2011

An overview of green jobs in the Louisiana forest sector

Ryan D. Olson
Louisiana State University and Agricultural and Mechanical College

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_theses

Part of the Environmental Sciences Commons

Recommended Citation
Olson, Ryan D., "An overview of green jobs in the Louisiana forest sector" (2011). LSU Master’s Theses. 4080.
https://digitalcommons.lsu.edu/gradschool_theses/4080

This Thesis is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Master's Theses by an authorized graduate school editor of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.
AN OVERVIEW OF GREEN JOBS IN THE LOUISIANA FOREST SECTOR

A thesis
submitted to the Graduate Faculty of
the Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Science

In
The School of Renewable Natural Resources

By
Ryan D. Olson
B.S. University of New Orleans, May 2010
December, 2011
AKNOWLEDGMENTS

This work would not be possible without the support of my Major Professor, Dr. Richard P. Vlosky, under whose supervision I began my thesis research. I greatly appreciate his continuous encouragement and guidance throughout the duration of my research project.

I would especially like to thank Paul Darby for his guidance through the entire process and for his contributions to my studies.

Thanks are due for my graduate committee members Dr. Michael A. Dunn, Department of Agricultural Economics and Agribusiness, Dr. Niels de Hoop, School of Renewable Natural Resources and Dr. Margaret Reams, Department of Environmental Sciences for their support during the course of this study.

I would also like to thank my co-workers and Roger Smithhart, Anil Raj Kizha, Priyan Perera, Rangika Perera, Erin Leonhardt and Xianglin Zhai for their friendship, guidance and encouragement.

I would finally like to thank my parents for their encouragement and support that has driven me to reach these achievements.
TABLE OF CONTENTS

AKNOWLEDGMENTS ................................................................................................................................. ii

LIST OF TABLES .............................................................................................................................................. v

LIST OF FIGURES ............................................................................................................................................... vi

ABSTRACT ........................................................................................................................................................ viii

CHAPTER 1: INTRODUCTION ................................................................................................................................. 1
  1.1 Introduction ............................................................................................................................................... 1
  1.2 The Green Economy ................................................................................................................................. 1
  1.3 The Louisiana and Mississippi Green Jobs Consortium ........................................................................... 3
  1.4 The Louisiana Forest Products Supply Chain ......................................................................................... 3
  1.5 Concluding Comments ............................................................................................................................ 5
  1.6 Literature Cited ......................................................................................................................................... 5

CHAPTER 2: LITERATURE REVIEW ......................................................................................................................... 6
  2.1 Introduction ............................................................................................................................................... 6
  2.2 Energy Production ................................................................................................................................... 8
    2.2.1 Legislation ........................................................................................................................................... 9
    2.2.2 Technology Advancements .............................................................................................................. 11
    2.2.3 Energy Production at Forest Product Manufacturing Facilities ................................................... 12
    2.2.4 Wood-Based Fuels ......................................................................................................................... 14
    2.2.5 Wood Pellets .................................................................................................................................. 16
    2.2.6 Commercial Energy Production .................................................................................................... 17
  2.3 Energy Production Feedstocks .................................................................................................................. 17
    2.3.1 Forest Biomass ................................................................................................................................... 19
  2.4 Export of Energy Feedstocks ..................................................................................................................... 21
    2.4.1 Growing Demand ............................................................................................................................. 22
    2.4.2 Legislation ....................................................................................................................................... 22
  2.5 Energy Efficiency ....................................................................................................................................... 23
    2.5.1 Production Processes ....................................................................................................................... 23
    2.5.2 Goods and Services .......................................................................................................................... 24
  2.6 Sustainability and Natural Resource Conservation ..................................................................................... 25
    2.6.1 Forest Management .......................................................................................................................... 27
    2.6.2 Wetland Conservation ..................................................................................................................... 27
  2.7 Greenhouse Gas Reduction ......................................................................................................................... 28
  2.8 Recycling and Waste Reduction ................................................................................................................ 28
    2.8.1 Pulp and Paper Mills ......................................................................................................................... 29
    2.8.2 Recovered and Reclaimed Logs ....................................................................................................... 30
  2.9 Education and Training .............................................................................................................................. 30
  2.10 Future Growth Potential .......................................................................................................................... 31
  2.11 Summary .................................................................................................................................................. 32
  2.12 Literature Cited ....................................................................................................................................... 33
LIST OF TABLES
Table 1: Requirements for RFS 2 (billions of gallons). EISA .................................................... 11

Table 2: Respondent Green Activity Attitudes and Behaviors .................................................... 47

Table 3: Correlation of Green Activity Attitudes and Behaviors to Company Revenue in 2009
(Pearson Chi-Square) .................................................................................................................... 48

Table 4: Correlation of Green Activity Attitudes and Behaviors to Company Current Green Job
Percentage in 2009 (Pearson Chi-Square) .................................................................................... 49

Table 5: Correlation of Green Activity Attitudes and Behaviors to Company Future Green Jobs
Percentage (Spearman Correlation) .............................................................................................. 49

Table 6: Green Job Drivers compared to different Company Ownership in 2009 (One-way
ANOVA) ....................................................................................................................................... 51

Table 7: Examples of accurate and inaccurate Green Job Activities Descriptions reported by
respondent companies ................................................................................................................... 55
LIST OF FIGURES
Figure 1: Economic impact of employment in forest-products manufacturing and timber contracting. Louisiana Forestry Association........................................................................................................ 4
Figure 2: U.S. Housing Starts from 2006 to 2011 ........................................................................ 7
Figure 3: Southern U.S. pellet mills by capacity. (Spelter and Toth, 2009)................................. 16
Figure 4: Concentration of biomass resources throughout the United States. National Renewable Energy Laboratory (2005). ....................................................................................... 20
Figure 5: Existing home inventory in the United States. The National Association of Realtors 21
Figure 6: Renewable energy make-up in the United States-2010. U.S. Energy Information Administration .......................................................................................................................... 31
Figure 7: Percent of Respondents by Louisiana Parishes (n=228) .............................................. 40
Figure 8: Louisiana parishes represented by survey respondents (n=228)................................. 41
Figure 9: States containing company headquarters of respondent companies (n=250)............. 41
Figure 10: Percent of respondents by Forest Sector Activity Category (n=244) ....................... 42
Figure 11: Percent of respondents by Revenue Category (n=230) ............................................ 43
Figure 12: Percent of respondents by Company Ownership Category (n=251) ....................... 44
Figure 13: Percent of Respondents by Company Activity (n=245) ........................................... 44
Figure 14: Percent of respondents by Year Company was Founded (n=242) ............................ 45
Figure 15: Percentage of Respondents by Full-time and Part-time Employment (n=240) ....... 46
Figure 16: Potential of Green Job Drivers to spur green job creation. ...................................... 50
Figure 17: Percent of Respondent Green Activity Descriptions by Green Activity Category (n=667) ........................................................................................................................................ 52
Figure 18: Current Green Job Estimate and Five Year Growth Estimates reported by respondent companies (n=232) ........................................................................................................................................ 53
Figure 19: Areas of Green Job Growth (in 5 years) by Category. Percent of respondents by category (n=194) ....................................................................................................................... 54
Figure 20: Percentage of accurate and inaccurate Green Job Activities Descriptions reported by respondent companies (n=793) ........................................................................................................................................ 55
ABSTRACT

The term “green job” is a relatively new definition that defines employment activities that are likely to have occurred since the beginning of human existence. The push to identify, to quantify and to drive the growth of these jobs has recently been brought on by climate change and the depletion of Earth’s natural resources. According to the United States Department of Labor Bureau of Labor Statistics, green jobs are either (a) Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources or (b) Jobs in which workers’ duties involve making their establishment’s production processes more environmentally friendly or use fewer natural resources. For the purposes of this study, seven “green job categories” were used.

