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An Economic Analysis of Forest Products and Nature-Based Tourism Sectors in North Carolina

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ABSTRACT As part of a study on the impacts of wood chip mills in North Carolina, we analyzed the economic contributions of the forest products sector and tourism sector in the state, using a variety of regional economic and demographic data bases and the IMPLAN input-output model. As of 1996, forest products firms in the state employed about 105,000 people and the nature-based tourism sector about 91,000 people. Total employee compensation in the forest products industry was \$3.2 billion; for tourism it was \$1.4 billion. Industrial output was \$13.5 billion for the forest products industry in 1996, and \$3.9 billion for the tourism sector. Value added, which provides a economic measure consistent with Gross State Product (GSP), was \$4.9 billion for the forest products sector and \$2.2 billion for the nature-based tourism sector, compared to the state GSP of \$204 billion. From 1977 to 1996, value added in the forest products sector increased 6.6 percent per year, compared to 8.7 percent for the total state economy, and 9.1 percent for the tourism-based sector. The oldest population class in the state (65 years or more) was projected to increase the most (90 percent) over the next two decades, compared to 30 percent for the total state population, favoring more growth in the service-based economic sector than the manufacturing sector.

In May of 1998, the North Carolina Department of Environment and Natural Resources (DENR) funded a North Carolina Wood Chip Mill Study, which examined the economic and ecological impacts associated with production of wood chips at satellite chip mills in the state of North Carolina. The study was completed in the Fall of 2000. One of the major issues identified at the beginning of the

wood chip study was the comparative economic contributions of wood chip mills and the forest products industry versus that of forest-related tourism, stemming from concerns that increased timber harvesting would be detrimental to the tourism industry. This paper summarizes the approach and findings of our economic analyses of the forest products industry and tourism sectors contributions to the economy in the state of North Carolina. This research employed several demographic, employment, and economic data sources and the IMPLAN model to describe the forest products and nature-based sectors in North Carolina. This article is a more focused analysis based on a wood chip mill study final technical report, which can be obtained at <http://www.env.duke.edu/scsf/>.

METHODS

Our wood chip mill study performed a regional economic impact analysis of the forest products and nature-based tourism sectors in the state using available data. This included basic data from the U.S. Department of Commerce (Regional Economic Information System 1969-1995; Bureau of Census 1992, 1994, 1995, 1996; Bureau of Economic Analysis 1990); Department of Labor Bureau of Labor Statistics (1998) on population and business trends; the USDA Forest Service IMPLAN input-output model (Alward and Palmer 1983; Minnesota IMPLAN Group 1998; U.S. Department of Agriculture, Forest Service 1977, 1996); and various other sources for model inputs. These data sources and models used parallel approaches used by Leatherman and Marcouiller (1996) and Marcouiller and Mace (1999) in analyzing tourism-based and timber and tourism-based economies in Wisconsin. These data and the IMPLAN model approaches were augmented by periodic meetings with a 17 member technical advisory board, which reviewed our study approaches, assessed the applicability of the methods for North Carolina, and occasionally suggested modifications.

We compared and contrasted the economic contributions made by the forest-based manufacturing and tourism sectors in North Carolina using the IMPLAN (Impact analysis for PLANning) computer model, which represents the structure of the region's economy. We ran the model using 1977 and 1996 data, and examined the shares of these forestry and tourism sectors in relation to

the overall economy. IMPLAN provided a quantitative input-output approach to estimating the economic impact on an area's economy. IMPLAN accounts for revenues, income, and jobs for the self-employed and government sectors of the economy as well. The census data described above does not include self-employed people. IMPLAN is a large economic accounting matrix that divides all the economic activity for a state or region into separate sectors of the economy, such as those identified by Standard Industrial Codes (SICs) for manufacturing (e.g., pulp and paper), retail (e.g., food stores), or services (e.g. automobile repair). IMPLAN can divide each component of the economy—including employment, wage earnings, industrial output, and value added—among the industrial and service sectors identified in the model. Thus the relative share of each sector to the state or regional total can be estimated without any double counting. Similarly, the multiplier effects of one sector on the other sectors in the matrix (state or regional economy) also can be estimated without double counting.

