

**Analysis of Forest Development Program Impacts
on North Carolina's Economy in 2012**

by
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ABSTRACT

KOESBANDANA, SADHARGA. Analysis of Forest Development Program Impacts on North Carolina's Economy in 2012 (Under the direction of Dr. Frederick Cabbage, Dr. Erin Sills, and Dr. Robert Abt).

In calendar year 2012, a total of \$4.2 million was spent under the Forest Development Program (FDP) in North Carolina, including \$1.6 million (39%) from the state government and \$2.6 million in cost-share from private landowners. While it is likely that private landowners would have reforested some portion of their land even without FDP, we calculate the impact of the FDP on the state economy by assuming that the full \$4.2 million was additional spending in the state due to the FDP. Based on an economic impact analysis in IMPLAN, combined FDP expenditures in 2012 increased total industry output in the state by about \$12.6 million, and total value added by about \$7.6 million. That is, spending under the FDP leveraged about twice as much in value added, and three times as much in industrial output. The FDP generated 133 direct jobs in North Carolina, and a total of 197 jobs overall in 2012. As a lower bound on the contribution of the FDP to the state economy, we calculated that just the \$1.6 million in state spending on the program generated 76 jobs, \$4.9 million in industrial output, and \$3.0 million in value added.

The output multiplier effect for program expenditures was 3.0 for the state, ranging from 2.4 to 3.0 across the NC Forest Service's three administrative regions. Thus, every dollar spent through FDP contributes 1.4 to 2.0 times as much to the regional economies. The Piedmont received the most FDP funds in 2012, and benefited from even greater proportional regional economic impacts from the direct funds spent. However, on a per acre of private land which reforestation activities being completed under FDP in 2012, the industrial output and value added were very similar for all regions. Thus, the program is reasonably equitable on impacts across the three regions, even though the Piedmont region had the highest multiplier, but at the lowest cost per acre.

DEDICATION

To my lovely wife and main inspiration Marlina and our two talented boys Adam and Idris. Our journey has just begun, enjoy the ride together. My appreciation to my advisors: Fred, Erin and Bob for their thoughtful guidance and tremendous patience and support for my education. I am also indebted to Ron Myer who provided me with the valuable data and interesting discussions, Eric McConnel who generously reviewed detailed methodology, Sarah Slover who kindly assisted me with administrative requirements and James Jueck who set up my IMPLAN access. Without them all, I would never complete this paper and successfully finished my MNR program.

BIOGRAPHY

Sadharga ‘Hargo’ Koesbandana was born in a small town at the foothill of Mount Merapi, Central Java – Indonesia. As an avid boy scout, mountain hiker, and camper during his youth, he enjoyed being outdoor with the nature most the time. That experience led him to study at ‘the green campus’ Bogor Agricultural University, Indonesia and earned his Bachelor degree in Landscape Architecture. After graduation, he worked in landscape industry and public works for about 5 years in the greater Jakarta area before accompanied his wife studying in the United States. While being a stay home dad, Hargo took courses one at a time and completed a Master of Economics degree from North Carolina State University (NCSU) and then pursued a doctoral program in Forestry at the same school. After completed all the PhD program courses requirement, he decided a Master of Natural Resources program is the best option for him. He married to Marlina, a PhD graduate from NCSU’s Statistics department, who is currently working as a biostatistician at one of Research Triangle Park company. They are the parents of Adam, a double major student in computer science and linguistics at The University of North Carolina – Chapel Hill; and Idris, a student at Chapel Hill High School.

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INTRODUCTION

To increase productivity of privately owned forests, the State of North Carolina has provided cost-sharing assistance to private landowners, which is called the Forest Development Program (FDP). For the last few years, almost \$2 million per year on average were invested to facilitate establishing production forests. The federal government, the State of North Carolina, and Non-Governmental Organization (NGOs) have myriad programs garnering to improve the state of natural resources. Among others, Environmental Quality Incentive Program (EQIP), Conservation Stewardship Program (CSP), and Forest Stewardship Program (FSP) provide funds from nationwide agencies; from the state, there are NC Forest Agriculture Cost-Sharing Program, NC FDP, and Property Tax Program on Forest Land. The NGOs support the Longleaf Restoration Program, NC Tree Farm Program, and more. Each aims at different targets and approaches, but the main concern of those programs is to keep the forest healthy and productive for sustainable benefits of all residents in the state. The existence of many programs can be confusing and their effectiveness were hard to track. Greene et al. (2010) surveyed forestry officials in 13 West states in the US and received suggestions from landowners that it should be only a single agency at a state level who manages all the programs and focuses on the resources to achieve program consistency. On the other hand, multiple agencies and programs do provide more funds and meet distinct objectives for tree planting and forestry.

Among the North Carolina forestry programs, FDP has been going strong for more than 35 years and received the most funding. Other programs have been changed, merged or even discontinued over the years. Since 1978, FDP has helped private landowners plant trees in almost 1.2 million acres (more than 7.5% of the state's total private forestland).

Information on impacts of an economic activity in a region is an important input for public and industry managers while making their policy decision. For the industry, that information is essential in allocating their resources in the future in a response to the impacts for their own benefit, as a collaborator or a competitor. For the public institution, it is an evaluation of their past policies, if they are working in line with the impacts, and to give direction on what will be their focus of their upcoming policy. Furthermore, in the case of mill/plant closing (Brandies and Hodges, 2015) due to outsourcing, imports of cheaper products or a devastating hurricane may create serious impacts to the regional economy that those managers need to respond to strategically by knowing the magnitude of the impacts.