1. Education, Public Awareness, and Compliance
2. Energy Efficiency
3. Green Certification
4. Greenhouse Gas Reduction
5. Pollution Reduction and Cleanup
6. Recycling and Waste Reduction
7. Renewable Energy

In order to obtain information on green jobs in the Louisiana forest sector, a mail survey was administered to the known population of the Louisiana forest sector supply chain. Member sectors included loggers, primary producers, secondary manufacturers and brokers/distributors. The overarching objectives of the study were to classify and quantify current and future green jobs in the Louisiana forest sector and to develop an understanding of supply chain member attitudes and behaviors in the context of green jobs.

Results indicate that a wide array of green jobs exist in the industry. Each green category is well represented and overall, respondents consider 12.7 percent of employment in the sector to be green. Additionally, respondents forecast that 16.7 percent of employment in the forest sector supply chain will be green in five years. Increased profits, government incentives and
regulations and public perception were reported to be likely drivers of green job creation.

Respondents claimed to have a clear understanding of the term “sustainability” while there were misconceptions about the term “green jobs” and their potential impacts on the industry. Study results suggest that education and, potentially training would benefit forest sector members that participate in the green jobs arena.
CHAPTER 1: INTRODUCTION

1.1 Introduction

There is a trend in increased interest in environmental-focused or “green” employment globally as companies vie to compete in the evolving green economy. This trend has been influenced by growing clean energy markets, public concerns about a wide variety of environmental issues and increasing government intervention. The forest sector has long focused on sustainability as being an inherent and necessary part of long-term viability. As is the case with the term “sustainability”, there are misconceptions and various interpretations about the term “green” and its potential importance in the global economic environment.

1.2 The Green Economy

The “green economy” is defined as economic activity that reduces energy consumption and/or improves environmental quality (Chapple et al., 2011). Chapple et al., (2011) in their paper “Innovation in the Green Economy” state that the green economy encompasses both new and traditional sectors. In essence, the green economy has been around as long as there has been an economy at all. Before the use of fossil fuels, renewable resources represented the sole source of energy. However, as early as the 13th century, green energy and small-scale production were being abandoned simply because they could not compete economically in the industrialized world (Taylor and Van Doren, 2011). The reemergence of a focus on a green economy has come about relatively recently due to increased concerns about point and non-point environmental pollution as well as perceptions of human-caused climate change.

Environmental issues soared to a prominent place in the United States and other industrial nations in the early 1970s (Vig and Kraft, 2009). This renewed focus on the green economy through public awareness, corporate responsibility and government intervention has ushered in a new era of green job creation. The green economy has gained considerable...
momentum due to concerns about human-influenced climate change. Civic leaders and other policy influencers are becoming more aware of the importance of addressing sustainability, however it is defined, by focusing on pollution reduction, energy efficiency and reducing the overall carbon footprint (Scott and Brown, 2003). In addition, it is debatable whether current depressed global economic conditions hamper this momentum or can be seen as an additional driver to fostering growth in the green economy.

In order to understand investments in sustainability and the green economy, investments are divided into two categories, (a) direct investments and (b) indirect investments. Direct investments relate to normal business operations. They are likely to involve increased costs in the short term but are considered to be long-term investments because they provide potential benefits over time. Examples of direct investments in the context of a green economy include activities along the value chain including environmental research and green product development. Indirect investments are not related directly to normal business operations and include charitable donations and other philanthropic efforts in which benefits are often difficult to isolate and measure. In the case of indirect investments, monetary gain may be realized through brand recognition, brand equity, and differentiation (Sekerka and Stimel, 2011).

This study of green jobs in the Louisiana forest sector focuses on direct investments in the green economy, specifically on green job creation. Economic investment in green activities provides well-paying middle-class employment. Green job studies conducted in states such as Idaho and Oregon have shown that green jobs have high wages relative to average income, but may require special skills or training. The impact of green jobs has grown substantially in recent years. A recent report from The Brookings Institution concludes that the clean economy in the United States employs 2.7 million workers (Muro, 2011). Growth in the U.S. green economy
will be necessary to stay competitive with the green economies of developing countries and will provide income for millions of Americans and their families.

1.3 The Louisiana and Mississippi Green Jobs Consortium

As part of the American Recovery and Reinvestment Act of 2009, the United States Department of Labor announced $55 million in grants to help workers find jobs in expanding green industries. Of these grants, $48.8 million focused on collecting and disseminating labor market information. These grants gave state workforce agencies the opportunity to work side-by-side with institutions of higher learning as part of a consortium to collect information and create a regional, multi-state or national impact (Solis, 2009).

Funded through a $2.3 million grant from the U.S. Department of Labor, the Louisiana and Mississippi Green Jobs Consortium was created (LWC, 2009). The Louisiana and Mississippi Green Jobs Consortium is comprised of four entities (1) the Louisiana Workforce Commission, (2) Mississippi’s Department of Employment Security, (3) Louisiana State University and (4) Mississippi State University. Louisiana State University and Mississippi State University conducted survey research while working in consultation with the two workforce agencies. Each workforce agency will disseminate results of the study within their respective state. The Louisiana forest sector study was performed as part of the Louisiana and Mississippi Green Jobs Consortium.

1.4 The Louisiana Forest Products Supply Chain

The forest products supply chain in Louisiana is comprised of companies specializing in forest management, logging, distribution and production of finished products. The entire supply-chain is represented in the Louisiana forest sector from forest landowners to forest managers, loggers, distributors, primary and secondary producers and retailers. It is estimated that more than 4,900 companies currently participate in the Louisiana forest sector (Olson, 2011).
Louisiana forest sector participants range in size from one person operations to international corporations.

According to “2011 Louisiana Forest Facts” published by the Louisiana Forestry Association (2011), forestry accounted for 57 percent of the total value of all plant commodities grown in Louisiana in 2010. In the same year, the impact of forestry and forest products industries on Louisiana’s economy was $3.1 billion with Louisiana forest landowners receiving $396.8 million (LFA, 2011). There are approximately 180 primary wood-using industries and 750 secondary wood-using industries within the state. In 2010, employment in forest products manufacturing and timber contracting generated $670.8 million and $396.8 million in income for Louisiana residents respectively (Figure 1) (LFA, 2011).

Figure 1: Economic impact of employment in forest-products manufacturing and timber contracting. Louisiana Forestry Association
1.5 Concluding Comments

The concept of “green” jobs is a fairly recent phenomenon. With the reemergence of the environmental movement, or at least an increased awareness in environmental issues, the proliferation of green jobs in the U.S economy will proliferate. Whether or not this is sustainable without government intervention remains to be seen. In the forest sector in Louisiana, green jobs currently account for about 10 percent of all jobs and this percent is expected to increase over the next five years as reported by study respondents.

1.6 Literature Cited


CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Companies in the forestry, logging, wood products manufacturing, and paper manufacturing industries create green jobs in several categories including (a) Education, Public Awareness and Compliance, (b) Energy Efficiency, (c) Green Certification, (d) Greenhouse Gas Reduction, (e) Pollution Reduction and Cleanup, (f) Recycling and Waste Reduction and (g) Renewable Energy. Individuals employed in forest management ensure sustainable and responsible use of timber lands and are by definition, members of the green sector. Wood product manufacturers utilize sawdust and wood chips to create thermal and electrical energy that provides a majority of the power for production of wood products. Manufacturers of paper are increasingly taking part in recycling efforts while producing much of their energy from industry byproducts such as black liquor. In addition, wood products and paper manufacturers are sourcing raw materials from sustainability managed timberlands. Sustainability and energy efficiency are generally top priorities in all manufacturing nodes in wood product supply chains. In order to maintain continuous and available feedstock levels for production facilities, while protecting the natural environment, forest products companies have a vested interest in maintaining responsible harvest regimes and manufacturing methods.

