



What are Forestry Economic Contribution Reports? Making Sense of the Terms and Numbers in Economic Contribution Reports.

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Dec 17, 2019



Dr. Rajan Parajuli, Assistant Professor and Extension Specialist, NC State University

Dr. Shaun Tanger, Assistant Professor, Mississippi State University

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Webinar Outline

- Example forestry contribution reports
- The Journal of Extension Article
- I-O modeling and related terminology
- Common pitfalls to avoid
- Economic contribution analysis methods
- Forestry and forest product industry sectors
- IMPLAN and multipliers



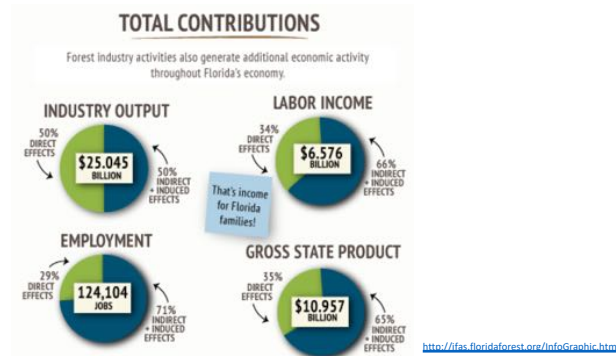
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Forestry Contribution Reports

- These analyses attempt to measure the **size and performance** of the forest sector
- Information such as jobs, wages and salaries, value-added are crucial to forestry stakeholders



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Forestry Contribution Reports

- Periodic reports in most of the southern states are posted at www.forestryimpacts.net
- These reports often vary widely in **modeling**, **results presentation**, and **interpretation** of estimates

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Example Contribution Reports

Economic Contribution of the Forest Sector in North Carolina, 2017

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Economic Contribution of the North Carolina Forest Sector in 2017¹

	Employment ¹ (jobs)	Labor Income ¹ (million \$)	Value Added ¹ (million \$)	Industry Output ¹ (million \$)
Direct Contribution¹				
Forestry operations	399	18.78	44.50	53.47
Logging	6,166	273.91	296.01	431.54
Primary solid wood mills ²	8,090	459.91	679.48	2,818.54
Secondary solid wood mills ³	39,997	1,910.31	2,407.80	7,426.99
Primary paper and paperboard mills	4,124	406.64	734.24	3,148.83
Secondary paper and paperboard mills	12,867	912.14	1,471.62	6,080.55
Total	71,642	3,981.69	5,633.64	19,959.93
Total Contribution¹				
Forestry	544	27.77	33.63	57.58
Logging	8,279	406.99	504.31	881.10
Primary solid wood products	18,716	989.00	1,688.96	4,406.27
Secondary solid wood products	73,217	3,493.18	5,336.38	12,912.22
Primary paper and paperboard products	16,707	1,056.04	1,876.52	5,313.62
Secondary paper and paperboard products	32,394	1,880.81	3,160.66	9,169.63
Total	149,856	7,853.78	12,600.46	32,740.43

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Example Reports

Economic Contributions of the Forest Industry and Forest-based Recreation in Florida in 2016

FLORIDA

FOREST INDUSTRY
ECONOMIC CONTRIBUTIONS

2016

Summary of economic contributions of the forest industry in the state of Florida in 2016

Industry Group	Impact Type	Employment Fulltime, Part- time Jobs	Labor Income	Value Added	Industry Output	State & Local Taxes	Federal Taxes
Forestry Production	Direct Effect	8,352	389	447	719	14.8	80.2
	Indirect Effect	1,564	54	98	146	4.2	14.2
	Induced Effect	6,669	316	530	904	41.5	62
	Total Effect	16,584	758	1,074	1,769	60.6	176.5
Primary Wood Product Manufacturing	Direct Effect	6,766	325	414	1,796	21.6	75.8
	Indirect Effect	3,239	175	253	505	23.8	42.9
	Induced Effect	8,544	406	679	1,155	52.6	105.4
	Total Effect	18,549	907	1,355	3,445	98	224
Secondary Wood Product Manufacturing	Direct Effect	5,304	236	323	985	7.7	55.4
	Indirect Effect	392	22	33	64	2.6	5.3
	Induced Effect	1,406	67	112	191	8.7	17.3
	Total Effect	7,101	324	468	1,239	19.2	78
Primary Paper Product Manufacturing	Direct Effect	3,222	338	689	2,762	27.2	97.7
	Indirect Effect	8,001	444	710	1,392	71.9	112.7
	Induced Effect	26,132	1,249	2,078	3,531	158.9	323.2
	Total Effect	37,355	2,031	3,477	7,685	258.1	533.6
Converted Paper Product Manufacturing	Direct Effect	6,081	444	924	3,453	35.2	128.7
	Indirect Effect	2,713	161	285	526	24.7	41.6
	Induced Effect	11,822	564	941	1,603	72.3	146.1
	Total Effect	20,615	1,169	2,150	5,582	132.3	316.4
Forest Chemical Manufacturing	Direct Effect	699	55	106	1,325	20.9	34.6
	Indirect Effect	2,361	130	214	421	20.2	33.6
	Induced Effect	6,118	294	486	623	36.8	75.8
	Total Effect	9,178	479	807	2,370	78	144.1
Sawmill Woodworking and Paper Machinery Manufacturing	Direct Effect	95	7	8	23	0.3	1.4
	Indirect Effect	41	2	4	7	0.3	0.6
	Induced Effect	207	10	16	28	1.3	2.5
	Total Effect	343	19	28	58	1.9	4.5
Wholesale Trade Lumber and Wood	Direct Effect	5,412	446	666	1,362	162.9	129.3
	Indirect Effect	1,348	57	108	190	6.8	16.9
	Induced Effect	7,494	360	596	1,005	44.8	93
	Total Effect	14,255	874	1,569	2,558	214.6	239.2
Biomass Electric Power Generation	Direct Effect	114	16	50	139	17.9	5.7
	Indirect Effect	0	0	0	0	0	0
	Induced Effect	0	0	0	0	0	0
	Total Effect	114	16	50	139	17.9	5.7
Total Industrial Activity (not including recreation)	Direct Effect	36,055	2,256	3,626	12,554	308.6	608.9
	Indirect Effect	19,559	1,055	1,694	3,251	154.8	267.7
	Induced Effect	68,591	3,265	5,438	9,240	417.1	645.4
	Total Effect	124,204	6,576	10,957	29,045	880.4	1,322.0