In this paper, we attempted to quantify the economic impacts of 2012 FDP in the state of North Carolina overall and by region. That information hopefully will shed light on how much the program contributed to private landowners' participation, industrial output, employment related to the activities, and which region brought a better response (i.e. multiplier effects).

Literature Review

Impact Analysis for Planning (IMPLAN) is a well-known tool in conducting Economic Impact Analysis (EIA). It was originally developed by US Forest Service in the 1970s for the purpose in analyzing Rural Development Act. After being improved by partnership with the University of Minnesota in the 1980s, it has been maintained and updated by the Minnesota IMPLAN Group (MIG) since 1993. IMPLAN employs input-output table at the core, which was developed by Nobel Prize winner Wassily Leontief in the early 1900s.

In an input-output model, planners are trying to capture all transactions within the economy in a table. Any changes in one sector will have ripple effects to other product and service markets on the landscape, because sectors are interconnected in backward and forward linkages. Those changes can be computed with the help of matrix calculation. The more sectors being disaggregated in the table, the more complex is the process. Fortunately, a computer with the right software, such as IMPLAN, Regional Input-Output Modeling System (RIMS) and Economic Modeling Specialists International (EMSI) can help this effort.

Historically, government assistance to private landowners focusing on forestry was started in the 1970s. Risbrudt and Ellefson (1983) estimated cost effectiveness of 1979 Forest Incentive Program (FIP) from 676 cost-share cases throughout the US. They found the average IRR was at 8.6% and FIP potentially added 1.3 billion cubic feet more to future timber supply in the first rotation. In early 1980s, incentive programs in the US South helped planting trees on nonindustrial private land about 450 thousand acres annually. Of those, 150 thousand acres were from FIP (Barber, 1989). Another recent study on forest incentive programs was conducted by Stoots, Straka, and Phillips (2017). Using marginal analysis, they discovered that a \$1 investment of Forest Renewal Program (FRP) in South Carolina today will generate \$5 impacts and add more than 500 thousand tons extra timber supply in the long run. So far as we know, there is no impact study in forest incentive programs using IMPLAN.

From the private landowners' perspectives, the decision to replanting depends on several aspects. Alig, Lee, and Moulton (1990) concluded from a panel of different research results that landowners' income and availability of cost-share program have a significant positive influence in that planting decision. Furthermore, Mehmood and Zhang (2002) analyzed 18 state cost-share

programs using logit regression and found that the forest industry may have more interest to the program than any other groups. The cost-share programs usually being funded by a combination of timber industry severance tax, state budget appropriation, and the private landowners' investment.

To see more closely on how effective a cost-share program was, it is also appealing to observe whether a smaller region within a larger region gave the same response to the overall large region. The multi-region input output (MRIO) model captures the interplay of economic activities among smaller regions within a larger region. A study by Henderson and Munn (2013) evaluated economic contribution of forest products industry in the state of Mississippi on its 4 congressional districts. Another study in contribution analysis on timber products industry considering smaller region within a region was conducted by Coronado et al. (2014). Their results showed that in Ohio, the Southeast region has the lowest contribution and the northeast is the highest. Both studies presented the results by regions, but effects among districts were not clearly stated, maybe due to the absence of MRIO model.

Objectives of the Study

There have been very limited studies of impacts on forestry incentive programs nationwide and there is none using input output model to calculate the economic impacts when this paper was written. Moreover, none of those studies used MRIO model, which compares regional impacts within a state.

The main goal of this study is as follow:

1. To correctly measure the direct, indirect, and induced economic impacts of FDP program as implemented in 2012 in North Carolina's three administrative regions and analyze the multi-region dynamics.
2. To compare how the three regions in North Carolina respond to public investment in forestry in real value and in normalized terms per area of private forest land.

METHODOLOGY

This study used IMPLAN version 3.1. (2013) for a “classic” impact analysis of an investment (FDP spending) into an industry. The key underlying assumption is that if the state and landowners did not invest in reforestation through the FDP, there would be no other new economic activity and thus no additional impacts. Meanwhile, for a reference only (not being conducted in this paper), the on-going (existing) timber production in the area would be calculated using contribution analysis (Henderson et al, 2017). The definition of economic impact and economic contribution are sometimes confusing (Watson et al., 2007), and so to make it clear: impact is a net change and contribution is a gross change.

In impact analysis, the economic activity which is the total investment being made for that year (2012) can be entered directly into the calculation as a new activity. In contribution analysis, the total output of that industry should be multiplied by the inverse of its multiplier effect before being used as a new activity amount. To apply MRIO, we need to select the primary region and the linked region(s). After each region was run, then the overall NC FDP was calculated (see Appendix 1 for detailed data by county), and comparisons were made. This

analysis used Economic Sector 19 in IMPLAN, which is Support Activities for Agriculture and Forestry (see Appendix 2 and 3 for the sector's description and a list of activities in this sector).