Energy efficiency is a priority in manufacturing and energy efficient products are produced for use in both residential and commercial production. Both cost considerations and necessity of sustainability drive companies to be innovative leaders in the areas that produce green jobs. In addition to sustainability and energy efficiency, forest products act as carbon sinks for large amounts of harmful greenhouse gasses. Harvested wood products including lumber, panels, paper, paper board and wood used for fuel were responsible for 30 million metric tons of carbon removals in 2005 (Skog, 2008).
The recent economic crisis has severely impacted many aspects of the forest products industry. Housing, the main economic driver for wood products saw a serious decline from 2006 to 2010. U.S. housing starts totaled 2.2 million in 2005 and fell to roughly 600,000 starts in 2010. In 2009, housing starts hit a low of around 500,000 (Figure 2) (U.S. Census Bureau, 2011). Demand for softwood fell drastically with overall production in the U.S. falling by 19 percent in 2008 and 2009 (UN, 2009).

The paper industry has also gone through a structural transition due to increased use of electronic documents while demand, production and prices continue to fall. Pulpwood prices are at historic highs in the U.S. South. In addition, wood energy markets, a relatively new sector, have remained stable throughout the economic crisis partly because the markets are largely driven by government subsidies and investment.

Figure 2: U.S. Housing Starts from 2006 to 2011
2.2 Energy Production

The wood product manufacturing sector has been implementing a number of green technologies for decades. For example, combined heat and power (CHP) or thermal energy generation takes place at many sawmills. A thermal generation process known as gasification uses wood residues such as bark and sawdust to produce heat for dryers and to create steam to run plant manufacturing operations. Gasification eliminates the need for fossil fuels to create thermal energy for the drying of materials in the production of wood products. In addition to the use of wood residues for thermal energy at mills, the production of wood pellets and cellulosic biofuels for thermal and electrical applications outside of the wood products industry has recently increased.

According to Spelter and Toth (2009), the use of wood pellets in residential heating is increasing in the United States and Canada. The export industry in the Southern United States supplies pellets vast quantities to Europe for production of electricity and combined heat and power (CHP) on a large scale. Pellets are also used to generate power by co-firing them with coal, reducing carbon dioxide emissions from fossil fuels in coal power production. Exports to Europe represent 80 percent of pellet demand from U.S. manufacturers and more than 90 percent from Canadian manufacturers. Of all pellet production in the United States, the Southern region represents 46 percent of the market. The growing demand for wood pellets in Europe offers opportunities for exportation of pellets from the southern United States because of the availability of feedstock sources, the moderate climate year-round, the transportation infrastructure and the access to deepwater ports (Spelter and Toth, 2009).

While production of traditional wood products has declined in recent years, biomass-to-energy production has grown across the U.S. and the world (Heinimö and Junginger, 2009). Production of traditional wood products is expected to rebound while the use of wood-based
energy continues to increase. Although biomass currently provides 14 percent of the world’s energy, most of its current applications such as cooking and heating are very inefficient (Fernholz, 2009). Highly efficient processes are being developed that take advantage of biomass as a cost-effective, sustainable resource. Due to growing global demand, the markets for industrially used biomass for energy purposes are developing rapidly toward being international commodity markets (Heinimö and Junginger, 2009). Jobs that deal directly with renewable energy production provide a large portion of green jobs in the wood product manufacturing sector.

### 2.2.1 Legislation

Federal legislation such as the Healthy Forest Restoration Act (HFRA), the Renewable Fuels Standards (RFS), The *American Recovery and Reinvestment Act of 2009 (ARRA)*, the Farm Bills, the Biomass Crop Assistance Program (BCAP) and the Energy Independence and Security Act of 2007 (EISA) have been beneficial to the forest sector in a variety of ways. The Energy Independence and Security Act of 2007 promote research and education in the field of biomass. The EISA places emphasis on realizing more domestic sources of fuels and energy production. Grants are available through the EISA for research, development, demonstration and commercial application of biofuel production technologies (CRS-RL34294, 2007).

The 2002 Farm Bill provided energy provisions that supported research and development through renewable energy grants that included biofuels and biorefineries. Support included grants for education, development of renewable energy systems for farmers and development of biorefineries for biomass conversion (USDA, 2002). The 2008 Farm Bill is the first to include a provision entitled “Forest Biomass for Energy”. Specifically, this provision authorizes a new research and development program to encourage use of forest biomass for energy. The provision
appropriates $15 million annually for 2009-12 for developing technologies that utilize low-value forest biomass for energy production, processes to integrate forest biomass into biorefineries, new transportation fuels and improving growth and yield of trees intended for renewable energy (USDA, 2008).

The Renewable Fuels Standards, set forth by the EPA, was created by the Energy Policy Act of 2005. These standards, now referred to as RFS1, mandated that 7.5 billion gallons of renewable fuels be blended with gasoline by 2012. RFS was later expanded under the Energy Security and Independence Act (EISA) of 2007 (Sissine, 2007). Referred to as RFS2, the expanded RFS further mandates 9 billion gallons of renewable fuels blended with gasoline by 2009 and 36 billion gallons by 2022 (Table 1) (EPA, 2010). RFS provides cash awards to biorefineries that reduce the life cycle greenhouse gas (GHG) emissions relative to gasoline and diesel. Additionally, RFS gives awards to biorefineries that produce fuels that displace more than 80 percent of the fossil-derived processing fuels used to operate a biofuel production facility (EPA, 2010).

A recent policy mandate from the European Union requires that 20 percent share of energy come from renewable sources by 2020. This policy has created the need to import millions of tons of wood pellets from countries such as the United States, Canada and Brazil. The outlook in Europe promises a demand of over 73 million tons of wood pellets per year. European demand has created a market for pellet producers that have access to low-cost feedstocks and water transportation. Regulations on emissions and use of renewable fuels in Europe help drive demand for wood pellets for renewable energy from U.S. manufacturers. North American biomass companies will supply a substantial proportion of European biomass demand. In addition to growing demand in Europe, The Biomass Crop Assistance Program (BCAP) has begun to shift feedstock from more traditional uses to biomass production. Demand for wood
pellets translates into opportunity for jobs in Louisiana plants that produce the pellets bound for the European market. Additionally, many indirect jobs will be created in industries such as service, trucking and shipping.

Table 1: Requirements for RFS 2 (billions of gallons). EISA

<table>
<thead>
<tr>
<th>Year</th>
<th>Cellulosic Biofuel Requirement</th>
<th>Biomass-Based Diesel Requirement</th>
<th>Advanced Biofuel Requirement</th>
<th>Total Renewable Fuel Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>n/a</td>
<td>0.50</td>
<td>0.60</td>
<td>11.10</td>
</tr>
<tr>
<td>2010</td>
<td>0.10</td>
<td>0.65</td>
<td>0.95</td>
<td>12.95</td>
</tr>
<tr>
<td>2011</td>
<td>0.25</td>
<td>0.80</td>
<td>1.35</td>
<td>13.95</td>
</tr>
<tr>
<td>2012</td>
<td>0.50</td>
<td>1.00</td>
<td>2.00</td>
<td>15.20</td>
</tr>
<tr>
<td>2013</td>
<td>1.00</td>
<td>a</td>
<td>2.75</td>
<td>16.55</td>
</tr>
<tr>
<td>2014</td>
<td>1.75</td>
<td>a</td>
<td>3.75</td>
<td>18.15</td>
</tr>
<tr>
<td>2015</td>
<td>3.00</td>
<td>a</td>
<td>5.50</td>
<td>20.50</td>
</tr>
<tr>
<td>2016</td>
<td>4.25</td>
<td>a</td>
<td>7.25</td>
<td>22.25</td>
</tr>
<tr>
<td>2017</td>
<td>5.50</td>
<td>a</td>
<td>9.00</td>
<td>24.00</td>
</tr>
<tr>
<td>2018</td>
<td>7.00</td>
<td>a</td>
<td>11.00</td>
<td>26.00</td>
</tr>
<tr>
<td>2019</td>
<td>8.50</td>
<td>a</td>
<td>13.00</td>
<td>28.00</td>
</tr>
<tr>
<td>2020</td>
<td>10.50</td>
<td>a</td>
<td>15.00</td>
<td>30.00</td>
</tr>
<tr>
<td>2021</td>
<td>13.50</td>
<td>a</td>
<td>18.00</td>
<td>33.00</td>
</tr>
<tr>
<td>2022</td>
<td>16.00</td>
<td>a</td>
<td>21.00</td>
<td>36.00</td>
</tr>
</tbody>
</table>

a. To be determined by EPA through a future rulemaking, but no less than one billion gallons.