Forest
Chemical
Manufacturing

Biomass
electric power
generation

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Example Reports

FOREST PRODUCTS INDUSTRIES' ECONOMIC CONTRIBUTIONS TO MICHIGAN'S REGIONAL ECONOMIES 2016 UPDATE

Industries in Michigan, 2014.

Forest Products Industries	Employment (Jobs)	Output (Millions of 2014 Dollars)	Labor Income
Direct Contributions			
Forestry	678	45.2	20.4
Logging	4,402	402.4	160.9
Primary Solid Wood Products and Wood-based Power	5,022	1,693.6	280.7
Secondary Solid Wood Products	6,874	1,157.7	320.5
Wood Furniture	9,943	2,017.1	628.2
Primary Paper and Paperboard Products	3,288	2,603.4	332.0
Secondary Paper and Paperboard Products	8,084	3,682.0	554.9
Grand Total	38,291	11,601.3	2,297.6
Total Contributions			
Forestry	1,019	79.8	33.2
Logging	7,076	689.5	260.5
Primary Solid Wood Products and Wood-based Power	17,197	3,399.7	847.4
Secondary Solid Wood Products	14,049	2,225.0	669.5
Wood Furniture	20,078	3,498.9	1,113.2
Primary Paper and Paperboard Products	15,318	4,566.7	959.4
Secondary Paper and Paperboard Products	21,888	5,874.6	1,266.7
Grand Total	96,623	20,334.1	5,150.1

Multipliers for 7 Aggregated Forest Products

Forest Products Industries	Employment (Jobs)	Output (Millions of 2014 Dollars)	Labor Income
Forestry	1,019	79.8	33.2
Logging	7,076	689.5	260.5
Primary Solid Wood Products and Wood-based Power	17,197	3,399.7	847.4
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Forestry Contribution Reports

- They often gloss over needed details such as
 - IMPLAN sectors included,
 - the IMPLAN method of analysis, and
 - explanation of IMPLAN and modeling terminology

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Journal of Extension Article

- Recent JOE article presents strategies for interpreting those reports
- Full copy of the article:
<https://www.joe.org/joe/2019august/tt7.php>



August 2019
 Volume 57
 Number 4
 Article # 4TOT7
 Tools of the Trade

Interpreting Forestry Economic Contribution Reports: A User's Guide

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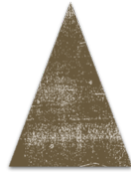
James Henderson
 Professor and Head

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Input-Output Modeling and Related Terminology

- I-O models track the inter-linkages of sectors and businesses in the economy

**Forestry and
forest products
sectors**



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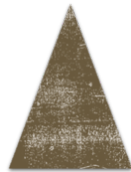
**Direct
Effect**

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Input-Output Modeling and Related Terminology

- I-O models track the inter-linkages of sectors and businesses in the economy

**Forestry and
forest products
sectors**



**Direct
Effect**

+

**Purchases
from
supporting
sectors**



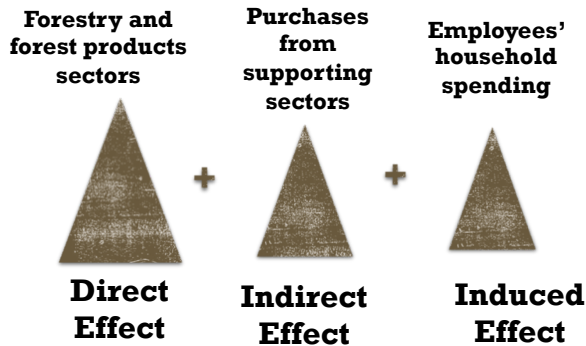
**Indirect
Effect**

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Input-Output Modeling and Related Terminology