In measuring impacts of NC FDP 2012 on the economy, there were several steps to follow:

- A. Using raw data obtained from NC Forest Service, the total amount of FDP funds for each region was calculated from more than one thousand records. There are 3 administrative regions within the state, i.e. Coastal Plain (27 counties), Piedmont (41 counties), and Mountain (32 counties). Total amount of investment will be calculated by adding subsidy money and participants' money. The subsidy money was a multiplication product of acreage completed, the value of the lower between actual and prevailed cost per acre, and the program cost-share. FDP cost-sharing were generally set at 40% for planting loblolly pine/softwood and 60% for planting longleaf/hardwood reforestation activities. The detail for each activities cost-share is in Appendix 2.
- B. Using IMPLAN software with NC data in 2012, calculate FDP impacts as follow:
 - (i) Create single economic models by selecting the name of counties based on NC Forest Service administrative grouping: Coastal, Piedmont, and Mountains regions, and then run each of them individually.
 - (ii) Copy each model and rename the copies as multi-region models.
 - (iii) Open the multi region model for each region to be evaluated and add the other two single region models in the scenario.
 - (iv) Enter the total investment (from step A) in the industry sales box after choosing Sector Code 19. Support Activities for Agriculture and Forestry from the drop list.
 - (v) Run the multi-region analysis and record the intended impact values.

- C. The next step was to see FDP economic impacts using area weight.
- (i) Using total investment from step A, divide each value by the total area (in thousand acres) being established under FDP in 2012 from each region.
 - (ii) Repeat steps B using the new values.

This approach had several assumptions in order to be modeled with IMPLAN. First, it was assumed that the program only funded site preparation, felling, tree planting, and 1st year maintenance. Second, we assumed that the costs were 100% being contracted to private companies located in NC and employed only NC residents, or at least that the expenditures and benefits from the program were contained entirely within North Carolina. Another critical assumption was that none of the acres that received FDP funds would have been reforested without that subsidy. Rather, the state and private landowners would just save the money and let the land regrow naturally. The analysis also assumed that the total impacts would be based on the total state funds plus the private owners' fund. And last, the analysis assumed that there was no capital substitution of the funds – e.g., the state cost-share funds were not replacing funds that the private owners might have spent anyway without the FDP subsidy. A review by Alig, Lee, and Moulton (1990) at least indicated that some studies did not find capital substitution, while others did.

INFORMATION ON FDP IN NORTH CAROLINA

FDP throughout the years

As noted, background information on FDP was obtained from the North Carolina Forest Service for various years and graphic summaries, as discussed below. The accumulated amounts

of FDP accomplishments from July 1998 to June 2008 (10 years) are shown in Table 1 and Figure 1 (and Appendix 1 for details). These data were readily available, so are presented here for illustration. In summary, about 3% of the total private forest land was planted using FDP in those 10 years. Geographically, the administrative regions of the NC Forest Service are shown in Figure 2. In term of funding, only severance tax from timber industry supported the FDP for the last seven years. NC State budget appropriations set aside a budget between \$500,000 to \$800,000 per year for FDP before fiscal year 2008 (except for 1991 and 1992), but had not contributed again since 2009 (see Appendix 4).

**Table 1. Ten-year FDP Achievement (1998-2008)
By Administrative region**

Region		FDP Acres	Private Forest Acres	% FDP
1	Coastal Plain	112,369	4,581,815	2.45%
2	Piedmont	321,884	6,959,024	4.63%
3	Mountain	52,088	4,123,580	1.26%
Total		486,341	15,664,419	3.10%