2.2.2 Technology Advancements

Advancements in renewable energy will create a variety of green jobs in the forest sector over the next ten years. More efficient use of wood biomass to produce energy and heat is increasing and there is a push by the U.S. Departments of Energy and Agriculture to increase the production of biofuels including cellulosic ethanol. High efficiency enzymes to facilitate economically competitive production of cellulosic biofuels are in the purported to be in the final stages of development. In another example of technological advancements, researchers at the School of Plant, Environmental and Soil Sciences at Louisiana State University are working with perennial oilseed crops such as Tung trees and Chinese Tallow trees. In south Louisiana, tallow trees have the potential to not only stabilize wet, erosive and saline oils. Vegetable oil yields
from Tallow trees is capable of yielding ten to twenty times more than vegetable oil obtained by soybeans grown on more fertile soils (LADNR, 2010). On an acre basis, the cost of producing Tallow tree seed will be equal or less than that of producing soybeans (EERE, 2010). Researchers believe the first step to commercialization is to identify and make available Tallow trees with traits that ensure high yields and uniform properties, such as pest and disease resistance. Chinese Tallow trees are largely cross-pollinated so researchers are developing cloning techniques to ensure that superior traits are expressed. The potential to produce high oil yields while addressing the issue of land loss in southern Louisiana provides a potential to create green jobs in renewable energy and coastal restoration.

An example of technology that is commercialized is Verenium, a company with production in Louisiana that is vertically integrated in the entire production process of cellulosic biofuel (Verenium, 2010). The company grows energy crops, develops enzymes and processes biomass into fuel. According to Verenium’s website, the company works with cellulosic biofuels, which incorporates discovery of enzyme products, optimization of proteins, ethical bioprospecting, technology patents, and manufacturing cellulosic biofuels (Verenium, 2010).

2.2.3 Energy Production at Forest Product Manufacturing Facilities

A large portion of biomass energy production takes place at wood products and paper manufacturing facilities. These facilities currently produce 94 percent of renewable fuel energy generated by manufacturing facilities in all sectors (AF&PA, 2010). Power generated from burning biomass including wood, plants and other organic material makes up 50 percent of all renewable energy produced in the United States or 1.5 percent of total production (Zeller, 2010). The wood products manufacturing industry produces much of its own energy similar to the paper industry.
In Louisiana, companies such as Roy O Martin use gasification in their plants to produce up to 60 percent of the energy required for drying and operation of machinery. Byproducts such as wood chips and sawdust are fired at plants in the production of renewable energy. According to the U.S. Energy Information Administration in 2007, the energy consumption from wood and wood waste solids in the lumber industry totaled 259 trillion btus. Specifically, more than 96 percent of the energy created was thermal energy with the remainder being used to produce electricity (DOE, 2009). Employees who deal directly with the production of renewable energy have green jobs.

Paper manufacturers participate in the use of renewable energy, pollution reduction and cleanup and recycling and waste reduction. Many paper mills utilize byproducts of the manufacturing process for cogeneration or combined heat and power (CHP). Byproducts such as black liquor are burned to create their energy for production and heat for “cooking” and drying of pulp. The use of CHP reduces the use of fossil fuels in the production of paper. A reduction in fossil fuels and purchased energy per ton of production significantly lowers the amount of pollution produced in the manufacturing process. Mills that use recycled paper reduce waste and limit the use of new resources.

Pulp and paper industries are the largest producers of electricity from biomass in the United States (AF&PA, 2010). Wood residue as renewable energy feedstock provides almost 90 percent of all biomass energy production in the United States. Pulp and paper companies produce 75 percent of all biomass energy in the United States according to the United States Department of Energy (AF&PA, 2010). According to the U.S. Energy Information Administration in 2007, the energy consumption from black liquor was 829 trillion btus. Of this black liquor energy consumption, 86 percent was used to create thermal energy while the rest was utilized in electricity production (DOE, 2009). Energy produced by these pulp and paper
mills is mainly implemented internally for heat and electricity required for pulp and paper production (Zeller, 2010).

2.2.4 Wood-Based Fuels

Wood biomass can be converted into a number of types of converted and drop-in liquid biofuels such as ethanol, butanol, and methanol. Cellulosic ethanol production still faces economic barriers that make direct competition with conventional gasoline difficult. Currently, in the case of corn-based ethanol, the blender’s credit will keep production going and the Renewable Fuels Standard mandate ensures the development of new capacity. Cellulosic ethanol has the potential to reduce greenhouse gas emissions by 88 percent compared to a gallon of gasoline (White and Jason, 2008). At this stage, markets forces that determine ethanol prices are very complex and lead to the instability of price. E85 blend (85 percent ethanol and 15 percent gasoline) may be less cost-efficient than conventional E10 gasoline because with E85 the number of miles driven per gallon decreases by 28 percent (Scarborough, 2008). Currently, production of corn ethanol is much less expensive than the production of cellulosic ethanol. The development of new technologies for cellulosic ethanol production is striving to eliminate the price disparity between cellulosic ethanol and corn ethanol. Cellulosic ethanol production from wood products has the potential to achieve more competitive production costs within the next five to ten years.

Currently, there are high capital costs associated with the development and production of next-generation cellulosic biofuel plants. According to a 2002 NREL study, the capital costs of a representative biochemical conversion plant producing 69.3 MM Gallons of ethanol per year were estimated at 197 million (Aden, 2002). Technology that makes cellulosic ethanol production more efficient may reduce prohibitive initial capital requirements and make long-term profit more feasible.
Novozymes, the world’s largest industrial enzyme producer, expects to offer an improved conversion product that reduces the cost of biofuel conversion with enzymes by 80 percent (Leber, 2010). These efficient, low-cost enzymes will allow cellulosic biofuels to better compete with corn-based ethanol and gasoline. A pilot cellulosic ethanol plant, operated by BP Biofuels North America, is currently in operation in Jennings, LA.

Cellulosic ethanol offers opportunities to create energy more sustainably and efficiently compared to current production of corn based ethanol. There is a net energy balance net energy balance (NEB) of only 25 percent due to the high energy inputs required to produce ethanol from corn. This means that corn ethanol provides only 25 percent more energy than required for its production (Hill et al., 2006). Other than a low NEB, there are a number of negative environmental effects of ethanol production from corn. One primary effect of corn ethanol production is its competition with human and livestock consumption. The use of corn ethanol raises corn commodity prices; consequently, raising the price of food items that depend on corn as a feedstock. Increased total food costs in the United States due to the production of ethanol were estimated at $14 billion in addition to $0.51 per gallon of ethanol contributed by taxpayers (Tokgoz et al., 2007). The requirement for high agricultural input and land with high-agricultural value are other major limitations of corn ethanol production.