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- I-O models track the inter-linkages of sectors and businesses in the economy

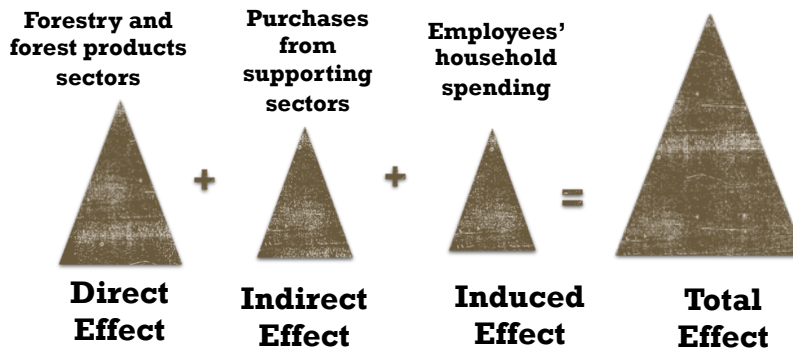


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Input-Output Modeling and Related Terminology

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- I-O models track the inter-linkages of sectors and businesses in the economy



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IMPLAN Terms

- Industry output: the total annual value of industry production including intermediate activities
- Value added: equivalent to GDP or GSP; industry output minus intermediate inputs
- Industry output could represent double or multiple counting!!

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IMPLAN Terms

- Industry: A group of establishments engaged in the same or similar types of economic activity
- Sector: Institutional units that make up the total economy. Sectoring schemes classify and aggregate industry and commodity data.

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IMPLAN Terms

- **Employment:** number of full-and part-time employees, including self-employed and seasonal jobs. No FTEs
- **Labor income:** employment income including employee compensation and proprietor income

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IMPLAN Terms

- **NAICS:** North American Industry Classification System→ A system of industrial classification developed and used by the US, Canada, and Mexico for grouping similar production process. NAICS replaced 1987 SIC.

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IMPLAN (Economic Impact Analysis for Planning)

- Tracks the inter-linkages of industries and businesses
- 546 (2018 model) sectors linked with NAICS code, representing entire industries in the economy
- Models: US, States, Counties, Zip Codes, MSAs

MAIN RAW DATA SOURCES

⊗ U.S. Bureau of Economic Analysis (BEA)
⊗ U.S. Department of Agriculture (USDA)
⊗ U.S. Bureau of Labor Statistics (BLS)
⊗ U.S. Census Bureau



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J. For. 115(2):112-116
<http://dx.doi.org/10.5831/jfor.116-041>
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Authors essentially “signed” this manuscript

PRACTICE OF FORESTRY

economics

Standard Procedures and Methods for Economic Impact and Contribution Analysis in the Forest Products Sector

James E. Henderson, Omkar Joshi, Shaun Tanger, Leslie Boby, William Hubbard, Matthew Polkki, David W. Hughes, T. Eric McConnell, Wayne Miller, Jarek Nowak, Charles Becker, Tim Adams, Clay Altizer, Rick Cantrell, Jesse Daystar, Ben Jackson, James Jeuck, Sayeed Mehmood, and Phil Tappe

Economic contributions from forestry and forest products help define the importance of this industry to a state or regional economy. IMPLAN input-output modeling software has proven helpful to conduct this analysis and is commonly used in the United States. However, input-output modeling and the results of economic impact or contribution analysis can vary substantially, depending on the modeling assumptions of the analyst, creating confusion among end users as comparisons are made among studies. Southern Regional Extension Forestry and the Southern Group of State Foresters invited forest and regional economists from the Southern Region to a summit in Little Rock, Arkansas, in 2015 to discuss concerns and issues with respect to collection, calculation, and delivery of information on the economic role of forestry and the forest products industry in the southern region. This article discusses major issues identified and recommendations suggested at the Little Rock Summit.

Keywords: multiplier effect, IMPLAN, input-output modeling

Advocates of the forestry and forest products industry (FFI) often use economic contribution or economic impact analyses. Economic contribution analysis estimates the relative importance of the existing forestry and FFI to an economy, and economic impact analysis estimates the effects of new or expanding forestry and FFI to a state or regional economy. These analyses often express the contribution or impact of forestry and FFI to an economy in terms of total sales or industry output, jobs, value added, wages and salaries, and taxes paid (Day 2015). Documenting these varying economic indicators and changes over time is crucial to the FFI with regard to public policy and private sector decisions. Further, such information is valuable to state forestry agencies, university forestry and wood products programs, and forestry and forest products advocacy organizations as they seek funding or backing for laws that are supportive of the industry. One of the most commonly employed computer software packages for estimating economic impact or contribution of forestry and forest products industries is the IMPLAN input-output model (IMPLAN Group, LLC 2014).