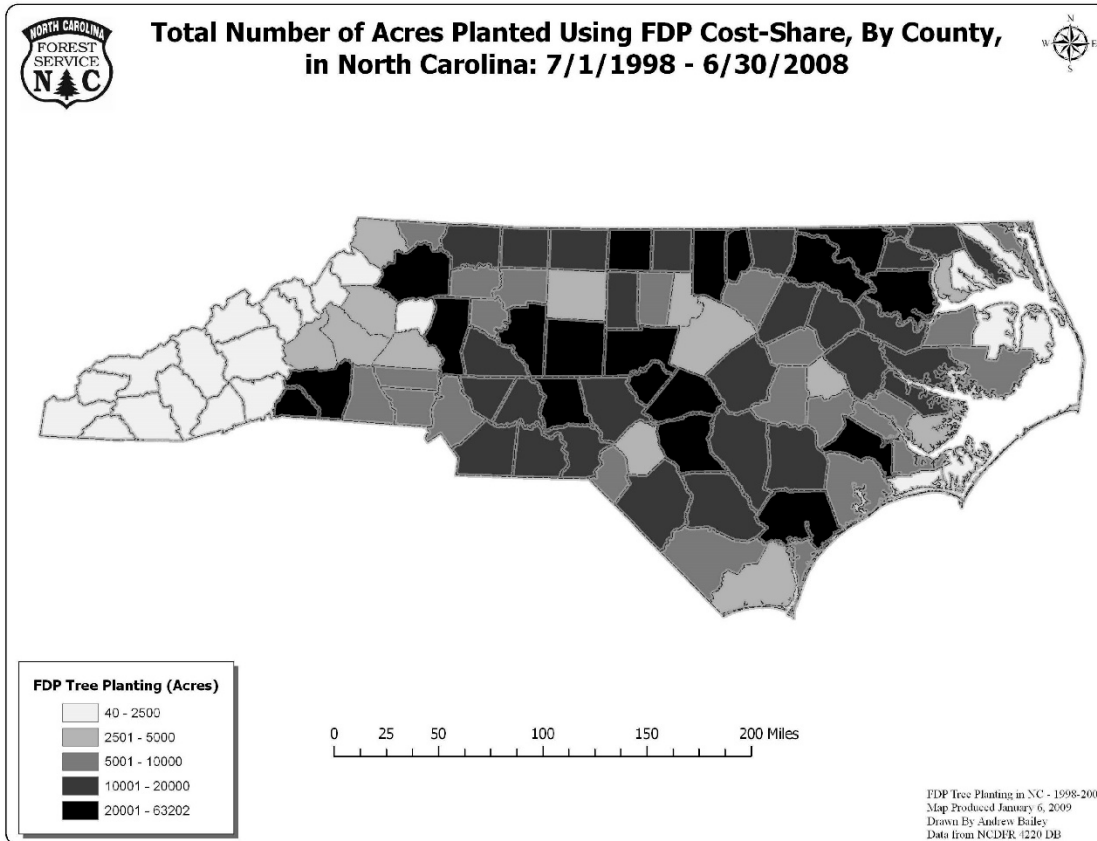


Figure 1. Accumulated FDP acres from 1998 to 2008 by counties

Administrative Region of NC Forest Service

The North Carolina Forest Service divides the state into three administrative regions to manage the forestland more efficiently. Any private forest owners in one region can apply FDP funds to each regional office. Region I (Coastal) office is in Kinston, Region II (Piedmont) office is in Jordan Lake, and Asheville is the Region III (Mountain) office.

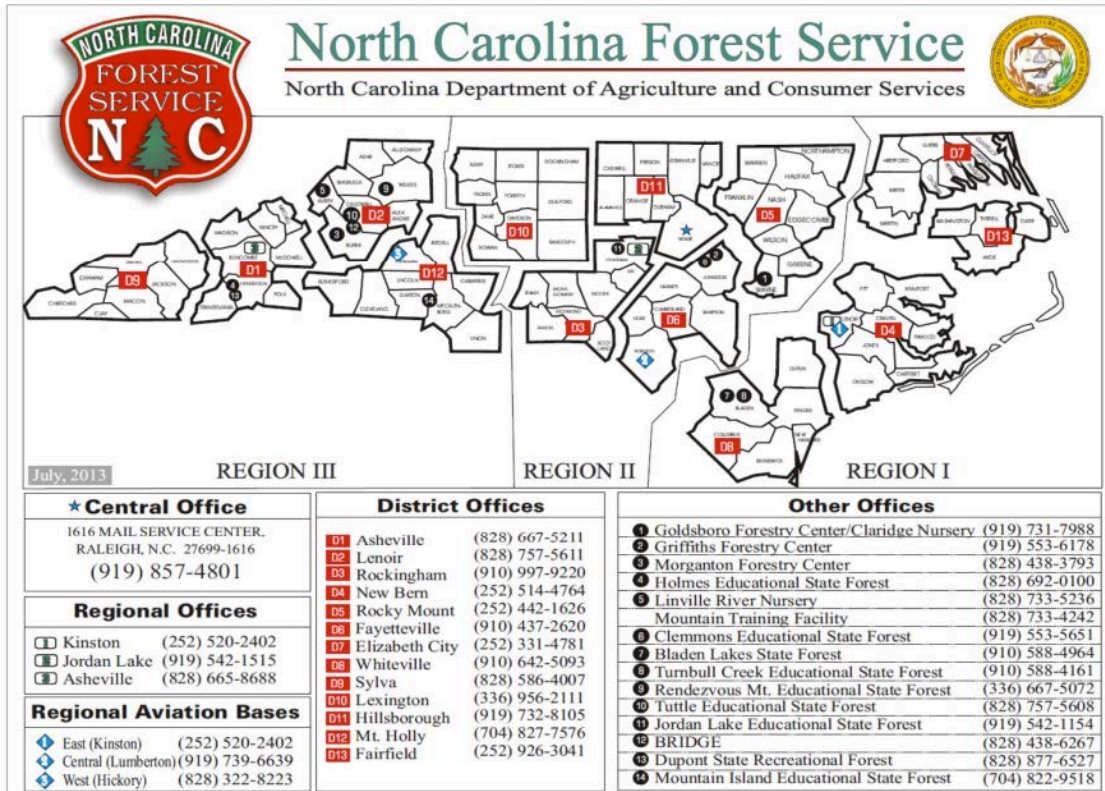


Figure 2. Administrative Regions of NC Forest Service

RESULTS AND DISCUSSIONS

FDP Funds by Area

Calculating total FDP in 2012 by region, landowners in the Piedmont region made the most use of the program, while landowners in the Mountain region enrolled the least number of acres. While the Piedmont has the most land area per Table 1, its relative proportion of FDP use per area of nonindustrial private forest land is still much greater than the Coastal Plain and the Mountains. The Mountains simply do not harvest as much timber, or make as many clearcuts, so are not as likely to qualify for the principal FDP activities. The Coastal Plain may receive proportionately less funds because it has more industrial ownerships than the Piedmont—in fact most of the industrial lands in the state, such as Resource Management Service and Weyerhaeuser—which are not eligible for FDP.

The tree species that was being established surely also influenced the decision to apply for FDP. Very few hardwoods are even planted, which would reduce Mountain region use for the program. Only about 8% of all FDP expenditures were used for longleaf or hardwood planting. Longleaf is best in the Coastal Plain, but still a smaller part of the program. So, overall, the brunt of the FDP expenditures was for loblolly pine planting, which favored nonindustrial private forestlands in the Piedmont.