This study examined the total economic contributions of all forest products manufacturing firms, spanning the processing chain from timber harvesting through the manufacture of lumber or pulp and paper. Analyses of timber markets in the state indicated that wood chip mills were just one part of an integrated forest products processing chain. Similarly, forest-based tourism was defined as including portions of all direct nature-based service activities that could be related to tourism. These approaches provided a broad regional economic comparison between the two identified sectors. Aggregate data were collected for various time periods and broad regions of the state. We were not, however, able to identify specific small scale areas that could quantify specific tradeoffs between forest harvesting and tourism. Rather we analyzed trends in these two sectors over time based on government data sources and the IMPLAN model.

We compared the economic contributions of the forest products sector and tourism sector based on the 1977 and 1996 IMPLAN data. The forest products sector industrial codes for solid wood products, wood-based furniture, and pulp and paper were identified directly in the IMPLAN data base. The specific sectors in the IMPLAN data that correspond to those SIC codes 24, 25, and 26 were used as the forest products manufacturing sector.

The nature-based tourism sector economic impacts were estimated as a proportion of several identified service sectors in IMPLAN, based on a method developed by Redmond (1999) for the Southern Appalachian Assessment Study (SAMAB 1996). The share of each sector's contributions to tourism were based on a study in West Virginia. The sector shares included: hotels and lodging (36 percent), amusement and recreation (36 percent), air transportation (28 percent), local, interurban transit (36 percent), retail trade-merchandise and food (5 percent), eating and drinking (15 percent), auto repair (12 percent), and auto rental (9 percent). These percentage breakdowns might tend to overestimate the impact of tourism as a share of North Carolina's economy, since it has a broader manufacturing base than West Virginia. These were the best available estimates based on any empirical data, and were used in the similar SAMAB economic study. The relative proportions were presented to, examined closely, and discussed by forest industry and environmental representatives on the wood chip mill technical advisory board, and were considered acceptable.

RESULTS

Population and Economic Trends

As of 1996, North Carolina's population was 7.3 million people. The greatest population densities were in the Piedmont, with 250 people per square mile. Population densities in the Mountains and Coastal Plain were about 100 people per square mile. North Carolina's population is projected to increase 30 percent between 1998 and 2025. People age 65 and over are projected to increase about 90 percent during the period; younger people about 20 percent. Personal income is projected to increase 68 percent by 2025.

The Regional Economic Information System (REIS) data from the Bureau of Economic Analysis (U.S. Department of Commerce – REIS 1969-1995) were used as one source to examine economic trends from 1970 and 1995. In 1970, the manufacturing sector accounted for 32 percent of the employment in the state. Government enterprises, services, and retail trade sectors were the next and employed 17.8 percent, 16.1 percent and 13.4 percent of the total employment in the state. By 1995, the service sector was

the largest employer, at 24.2 percent of the employment in the state. There was a 11.6 percent decline in employment in the manufacturing sector (to 20.7 percent of state employment). Government sector employment declined to 15.9 percent of the total and retail trade increased to 17.2 percent by 1995.

IMPLAN Model Analyses

Employment, Compensation, Industrial Output, and Value Added. Based on the IMPLAN model analyses, we estimated the total employment, employee compensation, industrial output, and value added for the relevant forest products and nature-based economic sectors in North Carolina. As of 1996, forest products firms employed about 105,000 people and the nature-based tourism industry employed about 91,000 people in North Carolina (Table 1). Total employee compensation in the forest products sector was \$3.2 billion; for nature-based tourism it was \$1.4 billion. Thus the average forest products sector annual wage was \$30,800. This could be computed as an average annual wage of \$47,200 for the paper and allied products sector, \$26,600 for wood furniture, and \$25,800 for lumber and wood products sectors. The average tourism sector annual wage was \$15,500, although many of these positions were probably seasonal rather than full time jobs. The state average annual wage was \$26,500.

Industrial output was \$13.5 billion for the forest products industry in 1996, and \$3.9 billion for the tourism sector. We also computed and independent, almost identical estimates of \$3.8 billion tourism total expenditures based on the estimates of tourism recreation visitor days for North Carolina times expenses per day, derived from Chen (1996).

Value added is the best measure of a sector's relative contribution to a state's (or country's) economy, because the sum of this for all sectors adds up to the Gross State Product (or Gross National Product), and value added avoids any double counting among industries. North Carolina's value added (GSP) in 1996 was \$204 billion. Value added in the forest products industry (\$4.9 billion) was greater than for the tourism sector (\$2.2 billion). Thus the

Table 1. Summary of IMPLAN Regional Economic Analyses of Forest Products Based and Nature Tourism Based Sectors in North Carolina, 1977 and 1996.