Although companies working with cellulosic ethanol are gaining ground, a recent study by Forisk Consulting warns that technology for processing cellulosic biofuels from wood biomass could be as much as eleven years away in their recent assessment. Researchers evaluated 12 technologies in 36 projects that converted wood to fuels like ethanol, butanol, diesel, gasoline, and jet fuel and found major technical hurdles impeding commercialization (Forisk, 2011).
2.2.5 Wood Pellets

According to the Pellet Fuels Institute (2010), there are approximately one million homes in the United States using wood pellets for heat. There are also numerous institutions across North America such as schools and prisons that utilize wood pellets to provide heating. Demand for wood pellets in Europe is increasing the demand for imported wood pellets from countries with excess feedstock such as the United States and Canada. Most pellet plants are small operations, less than 100,000 tonnes per year, relying on sawmill residues as a feedstock.

In 2009 there were 6.2 million metric tonnes of wood pellets produced by companies in the U.S. Canada is already taking advantage of European pellet demand by exporting most of their pellet production. Most wood pellets produced in the United States are currently used domestically but there is growth occurring in the export market (Spelter and Toth, 2009). There are more than 30 pellet mills in operation in the Southeast with more scheduled to begin production (Figure 3).

![Southern U.S. pellet mills by capacity. (Spelter and Toth, 2009).](image-url)
Bayou Wood Products, Inc. of Monroe, LA produces and sells wood pellets in Louisiana. Pointe Bio Energy, LLC of Port Allen, LA will join Bayou Wood Products, Inc. of Monroe, LA as a producer of wood pellets in the state. Point Bio Energy expects to begin production in the middle of 2012. Point Bio Energy expects to produce 400,000 metric tonnes of wood pellets each year. Production, storage and shipping will all take place at the Port of Baton Rouge location. Much of the production from the Port Allen facility at the Port of Greater Baton Rouge will be exported to meet growing demand for wood pellets in Europe.

2.2.6 Commercial Energy Production

Commercial energy production from wood biomass is not prevalent in Louisiana at this time. The use of wood biomass is occurring in pellet and biofuel production. While Louisiana has facilities producing these products, there is no commercial energy production taking place. Energy produced from wood biomass in Louisiana is limited to production at wood and paper manufacturing facilities. Combined heat and power facilities are operated in areas of the United States that have more demand for heating such as St. Paul, Minnesota. The largest commercial energy production from wood biomass is occurring at coal power plants that co-fire a certain percentage of biomass to coal.

2.3 Energy Production Feedstocks

Fast-growing, high yield trees such as eucalyptus and poplar are known as short rotation woody crops that may be farmed as dedicated energy crops. Short rotation woody crops offer an opportunity for Louisiana landowners to supply a feedstock for the production of renewable energy. According to the LSU AgCenter (2010), a hybrid version of eucalyptus can grow to harvestable heights of up to 70 feet in six to eight years. The LSU AgCenter is involved in a research project with Texas A&M University to study the optimal growth methods for
Eucalyptus. Eucalyptus can be grown on land that was previously used as timberland, idle or agriculture land. MeadWestvaco Co. has more than 5,000 acres of eucalyptus growing in Texas and Louisiana to supply a paper mill in Evadale, Texas. This eucalyptus will provide a feedstock for renewable energy production. There is great potential for eucalyptus as a feedstock for production of cellulosic ethanol, wood pellets and wood energy. Owners of timberland and agricultural land can benefit from diversifying their income by growing eucalyptus or other short rotation woody crops (Shmidt, 2006).

Wood biomass makes up the largest supply of biomass from any source in Louisiana and has the opportunity to power 238,312 homes if utilized to its full extent (USDA, 2007). The supply chains for many wood biomass energy applications are still developing. New opportunities for income exist in the harvesting of logging slash, small-diameter trees, tops and limbs. Private landowners must be on board to ensure a viable feedstock of wood biomass because an overwhelming majority of forestland in the southern United States is privately owned (DOE, 2005). Louisiana timberland owners will be faced with the decision to manage their lands for timber or biomass production or both. The renewable fuels industry must ensure landowners equal or greater value for their biomass than the landowners currently receive to make biomass production possible.

Responsible biomass harvest is possible when disruption of the forest is minimized and adequate residues are left for fertilization and wildlife habitat. A method of economical feedstock sourcing was established for some energy production practices across the United States. Energy production practices included wood pellet production, production of combined heat and power, limited production of cellulosic ethanol and energy production by the paper industry and the wood products industry. The most well established industrial energy production from wood biomass in the United States occurs in the paper and wood products industries.
There are still barriers to the growth and success of the wood pellet industry in the United States. Viable and constant sources of feedstock must be established to ensure continuous production, quality and price stability of wood pellets. Feedstock for pellet producers must be available at a close proximity to production facilities because biomass is bulky and expensive to transport. Markets for biomass should ideally be within 100 miles of harvesting sites to limit transportation costs (Berry, 2009). Furthermore, cost-effective transportation needs to be available year-round to keep wood pellets competitive with other fuel sources. Many energy producing facilities using biomass in the U.S currently operate on a seasonal basis based on feedstock availability. Prices of fossil fuels need to remain stable and high enough for the production of energy from wood to remain economical. Wood manufacturing companies will have to take advantage of new technologies and developing markets to supplement declines in traditional wood products.

### 2.3.1 Forest Biomass

Studies suggest that the harvest of biomass is economical under the right conditions. Transportation of machinery must be minimized to ensure economic feasibility. It was determined that harvests of over 50 acres were large enough to disperse move-in costs over sufficient acreage while maintaining minimal impact on total harvest costs (Demchik et al., 2009). Studies are currently underway to determine alternatives to transporting raw biomass.

Wood biomass is abundant in different concentrations in several areas of the United States. The Southeast has large amounts of wood biomass resources while the Midwest has large amounts of biomass from agricultural residues (Figure 4). The supply of wood biomass for Louisiana producers depends on cost-efficient transportation from areas within a certain radius of
each manufacturing facility. Louisiana producers can rely on feedstock from within the state along with supplies from areas of Texas, Arkansas and Mississippi.

Harvest of wood biomass can be performed in conjunction with harvest of traditional feedstocks. This conjunction will make logging more economical while providing a limited number of additional jobs in areas such as transportation and logistics. Employees tasked with sourcing and overseeing the distribution of wood biomass have green jobs in the renewable energy category. Utilizing wood biomass residuals from existing forest practices for the production of biofuels and biofuel components results in the development of new jobs and markets in rural areas (Vogt, 2009).

Figure 4: Concentration of biomass resources throughout the United States. National Renewable Energy Laboratory (2005).
A drastic decline in housing starts and an excess of unsold housing inventory, for instance 4 million homes on the market created a reduction in demand for wood products (Figure 5). Decreased production by sawmills decreased feedstock availability for fledgling pellet producers. With feedstock of sawdust and shavings limited, some pellet producers had to seek feedstock directly from the forest. The disruption in commercial-grade feedstock caused an increase in production costs and a decrease in the quality of wood pellets produced (Anderson, 2010).

![U.S. Existing Home Inventory in Millions](image)

**Figure 5: Existing home inventory in the United States. The National Association of Realtors**

### 2.4 Export of Energy Feedstocks

The potential for the U.S. to export biomass to countries in Europe is a major opportunity for growth for the wood pellet industry. Pellet markets are more mature in Europe than they are in the United States. Legislation that requires the use of renewable fuels and the relatively limited availability of wood biomass in Europe provide opportunities for companies in the U.S.
to export this biomass. Louisiana can be a key player in the pellet export industry because of availability of resources and access to deepwater to ports.