**Table 2. NC FDP Cost-Sharing in 2012
by Administrative Regions**

Region	Type	Program Share			Participants Share			Sub Total	Total	
		Plan	Realization		Plan	Realization				
Coastal Plain (1)	Pine/ Softwood	40%	371,163	38.1%	60%	602,690	61.9%	973,853	1,061,999	25.2%
	Longleaf/ Hardwood	60%	47,532	53.9%	40%	40,614	46.1%	88,146		
	Sub Total			418,695			643,304			
Piedmont (2)	Pine/ Softwood	40%	853,279	36.8%	60%	1,463,161	63.2%	2,316,440	2,524,988	59.8%
	Longleaf/ Hardwood	60%	120,411	57.7%	40%	88,137	42.3%	208,548		
	Sub Total			973,690			1,551,298			
Mountain (3)	Pine/ Softwood	40%	236,604	38.8%	60%	373,045	61.2%	609,649	635,189	15.0%
	Longleaf/ Hardwood	60%	13,263	51.9%	40%	12,277	48.1%	25,540		
	Sub Total			249,867			385,322			
Total	Pine/ Softwood	40%	1,461,046	37.5%	60%	2,438,896	62.5%	3,899,942	4,222,176	100.0%
	Longleaf/ Hardwood	60%	181,206	56.2%	40%	141,028	43.8%	322,234		
	Sub Total			1,642,252			2,579,924			

Regional Direct, Indirect, and Induced Effects

The regional economic impacts of the FDP are shown in Table 3.a., 3.b., 4.a., and 4.b. Based on the state FDP expenditures of \$1.6 million and private landowners matching expenditures of \$2.6 million (\$4.2 million total), the total industrial output due to FDP was about \$12.6 million in the state in 2012, and total value added was \$7.6 million. Hence, the state and private funds for FDP were leveraging about twice as much in value added, and three times as much in industrial output. The FDP generated about 133 direct jobs in North Carolina, and a total of 197 jobs overall.

Note that the most of the total economic impacts occurred in the Piedmont—more than their share of expenditures. Total industrial output impacts were about three times greater in the Piedmont than in the Coastal Plain, and about 4 times greater than in the Mountain.

The multi-region analysis showed additional information on how an investment in one region impacted the other regions (Table 3.b). Here, FDP activities in one NC region spilled over about 8% to the other NC regions. These additional impacts represent supplementary activities such as supply of workers, seedlings, or fertilizer from adjoining regions when a region invested in reforestation activities. In addition, some of the FDP money as wages could also be spent in neighboring region to purchase goods and services. To demonstrate the correct interpretation of the table, here is one example: total FDP investment of \$1.062 million in the Coastal Plain triggered indirect and induced impacts of \$2.301 million in that region and resulted \$0.204 million additional output outside Coastal Plain region, and created a total of 46 jobs at the average of \$54,473/person for Coastal Plain region and the rest of NC counties. Note that

overall NC FDP impacts in Table 3.a. and Table 4.a. were calculated as a single region in IMPLAN run, not the sum of three regions as in Table 3.b and Table 4.b.

**Table 3.a. OVERALL NC FDP IMPACTS IN 2012 (2012 Values)
SINGLE REGION ANALYSIS**

Region	Type of Impacts	Output	Value Added	Employment	Output Multiplier
		(in \$)			
All NC	Direct	4,222,176	2,624,860	133	2.98
	Indirect	1,546,208	656,852	6	
	Induced	6,799,906	4,364,638	58	
	Total	12,568,290	7,646,350	197	

**Table 3.b. OVERALL NC FDP IMPACTS IN 2012 (2012 Values)
MULTIREGIONAL ANALYSIS**

Region		Output	Value Added	Employment	Output Multiplier
		(in \$)			
Coastal Plain (1)	Direct	1,061,999	639,603	35	2.36
	Subject Area Total	2,301,190	1,377,862	45	
	Addn Multiregional	204,573	116,237	1	
	Total FDP Impacts	2,505,763	1,494,099	46	
Piedmont (2)	Direct	2,524,988	4,268,399	74	3.01
	Subject Area Total	6,752,396	4,268,399	109	
	Addn Multiregional	845,184	370,683	4	
	Total FDP Impacts	7,597,580	4,639,082	113	
Mountain (3)	Direct	635,189	377,516	21	2.83
	Subject Area Total	1,647,428	1,004,407	30	
	Addn Multiregional	151,434	78,970	1	
	Total FDP Impacts	1,798,862	1,083,377	31	

Comparing three NC Forest Service administration regions based on real 2012 values, the Piedmont received the most economic impacts from FDP in term of employment, total output, and value added. The Coastal Plain region placed second, and the Mountain region was the last in the

impacts received. The rank corresponds to the amount of investment, the bigger the investment the bigger the impacts.

The normalized values of every 1,000 acres of private land which reforestation activities being completed under FDP in 2012 tell a somewhat different story. Now the investment (costs) per acre rank do not correspond linearly to the employment created and total output. Even though the Piedmont region cost per acre was the least, it placed second in the impacts. But overall, they showed comparable impacts among regions.