A number of studies have reported the economic contributions of the FFI at the regional level over the last 20 years. Aruna et al. (1997) reported the economic contributions of the FFI for each of the 13 southern forestry region states using data from several sources as follows: employment (Impact Analysis for Planning 1992 data; Minnesota IMPLAN Group 1997); forest-based earnings

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Common Pitfalls to Avoid

- Contributions vs. Impacts
- Modeling Assumptions
- Current vs Constant Dollars
- Defining “Forest” Industries (sectors) – Be explicit about what is included
- IMPLAN Sectors versus Local Information
- Aggregation Bias
- Output versus Gross Domestic Product (GDP)
- Closing Portions of the Study Region’s Social Accounting Matrix (SAM) – which institutions to include.
- 2-year lag in data

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How do I conduct a Contribution Analysis?

economics

Economic Contribution Analysis of the Forest-Product Industry: A Comparison of the Two Methods for Multisector Contribution Analysis Using IMPLAN

Rajan Parajuli, James E. Henderson, Shaun Tanger, Omkar Joshi, and Ram Dahal

State agencies and universities often use IMPLAN software and data to quantify economic contributions of forest-product industries in specific regions. Since IMPLAN software is designed to estimate economic impacts rather than economic contributions, adjustments have to be made to the direct effect values to avoid overstating the results of the analysis. Two economic contribution analysis approaches are most common: internal adjustments to the IMPLAN software and external adjustments of the input values by using output multipliers. Results suggest that both methods of contribution analysis produce similar total effects, but their approaches of handling direct effects are substantially different. The strengths and weaknesses of each method are discussed, and the importance of adjustments to obtain economic contribution estimates as opposed to economic impact estimates is highlighted. Furthermore, practitioners are cautioned to follow the steps carefully and explain which, between the two contribution analysis methods, was used in their analysis.

Keywords: economic contribution analysis, IMPLAN, forest products industry, sector, matrix inversion

While economic impact and contribution analysis are two different concepts with meaningful differences in regional economic analysis, both concepts are used interchangeably in the literature. In other words, contribution analysis is about looking at how the current state of sector supports other businesses in the local economy. In many cases, practitioners have

used by forestry advocates and stakeholders to communicate the greater economic benefits of the industry to policymakers and elected officials (Henderson and Mann 2013, McConnell 2013, Henderson and Evans 2017, Joshi et al. 2017). State forestry agencies and universities are often tasked with conducting economic contribution analyses of forestry and other natural-resource industries at the state or county level. Recent efforts by those that conduct economic contribution analyses of forestry and forest products manufacturing have sought to identify best practices so that such analyses use consistent methodologies and are thus comparable over time and across states or regions (Henderson and Evans 2017, Joshi et al. 2017). However, not all cases are similar in terms of the forest

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Become familiar with two methods commonly used in contribution analysis

Internal adjustment

- “Eliminates” indirect and induced effects of the sectors of interest
- Does not report intra-sector relationships (i.e. indirect effects) among chosen industries
- Can be done more quickly for smaller geographies (counties)
- Simpler results, harder to misinterpret
- Recommend method by IMPLAN

External adjustment

- inversion of SAM output multipliers associated with the sectors of interest
- Allows indirect and induced effects of the sectors of interest
- May be more accurate for larger geographies (state or national)
- Essentially gives you more of a look “under the hood”
- Have to be sure to report before-adjusted input values as direct effects when reporting

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Comparison of the two methods

Table 1. Comparison of direct, indirect, and induced output values obtained from different approaches of contribution analysis of the forest-product industry in 13 southern states in 2012.

Sectors	Direct (\$2,012 million)	Indirect (\$2,012 million)	Induced (\$2,012 million)	Total output (\$2,012 million)
Contribution analysis method 1: model customization within IMPLAN				
Logging	4,222	—	—	4,222
Sawmills	12,028	—	—	12,028
Paper mills	25,160	—	—	25,160
Wood furniture	1,580	—	—	1,580
Other sectors*	—	23,501	69,518	93,019
Total	42,990	23,501	69,518	136,009
Contribution analysis method 2: adjusting input values using a matrix-inversion approach				
Logging	2,076	2,134	12	4,222
Sawmills	10,566	1,498	54	12,028
Paper mills	24,812	255	93	25,160
Wood furniture	1,567	2	12	1,580
Other sectors*	—	23,807	70,019	93,826
Total	39,021 [†]	27,606	70,189	136,816
No adjustment; equivalent to the impact analysis				
Logging	4,222	2,474	13	6,709
Sawmills	12,028	1,544	60	13,631
Paper mills	25,160	259	105	25,524
Wood furniture	1,580	2	13	1,595
Other sectors*	—	25,963	78,338	104,300
Total	42,990	30,241	78,528	151,760

* Other sectors include IMPLAN sectors 1, 21, 33, 34, 41, 319, 320, 332, 341, 354, 360, 367, 381, 382, 391, 394, 402, 411, 434, and 427, which have indirect and induced effects from the forest-product industry (IMPLAN sectors 16, 95, 105, and 297) in 2012.
[†] In this method, the matrix-inversion method of SAM total output multipliers reduces the initial total input value of \$42,990 million to \$39,021 million.

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What sectors should I include?