2.4.1 Growing Demand

Regulations in Europe created the need to import millions of tons of wood pellets from countries such as the United States, Canada and Brazil. European demand for wood pellets created a market for pellet producers in the U.S. that have access to ports. The outlook in Europe promises a demand of over 73 million tons per year (RISI, 2010). North American biomass companies supply a substantial portion of European biomass demand. Biofuel mandates in many countries require use of ethanol along with traditional fossil fuels. The growing demand for biofuels has made cellulosic ethanol an important biofuel because cellulosic ethanol is much cleaner to produce than corn ethanol. Cellulosic ethanol will be necessary to fulfill biofuel demands while leaving agricultural lands to food production.

2.4.2 Legislation

There is new legislation in the European Union that places a ban on timber imports from illegal sources. The new legislation promises to increase exports of forest products from the United States to countries in the EU. This legislation targets illegal logging practices in countries such as Russia, China, Brazil and Indonesia that currently supply at least 21 percent of demand in the EU. The ban on illegal timber imports was put into place because illegal logging is not done sustainably and one is one of the leading causes of deforestation. A ban on these imports offers suppliers in the United States an opportunity to gain a share of the market that previously went to illegal logging. A European study assessing the environmental and economic impact of the illegal timber ban found that the U.S. stands to raise timber exports to the EU by 2.3 percent (Bosello et al., 2010). This increase in timber exports represents an opportunity for
biomass harvesters to increase production to meet new European demand, thereby creating green jobs.

2.5 Energy Efficiency

A green building revolution has been taking place. Many factors prompted a shift to smart building materials and a focus on energy efficiency in buildings from single-family homes to skyscrapers. Hurricane Katrina in 2005 resulted in a 100 percent increase in oil prices from 2004 and fears of climate change. These factors have changed public perception on the power of natural forces, the continued availability of cheap oil and the inevitability of climate change. These factors prompted broad changes to design, development and construction of buildings. Companies who cannot keep up with changing consumer perceptions and preferences risk being left with a considerable competitive disadvantage (Yudelson, 2007).

Energy efficiency includes research on and development and implementation of technologies and practices to reduce greenhouse gas emissions through approaches other than renewable energy generation and energy conservation. Wood products are excellent insulators in homes and provide many advantages over other traditional building materials. Research and development of innovative energy efficient manufacturing processes is constantly being performed by companies in the forest products industries. Greenhouse gas emissions have been substantially reduced in the manufacture of wood and paper products.

2.5.1 Production Processes

More efficient uses of black liquor and other paper manufacturing byproducts are being implemented. Nanotechnologies have been developed at Louisiana Tech that will promote energy savings in pulp production and increase the recyclability of some paper. The processes decreases pulp beating to increase energy efficiency and repair broken fibers for better recycling. Paper manufacturers are using byproducts such as black liquor more efficiently than ever before.
Some mills that were only using these products to produce heat are finding more efficiency using co-generation. Member paper and pulp mills of the American Forest and Paper Administration (AF&PA) reduced fossil fuels and purchased energy by 9 percent from 2004 to 2006 (AF&PA, 2010).

Reduction of energy inputs required for harvest and logging has a broad positive impact on the environment. Agricultural equipment, especially, has become far less energy intensive than in the past. Equipment for logging has seen slighter gains in energy efficiency; however, sustainable logging practices including Reduced Impact Logging (RIL) reduce energy inputs while protecting forest health. Training and education are required to ensure precision logging and participation in environmentally responsible “best practices” in the forest (Jonkers, 2000). Advances in the capacity of agricultural equipment have made them more energy efficient. Practices of seeding, fertilizing and planting have been revolutionized with great efficiency. Equipment is able to cover more area with fewer passes, thus using fewer inputs like diesel and fertilizer. Efficient farming practices produce a reduction in fossil fuel consumption in the agriculture industry (Pimentel et al., 2008). This more efficient equipment in combination with agriculture precision technologies is capable of maximizing crop production and liming energy inputs to a scientific degree.

2.5.2 Goods and Services

The value of green building construction starts reached all-time highs in 2010. Green building starts were up 50 percent from 2008 to 2010, from $42 billion to $55 billion-$71 billion. This growing trend in new construction represented 25 percent of all new construction activity in 2010 (Russo et al., 2010). Although the trend is higher in commercial and institutional buildings that are typically users of large amounts of energy, the green residential construction industry which is closely tied to the forest sector is experiencing unprecedented growth as well.
McGraw-Hill Construction’s *Green Outlook 2011* attributes green building’s rapid expansion to owners’ desire for market differentiation, growing public awareness, and an increase in local and federal government regulations.

Louisiana System Built Homes produces structural insulated panels that utilize foam in between OSB to achieve greater strength and energy efficiency of a building. Roy O Martin manufactures an insulation product called Eclipse that utilizes oriented strand board (OSB) with a thin layer of reflective material to block up to 97 percent of the sun’s radiant heat coming through the roof of a house (RoyOMartin, 2008). Education about the energy efficient opportunities of wood and wood products is carried out by institutions such as the LSU AgCenter and LA Tech. The extension service and educational models like LA house at LSU and provide information about the energy efficiency of wood products.

### 2.6 Sustainability and Natural Resource Conservation

Forests in the United States represent 751 million acres of private and public land. This figure has remained relatively stable since 1910 (Oswalt et al., 2010). In Louisiana, forests cover 14 million acres, representing 50 percent of the state’s land area (LFA, 2010a). There is a variety of forestry related jobs in Louisiana that are considered green jobs. Companies in the forest products industry play a vital role in replanting and reforestation to ensure sustainability. Employees that oversee reforestation and land management, harvest of wood biomass for renewable energy along with recycling and waste reduction all have green jobs.

FSC certification ensures the sustainability of forests and the products that rely on them for feedstock. FSC certified companies chose to participate in sustainable and environmentally responsible practices. The Energy Independence and Security act of 2007 promotes research and education in the field of biomass. Title X of the Energy Independence and Security act of 2007 provides $125 million in funding to establish national and state job training programs,
administered by the Department of Labor, to help address job shortages that are impairing 
growth in green industries, such as energy efficient buildings and construction, renewable 
electric power, energy efficient vehicles, and biofuels development (Sissine, 2007). Grants are 
available for research, development, demonstration and commercial application of biofuel 
production technologies.

Certification of wood products ensures the use of sustainable practices throughout 
growth, harvest and manufacturing. Certification of forest products begins with forestry and 
logging. The use of certifications in wood products has influenced practices in both the forestry 
and logging industries and through the wood products supply chain. Certifications of wood 
products include the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council 
(FSC). These certifications are entirely voluntary and ensure the sustainability of participating 
companies’ products through chain-of-custody certifications. FSC certification ensures that the 
forest products are from responsibly harvested and verified sources. Similarly, SFI certifies that 
wood and paper products are manufactured with raw materials from a responsible source. The 
SFI is sponsored by the Louisiana Forestry Association (LFA) in Louisiana. Every major forest 
products company in the state has agreed to abide by the recommendations of the SFI as 
mandated by the American Forest & Paper Association (LFA, 2010b). Recently, SFI has taken 
heat over the legitimacy of its label. Allegations have been made by the activist group Forest 
Ethics that “SFI allows logging in old growth, logging in endangered species habitat and clearcut 
logging on landslide prone slopes above salmon streams.”

While automation technology is reducing the number of employees needed in the 
capacity of forest products processing, opportunities exist in harvesting, growing and managing 
trees. Land management and harvesting technologies are allowing loggers to place more focus 
on sustainable practices and harvest of residues that can be sold to biomass markets that produce
renewable energy. New technologies designed for harvesting of wood biomass promises to spur the creation of new green jobs in the renewable energy sector.