This does indicate that even though the total funds spent in the Mountain region are less, the amount of investment per private land area is relatively higher. There is large share of public lands in the mountains, so less opportunity for private forest planting. It is however comparable to the rest of the state on a per private land basis. This might be partially related to the higher percentage of cost-sharing for hardwood plantation, but pines still received most funding even in the mountain region.

**Table 4.a. OVERALL NC FDP IMPACTS IN 2012 (Normalized per 1,000 acres)
SINGLE REGION ANALYSIS**

	Type of Impacts	Output	Value Added	Employment	Output Multiplier
		(in \$)			
All NC	Direct	94,331	58,644	3.0	2.98
	Indirect	34,545	14,675	0.1	
	Induced	151,921	97,513	1.3	
	Total	280,797	170,832	4.4	

**Table 4.b. OVERALL NC FDP IMPACTS IN 2012 (Normalized per 1,000 acres)
MULTIREGIONAL ANALYSIS**

Region		Output	Value Added	Employment	Output Multiplier
		(in \$)			
Coastal Plain (1)	Direct	103,573	62,378	3.4	2.36
	Subject Area Total	224,426	134,377	4.4	
	Addn Multiregional	19,951	11,336	0.1	
	Total FDP Impacts	244,377	145,713	4.5	
Piedmont (2)	Direct	88,683	57,273	2.6	3.01
	Subject Area Total	237,158	149,915	3.8	
	Multiregional	29,684	13,019	0.1	
	Total FDP Impacts	266,842	162,934	3.9	
Mountain (3)	Direct	105,277	62,570	3.5	2.83
	Subject Area Total	273,046	166,471	4.9	
	Multiregional	25,099	13,089	0.1	
	Total FDP Impacts	298,145	179,560	5.0	

Multiplier effects

The total impacts of an economic activity can be simplified by its multiplier effects. Since this is a multi-region analysis, the best type of multiplier that represents is the total output from all outputs from all region being linked over the direct output (Table 4.b).

As we can see from the table, Piedmont region has the biggest multiplier effect, followed by mountain and coastal regions. This tells us that investment in Piedmont region for this type of activity (cost-sharing forestry program) is the best. Every single dollar of investment will result in 2 (two) additional dollars to the region and its surrounding.

After we normalized it to every 1,000 acres, the multiplier effects should remain the same. The weighted values changed proportionally.

CONCLUSIONS

In calendar year 2012, State of North Carolina Forest Development Program (FDP) funds of \$1.6 million contributed 39% of the total expenditures on the program through cost-sharing arrangement, and private landowners provided the balance of \$2.6 million, for a total expenditure of \$4.2 million. The total industry output due to the combined public funds and private matching for FDP was about \$12.6 million in the state in 2012, and total value added was \$7.6 million. The Piedmont region received the most FDP funds, and had even greater proportional regional economic impacts from the direct funds spent. However, on a per acre of private land which reforestation activities being completed under FDP, the industrial output and value added were very similar for all regions. Thus, the program is reasonably equitable across regions, even though more income is received by nonindustrial private landowners in the Piedmont region. Based on this study, every dollar spent in FDP will result immediate return of 1.4 to 2.0 times as much from other linked economic activities.

Overall, the FDP seems to be effective at achieving its mission of increasing forest planting and improvement on forest sustainability in the state of North Carolina. It does attract matching funds from private forest landowners, and generates more regional economic impacts from its total investment made. All the funding in recent years came from the forest products mills, which pay a yield tax at the mill to fund the program; the state stopped contributing funds to the program in 2009. Therefore, the program funds coming from the forest products industry are generating more forests and more timber for them in the future, as intended. Having the state renew its contribution could further enhance the program accomplishments, since it is always

fully subscribed and has more applicants than available funds (see Appendix 5 for the latest yearly waitlist).

It is possible that not all FDP expenditures would be attributable just to that program. First, there may be some capital substitution. Second, the landowners share maybe spent on reforestation even without FDP incentives. Thus, the total impacts here could be only about 39% (a lower bound) and going up as the assumptions apply.

In general comparison, even though using different methods, the North Carolina FDP had a multiplier of 3.0, South Carolina FRP at 5.0 (Stoos, Straka, and Phillips, 2017), and Kansas Rural Forestry Program (RFP) had 1.8 (Thompson and Rosenbaum, 2011). NC FDP had less than SC FRP due to the time horizon but more than Kansas RFP. In the meantime, comparing to Henderson and Munn (2013) that gave results in the state of Mississippi with multiplier effect about 1.4, despite different forest activities, NC FDP had a bigger multiplier effect at 3.0 because Mississippi study was a contribution analysis which is expected to be lower. Cox and Munn (2001) estimated that total regional impacts of forest-based industry in US South was about 5 times larger than US Pacific Northwest using 1993 data.

To avoid making comparison error, we should be very careful in trying to interpret those results, and pay attention to the different methods and assumptions being used for each study. The best strategy in study comparison to get an accurate interpretation, in our opinion, is to repeat the same method and assumptions at different time frame in the same region, or at the same time frame in a different region. Then we can impartially make a critical judgement on efficiency of each program.

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APPENDIXES

Appendix 1.