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J. For. 15(5):88-95
http://dx.doi.org/10.5849/jfor.15-044
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BRIEF COMMUNICATION

economics

A Synopsis of Methodological Variations in Economic Contribution Analyses for Forestry and Forest-Related Industries in the US South

Omkar Joshi, James E. Henderson, Shaun M. Tanger, Leslie A. Baby, Matthew H. Pelkki, and Eric L. Taylor

The forest products sector plays an important role in regional economies in the United States. Although direct economic contribution values are relatively easy to estimate and compare across states, several modeling and data-related assumptions used in contribution analysis create variations among states that can be difficult to explain. Economic contribution analyses were surveyed to understand variations in methodologies used in conducting economic contribution analysis of the forest products sector. Survey results suggest that although analysts were generally consistent with direct effect sector selection of traditional forest industries (e.g., logging and sawmills) in the IMPLAN sector scheme, several variations were noted in decisions to include or exclude nontraditional forest industries that produce engineered wood products, among others. Likewise, there were subtle differences in opinions on which institutions to include in the social accounting matrix. Some policy-related suggestions were provided for consistent reporting.

Keywords: IMPLAN, multiplier, input-output modeling

Forest-related industries play an important role in regional economies with abundant forest resources. Economic output, value-added, labor income, and employment opportunities impacted by forest-related industries in the United States have been reported in several studies (e.g., throughout the United States (Foreword et al. 1988, Lynch 2000). IMPLAN is a sophisticated static model that cannot track economic contributions over longer time spans (May 2012). However, in case of model development, relatively low cost, and geographic flexibility contribute to its popularity, which provides for analyses at national, statewide, county, congressional districts, and ZIP code levels (Minnesota IMPLAN Group 2004). An examination of past input-output analyses reveals several variations among analyses in terms of their forestry sector inclusion/exclusion criteria. For example, Tiley and Manis (2007) categorized forest product sectors into three aggregated subindustries: lumber and wood products, paper and applied products, and wood furniture. In contrast, Xu (2002) in his analysis of the economic contribution of the Texas forest sector assessed forest sectors into six sub-

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What sectors to include?

- Think back to the previous slide on NAICS and IMPLAN sectors
- Aggregation Bias
- Unique Industries
- Local Knowledge and Data

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Table 1. Percentage of analysts who included each forestry and forest products industry sector in their analyses.

IMPLAN sector no.*	IMPLAN sector title	NAICS code	Should the sector be included for analysis? (%)
15	For., FP, & timber tract production	1131-2	100
16	Commercial logging	1133	100
19	Support activities for agriculture/for.	115	71
47	Electric power generation—biomass	221117	64
134	Sawmills	32113	100
135	Wood preservation	32114	100
136	Veneer & plywood mfg.	932121-2	100
137	Engineered wood member & truss mfg.	321213-4	100
138	Reconstituted wood prod. mfg.	321219	100
139	Wood windows & door mfg.	321911	100
140	Cut stock, resawing lumber, & planing	321912	100
141	Other millwork, including flooring	321918	100
142	Wood container & pallet mfg.	32192	100
143	Manufactured home (mobile-home) mfg.	321991	71
144	Prefabricated wood building mfg.	321992	100
145	All other miscellaneous wood prod. mfg.	321999	100
146	Pulp mills	32211	100
147	Paper mills	32212	100
148	Paperboard mills	32213	100
149	Paperboard container mfg.	32221	100
150	Paper bag & coated & treated paper mfg.	32222	100
151	Stationery prod. mfg.	32223	93
152	Sanitary paper prod. mfg.	322291	93
153	All other converted paper prod. mfg.	322299	100
368	Wood kitchen cabinet & countertop mfg.	32711	86
369	Upholstered household furn. mfg.	32721	86
370	Non-upholstered wood household furn. mfg.	32722	86
371	Other household non-upholstered furn. mfg.	32724-5	43
372	Institutional furn. mfg.	32727	57
373	Wood office furn. mfg.	327211	86
374	Custom architect, woodwork & millwork	327212	86
375	Office furn., except wood, mfg.	327244	21
376	Showcase, partition, shelving, & locker mfg.	327215	43

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IMPLAN

• IMPLAN Sectors Can Be Mapped Back to NAICS Codes At Varying Levels of Detail

- The NAICS standard was adopted in 1997 to replace SIC codes
 - Go from primary 2 digit categories down to 6 digit level of detail
- IMPLAN sectors based on the BEA Input-Output Study
 - IMPLAN maps very closely to 6 digit NAICS for manufacturing
 - More aggregate for service sectors
 - Construction one of few main sectors not directly corresponding to NAICS
- Each IMPLAN sector has varying factors for how inputs flow through the local economy
- Choosing the correct sector therefore increases the accuracy of the model