### 2.6.1 Forest Management

According to the USDA and the Natural Resources Conservation Service (NRCS), a forest management plan is a site specific plan developed for a client, which addresses one or more resource concerns on land where forestry-related conservation activities or practices will be planned and applied. Forest managers meet resource oriented goals of timber owners with minimum impacts to the environment. Forest management assesses a variety of environmental concerns associated with forestry and logging. In the situation where hardwood forests are involved, a forest manager will determine the proper amount of thinning to maximize reproduction of new trees. In the instance of pine or other softwoods, forest managers determine best use of land at which points to perform thinning and prescribed burnings to maximize forest health and production. Forest managers utilize precision technologies such as Geographic Information Systems (GIS), a digital management information system, to map and characterize different areas of timberland and quantify feedstock availability (Doyle et al., 2007).

### 2.6.2 Wetland Conservation

The changing hydrology of Louisiana’s wetlands has had an effect on the regeneration of cypress forests. Factors affecting the hydrology of Louisiana’s wetlands include levee construction, pipeline operations, oil and natural gas exploration, shipping concerns, and subsidence (Conner et al., 2007). Logging of cypress trees became an issue starting in 2000 because of fears that the loss of trees would degrade Louisiana’s wetlands and the chance of regeneration in some areas was close to nothing. Baldcypress is highly susceptible to the combined stresses of flooding and salinity (Allen et al., 1996). Possible outcomes of a rise in sea level include the loss of wetland area or a shift in species dominance to exotics such as Chinese...
tallow (Conner and Askew, 1992). The EPA has ruled that permitting of cypress logging previously exempt from the 1972 Clean Water Act, Section 404 will be reinstated unless landowners can establish that the cypress will successfully regenerate (Flores, 2006). Logging activities on private land were previously exempt from permit requirements. Enactment of EPA permitting has slowed cypress logging in Louisiana almost to a halt. Research is being conducted to ensure the regeneration of new cypress trees and ensure the sustainability of Louisiana’s cypress logging industry (Conner et al., 2007).

2.7 Greenhouse Gas Reduction

According to the EPA, “Terrestrial carbon sequestration is the process through which carbon dioxide (CO₂) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils.” While there is no fully developed market for carbon, opportunities to buy, sell, and trade carbon credits do exist. Before a fully developed market may be established there must be better standards for determining the amount of carbon sequestered by various activities. In the case of carbon sequestration in trees, growing conditions, life-span and end use are key factors in determining carbon sequestration each year and over the life of the tree. With regulations on CO₂ emissions becoming stricter, the introduction of a cap and trade system seems to be on the horizon. This will spur the establishment of a developed market for carbon credits. Louisiana’s 148,000 forest landowners may participate in a carbon market. An established market will increase development of carbon sequestration and will create jobs for specialized forest managers.

2.8 Recycling and Waste Reduction

Recycled paper is the main green product produced at pulp and paper mills in Louisiana. With recovery rates for paper at 60 percent nationwide, an increased effort has been placed on
collection, processing and production of recycled paper products. Production of recycled paper requires only 60 percent of the energy required to make paper from virgin wood pulp according to the Environmental Protection Agency (EPA). Recovery of sunk logs from Louisiana waterways gives new life to logs that may have been felled over 100 years ago. In addition to recovery of old logs, small-scale manufacturers produce furniture and other products with reclaimed wood.

2.8.1 Pulp and Paper Mills

Increasing use of renewable energy to facilitate production and increased paper recovery for recycling will create new green jobs in the pulp and paper industries. Pulp and paper mills produced 65 percent of the energy they required for production in 2008. Paper recovery has surpassed the goals of the AF&PA by reaching a paper and paperboard recovery rate of 63.4 percent in 2009 (AF&PA, 2010). Pollution reduction and cleanup can be another driver of green job growth. In Louisiana there are currently five pulp and paper mills that use chlorine and chlorine dioxide as bleaching agents in their production processes. Technologies are available that could greatly reduce environmental risks posed by both chlorine and chlorine dioxide. The implementation of a totally chlorine-free (TCF) process that is oxygen based would eliminate the use of some hazardous chemicals and create green jobs (Fidis, 2007).

More efficient uses of black liquor and other paper manufacturing byproducts are being implemented. Nanotechnologies have been developed at Louisiana Tech that will promote energy savings in pulp production and increase the recyclability of some paper. The processes decrease pulp beating to increase energy efficiency and repair broken fibers for better recycling (Grozdits, 2006). Paper manufacturers are using byproducts such as black liquor more efficiently than ever before. Some mills that were only using these products to produce heat are finding more efficiency using co-generation.

2.8.2 Recovered and Reclaimed Logs

Louisiana’s waterways were used to transport timber a century ago. Logging and drilling companies cleared cypress swamps and floated logs through waterways on their way to sawmills. Some of these logs sunk and were preserved in the silt at the bottom of waterways. There are logs being brought out of Louisiana’s waterways today that have been preserved for over a century. These loggers are retrieving logs that were cut and lost in waterways and therefore recycling a resource that would have otherwise been wasted. These old logs grew when cypress was plentiful and competition for nutrients and sunlight was more prevalent than in today’s sparser cypress swamps. The slower intake of nutrients and sunlight in the old cypress swamps caused trees to have much smaller growth rates than are measured today. The slow growth caused growth rings to be very close together, making a very attractive wood grain. These finely grained trees are highly valued in the production of custom wood furnishings. Due to the slow nature of the logging and the high-end niche market for recovered timber there are only a handful of loggers recovering logs from Louisiana’s waterways.

2.9 Education and Training

Education and training will be necessary for land managers and loggers to ensure sustainable harvesting of timber and biomass in conjunction. A workforce will be required to
manage timberland that is used for both timber and biomass production. Maximum yield and minimum impact are important to ensure a sustainable supply for traditional wood products and biofuels. These new green jobs will be required to ensure that residue harvesting is sustainable and does not negatively affect soil quality or wildlife habitat.

2.10 Future Growth Potential

The largest job growth potential will be in renewable energy from biomass. Power generated from burning biomass including wood, plants and other organic material makes up more than 50 percent of all renewable energy produced in the United States (Figure 6) (Zeller, 2010). There will be an estimated 20 million new jobs created worldwide in renewable resources in coming decades. A significant portion of the jobs created will deal with energy production from wood based biomass and cellulosic ethanol.

Figure 6: Renewable energy make-up in the United States-2010. U.S. Energy Information Administration
Cost-effective transportation needs to be available on a year-round basis to keep wood pellets competitive with other fuel sources. Many energy producing facilities in operation currently operate on a seasonal basis based on feedstock availability. Infrastructure must be evaluated to ensure the ability to transport feedstock for wood-energy producers year-round. Prices of fossil fuels need to remain stable and high enough for the production of energy from wood to remain economical. Wood manufacturing companies will have to take advantage of new technologies and developing markets to supplement declines in traditional wood products.

There barriers to the growth and success of the wood pellet industry in the United States. Viable and constant sources of feedstock must be established to ensure continuous production, quality and price stability of wood pellets. Feedstock for pellet producers must be available at a close proximity to production facilities because biomass is bulky and expensive to transport. Markets for biomass should ideally be within 100 miles of harvesting sites (Berry, 2009). Cost-effective transportation needs to be available on a year-round basis to keep wood pellets competitive with other fuel sources. Prices of fossil fuels need to remain stable and high enough for the production of energy from wood to remain economical. Wood manufacturing companies will have to take advantage of new technologies and developing markets to supplement declines in traditional wood products.

2.11 Summary

From renewable energy production to recycling and waste reduction, green activities are taking place throughout the Louisiana forest sector. High-tech fuel handling and delivery systems are being installed in boilers at paper mills. Products manufactured with recycled materials are becoming more prevalent. A wood pellet plant capable of 400,000 metric tonnes of production each year is slated to begin operations and shipments starting in June 2012 at the Port
of Greater Baton Rouge. Corporations and educational institutions are conducting research and growing high-yield wood biomass feedstocks for the renewable energy market.