Ten-year FDP Achievement by Counties
July 1998 to June 2008

Coastal (1)					
		FDP	Private Forest	%	
County		Acres	Acres	FDP	
D4	1	Beaufort	7,545	338,970	2.23%
	2	Carteret	1,332	112,016	1.19%
	3	Craven	4,972	196,707	2.53%
	4	Jones	3,978	173,714	2.29%
	5	Lenoir	3,290	135,465	2.43%
	6	Onslow	2,408	179,256	1.34%
	7	Pamlico	2,823	130,815	2.16%
	8	Pitt	9,060	156,681	5.78%
D7	9	Bertie	14,145	306,373	4.62%
	10	Camden	1,503	46,610	3.22%
	11	Chowan	3,321	52,074	6.38%
	12	Currituck	1,567	23,594	6.64%
	13	Gates	6,492	117,117	5.54%
	14	Hertford	6,405	165,879	3.86%
	15	Martin	1,323	205,337	0.64%
	16	Pasquotank	2,171	31,037	6.99%
	17	Perquimans	2,821	58,904	4.79%
D8	18	Bladen	11,144	350,381	3.18%
	19	Brunswick	2,425	378,039	0.64%
	20	Columbus	6,533	398,509	1.64%
	21	Duplin	4,318	262,885	1.64%
	22	New Hanover	364	42,372	0.86%
	23	Pender	5,070	370,712	1.37%
	D13	24	Dare	42	10,497
25		Hyde	3,024	161,284	1.87%
26		Tyrell	1,238	65,543	1.89%
27		Washington	3,055	111,044	2.75%
SUB TOTAL			112,369	4,581,815	2.45%

Piedmond (2)						
			FDP	Private		
County			Acres	Forest	%	
			Acres	Acres	FDP	
D3	28	Anson	13,164	223,496	5.89%	
	29	Chatham	12,697	239,590	5.30%	
	30	Lee	766	172,001	0.45%	
	31	Montgomery	19,784	167,215	11.83%	
	32	Moore	18,273	288,823	6.33%	
	33	Richmond	9,479	195,257	4.85%	
	34	Scotland	5,770	120,515	4.79%	
	35	Stanly	4,993	123,460	4.04%	
	36	Edgecombe	9,606	172,053	5.58%	
	37	Franklin	8,479	206,429	4.11%	
	38	Greene	4,396	64,874	6.78%	
D5	39	Halifax	16,631	262,126	6.34%	
	40	Nash	7,607	176,319	4.31%	
	41	Northhampton	18,950	223,656	8.47%	
	42	Warren	9,530	209,131	4.56%	
	43	Wayne	4,308	140,431	3.07%	
	44	Wilson	4,929	93,816	5.25%	
		45	Cumberland	7,425	187,085	3.97%
		46	Harnett	10,224	160,127	6.38%
D6	47	Hoke	3,037	116,782	2.60%	
	48	Johnston	6,652	195,769	3.40%	
	49	Robeson	11,157	332,954	3.35%	
	50	Sampson	11,488	274,147	4.19%	
		51	Davidson	9,158	170,139	5.38%
D10	52	Davie	2,151	88,243	2.44%	
	53	Forsyth	1,230	106,183	1.16%	
	54	Guilford	2,451	144,567	1.70%	
	55	Randolph	12,879	250,227	5.15%	
	56	Rockingham	7,462	270,145	2.76%	
	57	Rowan	4,036	119,238	3.38%	
	58	Stokes	4,754	177,598	2.68%	
	59	Surry	3,358	186,756	1.80%	
	60	Yadkin	2,071	89,563	2.31%	
	D11	61	Alamance	4,893	128,088	3.82%
62		Caswell	12,477	153,525	8.13%	
63		Durham	1,380	72,717	1.90%	
64		Granville	11,515	200,232	5.75%	
65		Orange	3,560	110,724	3.22%	
66		Person	11,842	135,204	8.76%	
67		Wake	1,786	117,454	1.52%	
68		Vance	5,536	92,365	5.99%	
SUB TOTAL			321,884	6,959,024	4.63%	

Mountain (3)					
	County	FDP Acres	Private Forest Acres	% FDP	
	69	Buncombe	267	165,127	0.16%
	70	Henderson	99	131,760	0.08%
D1	71	Madison	8,018	169,968	4.72%
	72	McDowell	260	148,409	0.18%
	73	Mitchell	77	81,520	0.09%
	74	Polk	2,335	88,828	2.63%
	75	Transylvania	137	112,075	0.12%
	76	Yancey	79	128,257	0.06%
D2	77	Alleghany	3,787	85,065	4.45%
	78	Alexander	819	98,704	0.83%
	79	Ashe	1,545	181,363	0.85%
	80	Avery	118	103,532	0.11%
	81	Burke	1,011	203,020	0.50%
	82	Caldwell	1,061	181,046	0.59%
	83	Watauga	348	106,740	0.33%
	84	Wilkes	4,504	318,829	1.41%
D9	85	Clay	421	34,973	1.20%
	86	Cherokee	766	172,001	0.45%
	87	Graham	19	60,741	0.03%
	88	Haywood	251	149,367	0.17%
	89	Jackson	167	216,922	0.08%
	90	Macon	169	108,743	0.16%
D12	91	Swain	53	57,632	0.09%
	92	Cabarrus	4,191	87,891	4.77%
	93	Catawba	1,446	110,529	1.31%
	94	Cleveland	1,928	113,892	1.69%
	95	Gaston	2,268	96,446	2.35%
	96	Iredell	4,510	131,169	3.44%
	97	Lincoln	1,740	81,251	2.14%
	98	Mecklenburg	677	53,755	1.26%
	99	Rutherford	5,272	179,319	2.94%
	100	Union	3,745	164,706	2.27%
SUB TOTAL			52,088	4,123,580	1.26%

Source: FDP Final Report, 2009

Appendix 2.