Sector	Employment		Employee Compensation		Industrial Output		Value Added		Average Wage	
	1977 (number)	1996 Change (number) (%)	1977 (million \$)	1996 Change (million \$) (%)	1977 (million \$)	1996 Change (million \$) (%)	1977 (million \$)	1996 Change (million \$) (%)	1977 (\$)	1996 Change (\$) (%)
Lumber and wood products	32,895	39,713 21	280	1,023 265	1,352	4,475 231	456	1,661 264	8,526	25,770 202
Wood furniture	38,921	42,534 9	390	1,131 190	1,148	3,506 205	469	1,428 204	10,014	26,595 166
Paper and allied products	21,189	23,109 9	356	1,091 207	1,524	5,568 265	530	1,828 245	16,785	47,224 181
Total forest products manufacturing	93,005	105,356 13	1,026	3,246 216	4,024	13,549 237	1,455	4,917 238	11,030	30,809 179
Total Tourism based sector	32,645	90,974 179	264	1,413 435	737	3,902 429	420	2,206 425	8,087	15,532 92
Region's all sectors	2,338,876	4,449,948 90	26,013	117,932 353	82,256	375,694 357	42,252	204,967 385	11,122	26,502 138
% forest products manufacturing of North Carolina's economy	3.98	2.37	3.94	2.75	4.89	3.61	3.44	2.40		
% tourism based sector of North Carolina's economy	1.40	2.04	1.01	1.20	0.90	1.04	0.99	1.08		
Economic Multipliers, 1996	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II		
Lumber and wood products	1.50	2.01	1.65	2.13	1.55	1.88	1.70	2.25		
Wood furniture	1.36	1.80	1.40	1.81	1.43	1.89	1.53	2.10		
Paper and allied products	2.11	3.12	1.87	2.41	1.63	1.93	1.90	2.44		
Tourism	1.29	1.61	1.11	1.43	1.40	1.75	1.42	1.90		

Source: Author estimates from IMPLAN.

forest products industry had much larger industrial output than tourism, but only a moderately larger value added. This indicates that tourism, which relies mostly on labor and local inputs, creates more value to the state's economy per amount of sales. Forest industry, however, creates more value with fewer employees, because of high capital costs.

As of 1996, the forest products sector in total comprised 2.75 percent of employee compensation payments in the state; 3.6 percent of industrial output; and 2.4 percent of value added. Nature-based tourism comprised 1 percent of employee compensation; 0.9 percent of industrial output; and 1.1 percent of value added. Both sectors comprised slightly more than 2 percent of total state employment. Forest industry employment levels have essentially stabilized in the last two decades, while tourism employment, as part of the service sector, is increasing faster than the overall state average.

The forest products sector had greater economic impacts on the state's economy in 1996 than tourism. In fact, the forest products industry was very robust, among the largest of any state in the South or the country, particularly due to the large wood-based furniture industry. However, from 1977 to 1996, the employment and economic output of the forest products industry grew more slowly than the rest of the state's economy. Total forest products employment increased only 13 percent in 19 years, while nature-based tourism employment almost tripled, increasing 179 percent.

The total employee compensation for forest products firms increases from 1977 to 1996 ranged from 190 percent for the wood furniture sector to 265 percent for the lumber and wood products sector. The value of industrial output for the three forest products sectors increased from 207 percent to 265 percent during the 1977 to 1996 period. Value added increases for forest products firms ranged from 204 percent to 264 percent. During the same period, increases in the nature-based tourism sectors were 435 percent for employee compensation, 429 percent for industrial output, and 425 percent for value added.

These periodic increases in economic activity can be compared to the state average growth rate of 350 percent to 380 percent for all economic measures. Based on value added, the periodic increases would convert into compounded annual increases of 6.6

percent for the forest industry; 9.1 percent for the tourism sector, and 8.7 percent for the entire state economy.

Regional Economic Multipliers

The Type I and Type II output multipliers represent the value of production required from all sectors by a particular sector to deliver one dollar's worth of output to final demand (Table 1). Final demand is the ultimate consumption of commodities, including both goods and services. The size of the multiplier does not represent the importance of a given industry or sector for the economy. It provides an estimate of the impact created if that industry's sales to final demand ratio changed. Hence, it is an indicator that can be used to gauge the interdependence of sectors. The multipliers are based on the mathematical relationships among each cell in the input-output model, and thus prevent double counting of the independent sectors. The larger the output multiplier, the greater the dependence of the sector on the rest of the regional economy and the more a dollar turns over in an economy.