Snapshot of IMPLAN Sector Map

IMPLAN Sector	IMPLAN Description	2007 NAICS
242	Basic printed-circuit board manufacturing	334412
243	Semiconductor and related device manufacturing	334413
244	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	334414-6
245	Electronic connector manufacturing	334417
246	Printed circuit assembly (electronic assembly) manufacturing	334418
247	Other electronic component manufacturing	334419
248	Electronic equipment manufacturing	334510
249	Search, detect, and measuring instruments manufacturing	334511
250	Automatic industrial process control instrument manufacturing	334512
251	Industrial electronic equipment manufacturing	334513
252	Totalizing and counting device manufacturing	334514
253	Electricity, electronic, and optical measuring and controlling device manufacturing	334515
254	Analytical instrument manufacturing	334516
255	Irradiation apparatus manufacturing	334517
256	Watch, clock, and other measuring and controlling device manufacturing	334518-9
257	Software, audio, and video media reproducing	334611-2
258	Magnetic and optical recording media manufacturing	334613
259	Electric lamp bulb and part manufacturing	33511
260	Lighting fixture manufacturing	33512
261	Small electrical appliance manufacturing	33521
262	Household cooking appliance manufacturing	335211
263	Household refrigerator and home freezer manufacturing	335222
264	Household laundry equipment manufacturing	335224
265	Other major household appliance manufacturing	335228
266	Power, distribution, and specialty transformer manufacturing	335311
267	Motor and generator manufacturing	335312
268	Electric, electronic, and optical instrument manufacturing	335313
269	Instrument manufacturing	335314
270	Other electrical and electronic equipment manufacturing	335911
271	Telephone and communications equipment manufacturing	335912
272	Radio, television, and communications equipment manufacturing	33592
273	Electronic and cable manufacturing	33593
274	Other electrical and electronic equipment manufacturing	335991
275	All other miscellaneous electrical equipment and component manufacturing	335999

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What does IMPLAN include that is FPI related?

Implan536Index	ImplanDescription	Naics2012
15	Forestry, forest products, and timber tract production	1131-2
16	Commercial logging	1133
47	Electric power generation - Biomass	221117
134	Sawmills	321113
135	Wood preservation	321114
136	Veneer and plywood manufacturing	321211-2
137	Engineered wood member and truss manufacturing	321213-4
138	Reconstituted wood product manufacturing	321219
139	Wood windows and door manufacturing	321911
140	Cut stock, resawing lumber, and planing	321912
141	Other millwork, including flooring	321918
142	Wood container and pallet manufacturing	32192
143	Manufactured home (mobile home) manufacturing	321991
144	Prefabricated wood building manufacturing	321992
145	All other miscellaneous wood product manufacturing	321999
146	Pulp mills	32211
147	Paper mills	32212
148	Paperboard mills	32213
149	Paperboard container manufacturing	32221
150	Paper bag and coated and treated paper manufacturing	32222
151	Stationery product manufacturing	32223
152	Sanitary paper product manufacturing	322291
153	All other converted paper product manufacturing	322299
368	Wood kitchen cabinet and countertop manufacturing	33711
369	Upholstered household furniture manufacturing	337121
370	Nonupholstered wood household furniture manufacturing	337122
373	Wood office furniture manufacturing	337211
374	Custom architectural woodwork and millwork	337212
376	Showcase, partition, shelving, and locker manufacturing	337215

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How do most practitioners aggregate sectors?

College of Natural Resources

Table 2. Aggregation preferences for each sector included by analysts.

IMPLAN sector	Aggregation categories for each sector included by analysts (%) ^a										
	For.	Logging	For. & logging	Solid wood prod.	Pulp & paper	Wood furn.	Bioenergy	1 st solid wood	2 nd solid wood	1 st paper	2 nd paper
131	64	7	20								
140	14	57	20								
19	36	0	36								
47		0	7				57				
134	?	?	0	50				36			
135	?		0	57				20	7		
136	?		0	57				36	0		
137	?		0	57				21	14		
138	?		7	50				21	14		
139	?		0	43				0	50		
140	?		7	43				?	36		
141	?			43				?	43		
142	?			50				?	36		
143	?			36				0	21		?
144	?			43				?	36		?
145	?			43		7		?	29		?
146	?				71					21	0
147	?				71					21	0
148	?				50					20	14
149	?				57					?	20
150	?				43						50
151	?				45						45
152	?				45						45
153	?				43						50
368			?			36				29	
369						50				29	
370				?		45				29	
371						21				21	
372						36				21	
373						50				29	
374				14		29				36	
375						7				14	
376						14					

^a Numbers in the table are percentages of all analysts who selected that sector for inclusion in their analysis, so not all sectors add up to 100% as some sectors did not have consensus from analysts that they were appropriate for inclusion as "Forestry and forest products industry." For., forestry prod., products from forests; 1st, primary; 2nd, secondary.
^b Values were automatically chosen for inclusion in three economic contribution analyses (Table 1), and therefore values in aggregation categories will add up to 100%.
^c Sectors that had less than 100% agreement for inclusion. Values in those aggregation categories will be equivalent to the total percentage of analysts who included them for analysis (Table 1).
^d Our analyst aggregated this into the "other" aggregation category.
^e Sectors and values are for those categories where there was less than 50% agreement that they should be included for analysis (Table 1).