FDP Activities and Its Cost-share Rates					
Code	Description	CSRate	Code	Forest Fertilization, Mid-Rotation	CSRate
A10	Burning	0.4	C20	Machine Plant	0.4
A20	Chopping	0.4	C21	Machine Plant, Chemical	0.4
A40	K-G, V-Blade Shear	0.4	C22	Machine Plant, Longleaf	0.6
A41	K-G & Pile	0.4	C23	Machine Plant, Hardwood	0.6
A42	Rake & Pile	0.4	C24	Machine Plant, Scalp	0.4
A50	Bulldoze	0.4	C25	Machine Plant, Shortleaf	0.6
A51	Bulldoze & Pile	0.4	C26	Machine Plant, Chemical, Shortleaf	0.6
A60	Bedding, Single	0.4	C30	V-Blade Plant	0.4
A61	Bedding, Double	0.4	C31	V-Blade, Plant, LL	0.6
A62	Bedding, V-blade	0.4	C70	Labor Only	0.4
A70	Furrowing	0.4	C80	Direct Seeding	0.4
A75	Chemical Control, Site Prep	0.4	C90	Natural Regeneration	0.4
A80	Chemical, Aerial	0.4	C99	Other, Tree Planting	0.4
A81	Chemical, Ground	0.4	D10	Chemical Control, Release, Aerial	0.4
A82	Pre-Harvest Treatment	0.4	D11	Chemical Control, Release, Ground	0.4
A99	Other, Site Prep	0.4	D15	Chemical Control, Release	0.4
B10	Fell and Leave	0.4	D20	Mechanical Control	0.4
B11	Fell and Remove	0.4	D30	Understory Release	0.4
C10	Hand Plant, Pine	0.4	D40	Release of Seedlings	0.4
C11	Hand Plant, Hardwood	0.6	D50	Cull-Tree Removal	0.4
C12	Hand Plant, Longleaf	0.6	D60	Crop Tree Crown Release	0.4
C13	Hand Plant, Cont., Longleaf	0.6	D70	Non-Commercial Thinning	0.4
C14	Hand Plant, Shortleaf	0.6	D80	Prescribed Burning	0.4
C15	Hand Plant, Cont., Shortleaf	0.6	D90	Forest Fertilization, Mid-Rotation	0.4
C18	Hand Plant, Wetland	0.6	D91	Forest Fertilization, Establishment	0.4
C19	Hand Plant, Cont., Loblolly Pine	0.4			

Source: FDP Final Report, 2009

Appendix 3.

DESCRIPTION OF SECTOR 19 IN IMPLAN

Sector 19 in IMPLAN is identical as NAICS code 115: Support Activities for Agriculture and Forestry. This sector includes: 1151. Support activities for crop production, 1152. Support activities for animal production, and 1153. Support activities for forestry.

Industries in the Support Activities for Agriculture and Forestry subsector provide support services that are essential part of agricultural and forestry production. These support activities may be performed by the agriculture or forestry producing establishment or conducted independently as an alternative source of inputs required for the production process for a given crop, animal, or forestry industry. Establishments that primarily perform these activities independent of the agriculture or forestry producing establishment are in this subsector.

Source: North American Industry Classification System (NAICS).

Appendix 4.

NC FDP APPROPRIATIONS HISTORY

CUT OUT DATE	AMOUNT	COMMENTS	CUT OUT DATE	AMOUNT	COMMENTS
7/1/78	\$500,000		7/1/98	\$689,500	
7/1/79	\$500,000		7/1/99	\$509,500	
7/1/80	\$500,000		7/1/00	\$439,500	
7/1/81	\$500,000		7/1/01	\$589,500	
7/1/82	\$500,000		7/1/02	\$589,500	
7/1/83	\$500,000		7/1/03	\$589,500	
7/1/84	\$500,000		7/1/04	\$589,500	
7/1/85	\$800,000		7/1/05	\$589,500	
7/1/86	\$800,000		7/1/06	\$589,500	
7/1/87	\$700,000		7/1/06	\$600,000	
7/1/88	\$700,000		7/1/07	\$589,500	
7/1/89	\$700,000		7/1/08	\$589,500	
7/1/90	\$700,000		7/1/09	\$0	No State Money
7/1/91	\$0	No State Money	7/1/10	\$0	No State Money
7/1/92	\$0	No State Money	7/1/11	\$0	No State Money
7/1/93	\$700,000		7/1/12	\$0	No State Money
7/1/94	\$700,000		7/1/13	\$0	No State Money
7/1/95	\$700,000		7/1/14	\$0	No State Money
7/1/96	\$700,000		7/1/15	\$0	No State Money
7/1/97	\$700,000		7/1/16	\$75,000	

Source: NC Forest Service, personal communication

Appendix 5

NC FDP Waitlist in Recent Years

Year	Number Projects	Amount Requested
Jun-10	298	\$947,372
Jun-11	176	\$672,386
Jun-12	233	\$961,271
Jun-13	337	\$1,284,779
Jun-14	583	\$2,204,287
Jun-15	555	\$2,249,482
Jun-16	629	\$2,907,790

Source: NC Forest Service, personal communication