Type I multipliers give the direct and indirect effects only, whereas Type II give the direct, indirect and induced effects. The Type II multipliers indicate that for a one dollar change in final demand for an industry, increases occur in inter-industry economic activity (as in Type I), but it also means that the income of people employed producing the output for this industry increases. These people spend their income on personal consumption, which leads to demands from other local industries.

Regional economic multipliers were generated directly by IMPLAN for each forest products sector (Table 1). We computed weighted average multipliers for tourism based on the proportion of each sector making up the total tourism sector. Pulp and paper Type I multipliers ranged from 1.63 for Industrial Output to 2.11 for Employment; Type II multipliers ranged from 1.93 to 3.12. Wood furniture Type I multipliers ranged from 1.36 to 1.53 for Value Added; Type II multipliers from 1.80 to 2.10. Lumber and wood products sector Type I multipliers ranged from 1.50 for Employment to 1.70 for Value Added; Type II ranged from 1.88 to 2.25. Tourism Type I multipliers ranged from 1.11 for Employee Compensation to 1.42 for Value Added; Type II from 1.43 to 1.90.

Overall, the forest products sector multipliers were slightly to moderately greater than those for tourism. Pulp and paper multipliers were the highest, generating more economic activity in the local economy. The differences between the solid wood sector and the furniture sector and tourism sector were small, indicating that local economies benefited slightly more from new wood-based manufacturing than from tourism services in generating additional economic activity.

CONCLUSIONS

Industry Sector Shares and Trends

In conclusion, it is clear that both the forest products sector and the tourism sector are extremely important to the economy of North Carolina. Indeed, large reductions in either sector would lead to drastic consequences for the state as a whole, and particularly for the rural areas where one or both of the sectors provides a large share of the economic development and activity. Timber-based manufacturing employment has pretty much stabilized due to labor-saving technical change. Timber manufacturing economic contributions for employment, employee compensation, industrial output, and value increased in magnitude at an annual rates of 0.6 percent, 6.2 percent, 6.6 percent, and 6.6 percent per year, respectively, from 1977 to 1996. Tourism-based economic contributions, although smaller in absolute terms, increased in magnitude more rapidly, at 5.5 percent per year for employment, 9.2 percent for employee compensation, 9.2 percent for industrial output, and 9.1 percent for value added.

Projections indicate that North Carolina's population will grow rapidly in the next two decades, with about a 30 percent increase statewide. However, the population of age 65 and older is projected to increase almost 90 percent during this period. Coupled with projected large increases in disposal personal income, we expect that nature tourism sector demand will increase even more rapidly than the state economy as a whole and the manufacturing-based economy.

A Comparison with Wisconsin

Our results can be compared with those found by Leatherman and Marcouiller (1996) and Marcouiller and Mace (1999) in Wisconsin. They used similar Census Bureau data and IMPLAN modeling to estimate the impacts of timber and tourism-based sectors. They employed a broader definition for tourism, including all relevant transportation, retail firms such as restaurants as gift shops, and hotel, motels, and recreational/amusement firms (e.g. bowling alleys). Leatherman and Marcouiller (1996) found that total Wisconsin employee compensation for tourism was \$1.38 billion in 1991—similar to our estimate of \$1.41 billion for North Carolina nature-based tourism in 1996.

Marcouiller and Mace (1999) used a broad definition of tourism that included all relevant urban and rural activity, and had much greater shares of each economic sector in their Wisconsin study. Their definition included income from travelers, which ranged from 18 percent to 100 percent of the expenditures for eating, drinking, miscellaneous retail, bowling alleys, and amusement and recreation. This compared to the 9 percent to 36 percent attributed to nature-based tourism that we used in our North Carolina study. In addition, the Wisconsin study included from 23 percent to 73 percent of the expenditures for building and maintaining recreational homes, food stores, and recreational real estate. We did not include these in our nature-based recreational estimates.

