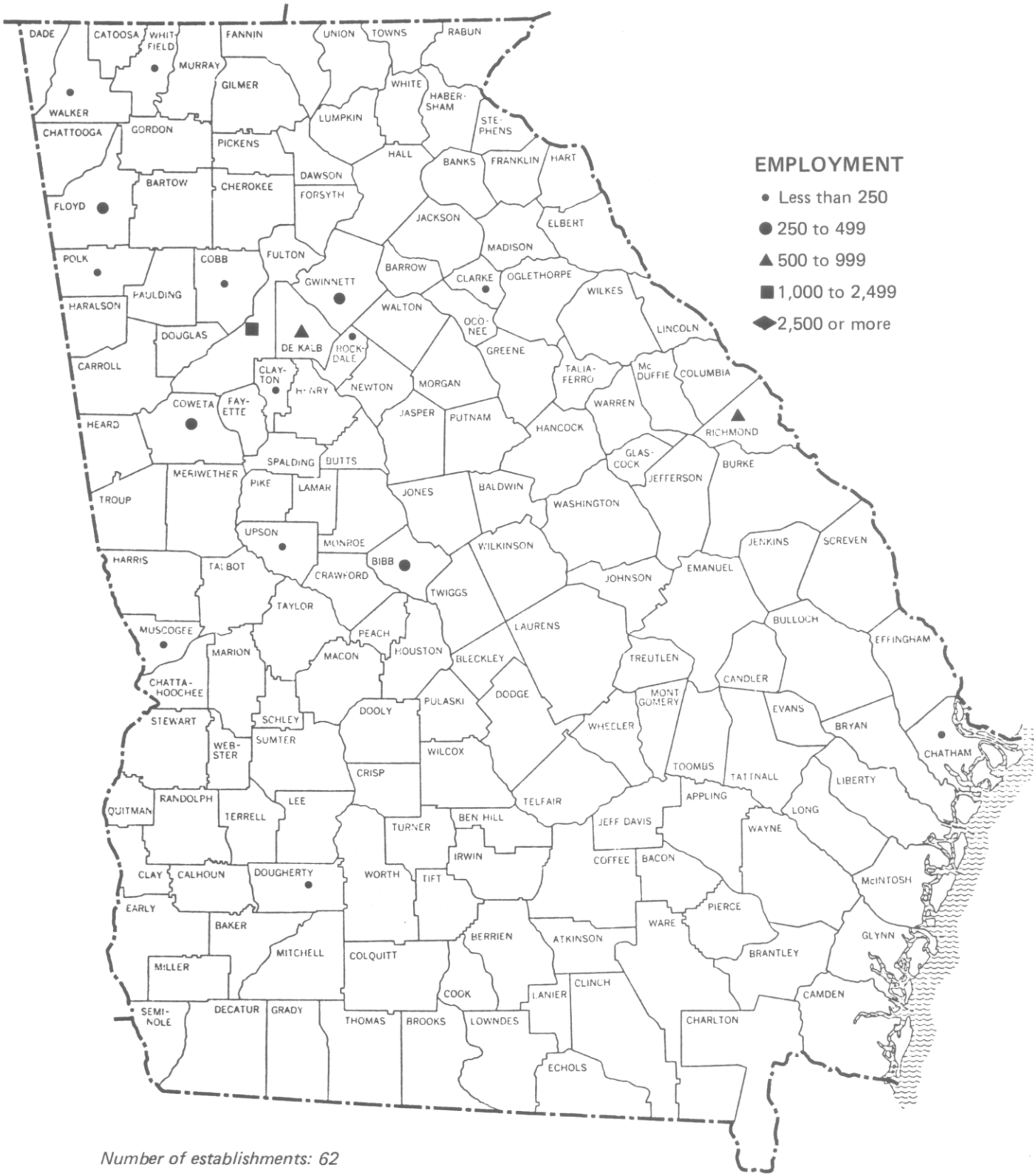


Number of establishments: 60

MAP 6

Georgia Employment In Paperboard Container And Box Plants

(By County)



Number of establishments: 62

GEORGIA FORESTRY COMMISSION

A. Ray Shirley, Director

John W. Mixon, Chief of Forest Research

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