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Input-Output Model → Social Accounting Matrix

- Transactions Table provides basic framework for regional accounting
- Producers by Purchasers (row x column)
- Demand Driven
- I-O"ese": Users purchase from Makers

Essentially an accounting worksheet

- Purchases must equal sales
- Economy must balance

Producer	Purchaser	Agriculture	Manufacturing	Services	Labor	Households	GrOp Surplus	Institutions	Exports	Output
Agriculture		6	1	3		10		7	9	36
Manufacturing		7	4	2		4		5	6	28
Services		3	0	7		2		6	8	26
Labor		9	5	9						23
Households					16					16
GrOp Surplus		7	2	2	0					11
Institutions		2	7	1			11	4	2	27
Imports		2	9	2	7			5	0	25
Outlays		36	28	26	23	16	11	27	25	192

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Input-Output Model → Social Accounting Matrix

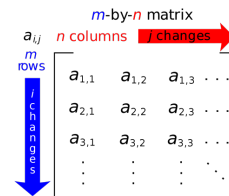
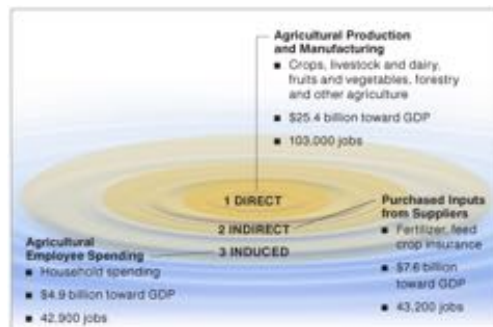
- The I-O model is the industry-to-industry relationships between purchases and sales
- All other accounts are summarized as Final Demands
- The SAM essentially recognizes the institutions that comprise Final Demands
- Some of these accounts are often internalized
 - Commonly, industry paying for labor that supports households' purchases for goods and services

	Agriculture	Manufacturing	Services	Labor	Households	GrOp Surplus	Institutions	Exports	Output
Agriculture	6	1	3		10		7	9	36
Manufacturing	7	4	2		4		5	6	28
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Imports	2	9	2	7			5	0	25
Outlays	36	28	26	23	16	11	27	25	192

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Input-Output Model → Social Accounting Matrix → Multipliers

- The Type SAM Multiplier captures the **Total Effect** of industrial activity
 - Relative to the **Direct Effect** of purchasing seen in the I-O Model and the SAM
- Fully reflects the circular flow of money from industry to social institutions, which flows back to industries
- **Type SAM Multiplier** = $\frac{Direct+Indirect+Induced}{Direct}$



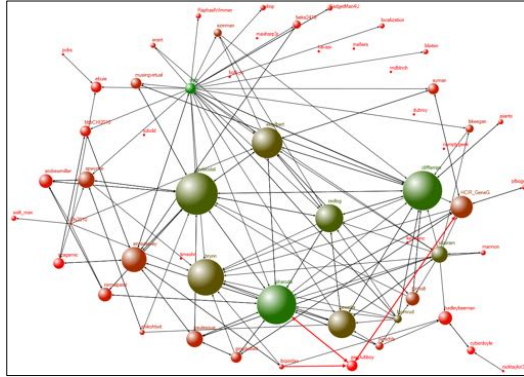
For those interested, Miller and Blair (2009) is an excellent reference on the science of calculating multipliers

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Economic Multipliers

What they are

- Measures of linkage
- Measures of dependency
- Types
 - Output- Sales
 - Valued Added- Income returned to study area
 - Employment- full and part-time jobs

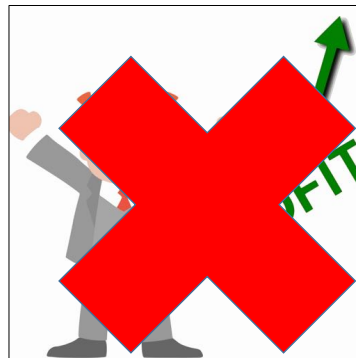


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Economic Multipliers

What they are NOT

- Measures of industry...
 - Profitability
 - Viability
- A sector could have large employment and output multipliers
 - Indicates strong linkages with other firms in the economy
- Yet, the same industry could struggle to be profitable



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Economic Multipliers

What they can do

Indicate the strength of Backward linkages with the rest of the regional economy



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Economic Multipliers

What they can't do

Indicate the strength of Forward linkages with the rest of the regional economy

Pull NOT Push

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Economic Multipliers

The dollar (job) change for all industries given a dollar (job) change for a particular industry

What they mean

Ex.: Output Multipliers

- Were a forest industry to increase sales by one dollar
- And that one dollar increase causes an eventual increase of \$1.50 in additional output for the entire economy