Marcouiller and Mace (1999) found that in 1994 the total Wisconsin industry output for all forest products sectors was \$14.9 billion and for all tourism sectors it was \$13.8 billion. For comparison, our 1996 estimates were \$13.5 billion for the forest products sectors and \$3.9 for nature-based tourism sector. The 1994 Wisconsin (1996 North Carolina) estimates for employee compensation were \$3.6 billion (\$3.2 billion) for forest products industries and \$4.8 billion (\$1.4 billion) for the relevant tourism sectors. Estimated Wisconsin (North Carolina) employment was 99,138 (105,356) forest products jobs and 447,259 (90,974) for the relevant tourism sectors. Average wages for jobs in the tourism-sensitive sectors in Wisconsin were \$11,000 per year, versus \$36,800 in the wood-based industries and \$25,000 per year across all sectors. These results were similar to those that we found in North Carolina.

Marcouiller and Mace (1999) found that roughly 12 percent of the Gross State Product and 18 percent of the jobs in Wisconsin were directly or indirectly related to the forest products industries or tourism-sensitive sectors. This was a larger proportional share than we found in North Carolina, which had a combined forest products and tourism employment shares of 4.4 percent and GSP share of 3.5 percent. This can be attributed to the much broader definition of the tourism sector, as well as the greater share of the each activity attributed to tourism. We drew our definition from related forest-based recreation studies in West Virginia and the Southern Appalachian Man and the Biosphere approaches (SAMAB 1996; Redmond 1999), which focused more on nature tourism in small rural economies. At least the Wisconsin results suggest that we did not grossly overestimate North Carolina tourism impacts based on the West Virginia primary data used as a basis for relative tourism shares of identified IMPLAN sectors.

The Type II output multipliers found for forest products were reasonably similar in both the Wisconsin and North Carolina studies. The multipliers for forest products sectors in Wisconsin ranged from 1.91 for reconstituted wood products to 2.18 for secondary wood processing. The North Carolina industrial output multipliers were all about 1.9. The Wisconsin Type II output tourism sensitive-sector multipliers were about 2.2; the weighted average North Carolina industrial output multiplier for tourism was 1.75. The slightly larger Wisconsin sector multiplier could again be attributed to the larger definition of a tourism sensitive sector. The studies were consistent in finding that tourism-based multipliers are almost as large (North Carolina) or larger (Wisconsin) than the forest products sector multipliers. This refutes a commonly stated belief that the basic manufacturing sector creates much larger multiplier effects.

Policy Implications

Overall, the Wisconsin and North Carolina regional economic studies were very consistent in their findings regarding the contributions of the forest products sector in the state, and had explainable differences in the tourism sector based on how broadly it was defined. The broad Wisconsin definition, which included recreational residences and maintenance, increased the share of recreation value

added in the state. Our nature tourism estimates included only direct expenditures for services, so were smaller. They were thus also more consistent with not including home building as part of the forest products sector. For comparison, we did find fairly similar rankings of the contributions of the forest products sector to the economy of most southern states as well in a prior study (Aruna et al. 1997)

Several other components of timber and tourism tradeoffs have been analyzed both in our wood chip mill study (Aruna and Cubbage 2000), by Marcouiller and Mace (1999), and by many other authors. These include opinions of persons who use forests about goals and values; opinions about clearcutting or other harvesting methods and appearance; and estimates of nonmarket values of forests (Murthy et al. 2001) in addition to those market values we summarized in this study. Those opinions and nonmarket values vary widely, as one would suspect, so we will demur on making generalizations here. But such broad regional differences and site specific impacts of tourism and timber management tradeoffs also affect resource management and protection. The fact that both forest products-based and tourism-based economic contributions increased in North Carolina is probably of no comfort to persons who have a clearcut made next to their house or a wood chip mill sited on their road. Aggregate state-wide economic benefits surely will not always mean everybody is better off locally.

Our research on the broad regional impacts and growth trends does provide better and internally consistent trends for forest products based and nature tourism-based economic contributions in the state of North Carolina. In aggregate, prudent development of both timber-based and tourism-based activities can provide more economic benefits from each sector in the future. Demographic and economic trends suggest that timber-based economic contributions will remain large, and tourism-based contributions will grow more rapidly. Timber-based and nature tourism-based sectors do complement each other as long as neither becomes too dominant, like all manufacturing and service sectors. These findings and conclusions were consistent in similar but independent studies performed in both North Carolina and in Wisconsin, which represent fairly different physiographic and economic regions. The crux of successful economic and environmental protection policies will be to balance

growth of these natural resource based sectors carefully and sustainably so that we do not diminish their utility, value, and enjoyment for future residents of and visitors to North Carolina, or indeed to other states.

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