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Economic Multipliers

What they mean

- The output multiplier for that forest industry will be 2.50
- The \$1.00 direct effect plus the \$1.10 in industrial spending
 - Indirect effect created by the direct effect
- Plus an additional \$0.40 in household spending
 - Induced effect created by the direct and indirect effects

$$\text{Type SAM} = \frac{(\text{Direct} + \text{Indirect} + \text{Induced})}{\text{Direct}}$$

$$2.50 = \frac{(\$1.00 + \$1.10 + \$0.40)}{\$1.00}$$

$$2.50 = \frac{(\$500 + \$550 + \$200)}{\$500}$$

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Economic Multipliers

What they mean

- The output multiplier for that forest industry will be 2.50
- The \$1.00 direct effect plus the \$1.10 in industrial spending
 - Indirect effect created by the direct effect
- Plus an additional \$0.40 in household spending
 - Induced effect created by the direct and indirect effects

How they should be viewed

- Upper bound estimates of the actual change in economic activity rather than a point estimate of the change in economic activity itself
- *I-O models are...*
 - *Static*
 - *Based on several rather restrictive assumptions*
 - *See Miller and Blair (2009)*

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Economic Multipliers: Beware



- **Is a low multiplier “bad?”**
 - Not necessarily; just means industry is not highly integrated within the economy
 - If a mill closes, effect on regional economy might not be as great as contrary
 - In times of recession, industry may be “insulated” from greater consequences
- **Is a higher multiplier “good?”**
 - In good times, Yes! Industry expansion spreads wealth across region
 - In bad times, not so much; See above re: industry contraction
 - Smaller-sized industries will have higher multipliers (generally) than larger-sized industries
- **How high is “too high?”**
 - For forestry, output < 2.00, value added < 3.00, employment < 4.00 or 5.00

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Difference between Economic Contribution and Impact

Economic IMPACT

- Primarily used for determining net changes created by singular event
- If workforce development targets timber and logging industry, must consider
 - What industries may be negatively impacted?
Agriculture, Energy, Mining, etc.
- If a mill closes, must consider
 - Govt unemployment, etc.
 - Include indirect effects?

HUH??



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Difference between Economic Contribution and Impact

Economic Contribution

- Contribution analysis is used for tracking the gross change associated with...
 - Industry, an event, or a policy in an existing regional economy
- How important is Industry X?
- By how much would economy shrink if Industry X disappeared?

HUH??



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Recommended Readings

- **Lists the methodological issues in standard procedures and methods for forestry economic impact and contribution analysis:** "Standard Procedures and Methods for Economic Impact and Contribution Analysis in the Forest Products Sector," by J. E. Henderson., O. Joshi, S. M. Tanger, L. Bobby, W. Hubbard, M. Pelkki, . . . P. Tappe, 2017, *Journal of Forestry*, 115(2), pp. 112–116.
- **Tabulates the commonly included IMPLAN sectors related to forestry and forest product industries:** "A Synopsis of Methodological Variations in Economic Contribution Analyses for Forestry and Forest-Related Industries in US South," by O. Joshi, J. E. Henderson, S. M. Tanger, L. Bobby, M. Pellki, and E. Taylor, 2017, *Journal of Forestry*, 115(2), pp. 80–85.
- **Compares and contrasts the two methods for multisector contribution analysis of the forest sector using IMPLAN:** "Economic Contribution Analysis of the Forest-Product Industry: A Comparison of the Two Methods for Multisector Contribution Analysis Using IMPLAN," by R. Parajuli, J. E. Henderson, S. M. Tanger, O. Joshi, and R. Dahal, 2018, *Journal of Forestry*, 116(6), pp. 513–519.
- **A user's guide to interpret forestry contribution reports:**
<https://www.joe.org/joe/2019august/tt7.php>

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Questions/Comments?

Forest Economic Contributions Summit
 Strategies for Development, Communication, & Education on the Sector's Role in the Southern Region
 March 10-11, 2020 * New Orleans, LA

Summit Objectives
 Connect forestry economic contribution analysts, economic development specialists, & advocates to learn from each other, improve the understanding, usage & communication of forestry economic contribution data to promote forestry & the forest products industry.

Learn More About:

- the current economic contributions of the forestry sector within your state & the financial contribution of each forestry-related business sector
- maximizing the meaning of the economic contributions & communicating broader impacts
- a new standardized protocol for analyzing forestry economic contribution data
- forest economic development & work being completed in other states
- creating effective and personalized messages about forestry economic impact

Who Should come to this meeting?
 Public and private decision makers advocating for forests, including interested individuals from:

- Forestry agency personnel (state and federal)
- State economic development agencies
- Forestry associations & other forestry advocates

Interactive Meeting Format
 Summit will include a mix of presentations from primary talks to "lightning" presentations, and small group discussion time. Primary presentation from Dr. Jerry Thornbush, Chief Economist and Director of Data Development for NRS&A. Agenda is in development and ideas for topics to cover and/or additional speakers are welcome!

Have an idea for a topic that should be covered or a speaker? Want to give a lightning presentation? Join the list for meeting updates! Provide input! or email Leslie Bobby, lbobby@ncsu.edu

- Dr. Rajan Parajuli, 919-513-2579, rparaju@ncsu.edu
- Dr. Shaun Tanger, 228-546-1014, smt489@msstate.edu
- Dr. Eric McConnell, 318-257-2820, temc@latech.edu



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