The forest sector has great potential to work with other industries in leading the clean energy and green movement. New trends in the industry along with age old practices give the forest sector a unique opportunity to provide green employment. Louisiana offers great opportunity for landowners, foresters, and forest product manufacturers alike. Forest resources and access to transportation position Louisiana among the top forestry states in the country. Through innovation and infrastructure, the forest sector in Louisiana continues to set an example for green employment and sound environmental practices.

2.12 Literature Cited


LADNR. (2010) Department of Natural Resources.


Spelter H., Toth D. (2009) North America's wood pellet sector U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, WI.


CHAPTER 3: THE STUDY

3.1 Problem Statement

To date, no study has attempted to assess the current status and future potential of green jobs in the Louisiana forest sector. In fact, no study in the United States has attempted to classify and quantify the impact of green jobs in the forest sector at all. It is important to understand existing green jobs and their economic impact in terms of number of jobs and wages created for Louisiana citizens. The forest sector exhibits the potential to be a leader in the growing green-collar workforce. Developing an understanding of green jobs and attitudes towards them is necessary to fully embrace the green sector and encourage its growth within the Louisiana forest products supply chain.

3.2 The Study

The study “Green Jobs in the Louisiana Forest Sector” was performed as part of the Louisiana and Mississippi Green Jobs Consortium. Quantitative, qualitative and opinion data was collected from members of the Louisiana forest sector in an effort by the Louisiana Forest Products Development Center to better understand green activities and their drivers within the industry. Results were published in the Summer 2011 issue of the Louisiana Agriculture Magazine published by the Louisiana State University Agricultural Center and were presented at the National Forest Products Society Conference held in July 2011 in Portland, Oregon.

This study outlines the current green collar inventory in terms of jobs and total wages and attempts to predict future creation of green jobs in the Louisiana forest sector. The Louisiana forest sector includes three broad industry sectors; the forestry and logging industry sector (NAICS Code 113), the wood products manufacturing industry sector (NAICS Code 321) and the paper manufacturing industry sector (NAICS Code 322). Employment in each of seven green categories was estimated and projections of growth were calculated. The study highlights
existing misconceptions regarding the definition of a green job and the importance to the
industry and to society as a whole.

3.3 Study Objectives

Specific objectives of the Louisiana forest sector study were:

1. To develop an understanding of the role that current environmental, governmental and
   societal factors play in the creation of green jobs in the Louisiana forest sector.

2. To quantify existing green jobs and develop an understanding of attributes of existing
   green jobs the Louisiana forest sector.

3. To identify misconceptions about green jobs in the Louisiana forest sector.

3.4 Methodology

3.4.1 Research Population

The population of interest includes companies engaged in the Louisiana forest sector
excluding private forest landowners. The population includes participants along the Louisiana
forest sector supply chain from foresters and loggers to producers of final products. Louisiana
forest sector members of particular interest take part in one or more green categories including
renewable energy, energy efficiency, recycling and waste reduction, sustainable agriculture and
natural resource conversion and education, compliance, public awareness and training supporting
green categories.

3.4.2 Survey Instrument Design and Measures

A survey instrument was designed based on previous green job studies and questions
unique to the Louisiana forest sector. Survey sections addressed forest sector member
demographics, current and future green job employment, and attitudes toward green jobs.
Mailing lists represented 3 three-digit NAICS codes in Louisiana; 322, 321 and 113. Mailing
lists were purchased from a national list provider, Best Lists. The survey instrument was
administered to the entire population of the Louisiana forest sector according to the Dillman tailored design method.

3.4.3 Statistical Analysis

Primary data in the returned questionnaires were checked for validity and reliability. Discrepancies between answers and random responses were eliminated from the final data set whenever they were identified. SPSS version 10.0 (Statistical Package for Social Sciences) for Windows was the statistical package used to analyze data. One-way Analysis of Variance (ANOVA) was performed in comparison of ordinal data. A Pearson Chi-square analysis was performed in comparison of ordinal and binomial data. Nonresponse bias was calculated by comparing first and second mailing responses with an independent samples t-test.

3.5 Results

3.5.1 Response Rate and Demographics

There were 251 respondents to the survey, “Green Jobs in the Louisiana Forest Sector.” Respondents came from 50 of 64 parishes in the Louisiana (Figure 7) (n=228). Jefferson, East Baton rouge, Orleans, St. Tammany and Caddo parishes were each home to more than 5 percent of respondent facilities (Figure 8) (n=228). Calcasieu, Ouachita, Terrebonne, Lafayette and Tangipahoa were each home to more than 3 percent of respondent facilities. The top ten parishes represented included a mix of urban and rural areas. This makeup of respondents indicates a representative mix of logging, primary manufacturing, value-added manufacturing and retail locations. Thirty-six Louisiana parishes were represented by at least two respondents. Additionally, respondents reported company headquarters in 13 different states, with a majority (234) claiming headquarters in Louisiana (Figure 9) (n=250). Areas of the United States represented by survey respondents included the Southeast, the Northeast, and the Northwest.
Figure 7: Percent of Respondents by Louisiana Parishes (n=228)
Figure 8: Louisiana parishes represented by survey respondents (n=228)

Figure 9: States containing company headquarters of respondent companies (n=250)
Companies responding to the survey represent Forestry and Logging, Wood Product Manufacturing, Paper Manufacturing, Furniture Manufacturing, Periodical/Newspaper Publication, Other Print Media, Brokerage, and Distribution. More than 30 percent of respondents participated in Wood Product Manufacturing. Forestry and Logging activities were reported by 25 percent of respondents while Distribution was reported by 23 percent. Furniture Manufacturing and Newspaper/Magazine Publication were each reported by 5 percent of respondents (Figure 10) (n=244).

![Figure 10: Percent of respondents by Forest Sector Activity Category (n=244)](image)

**Figure 10: Percent of respondents by Forest Sector Activity Category (n=244)**

Respondent revenues varied from less than $50,000 to greater than $1 billion in 2009. Seven percent of respondents fell in the less than $50,000 category while three percent fell in the greater than $1 billion category. These figures indicate that many members of the Louisiana forest sector are micro-operations while some members are large multi-national corporations. The largest percentage of respondents, almost fifteen percent, fell in the $1 million to $2,499,999 category. Respondents companies reporting revenues $2.5 million to 4,999,999 equaled 13
percent and respondents reporting revenues of $100,000 to $249,999 equaled 13 percent. In total, more than 78 percent of respondents reported revenue between $100,000 and $24,999,999 in 2009 (Figure 11) (n=230).

Survey participants were asked to describe the ownership of their companies and the business activities in which they participated. A majority of survey respondents described their ownership as a Corporation followed in order by LLC, Private, Other and Partnership. 53 percent of survey respondents were Corporations, 30.7 percent were LLCs and 11.2 percent were privately owned (n=251) (Figure 12). Of all business activities reported by respondents, Sales was the most prevalent with 46.6 percent reporting the activity. 43.4 percent of respondents reported Main Offices located in Louisiana. Manufacturing, Retail Location and Administration were the next most prevalent activities, each reported by more than 30 percent of respondents (n=245) (Figure 13).
Survey participants were asked to report the year their company was founded. The most common single year that companies were founded was 1980. Companies represented were
founded as early as the late 1800s with several from the early 1900s. Of survey respondents, the most recent company was founded in 2010. More than 70 percent of respondent companies were founded in 1970 or later. 11.6 percent of respondent companies were founded in the 1970s, 22.8 percent were founded in the 1980s, 17.4 percent were founded in the 1990s and 18.7 percent were founded in the 2000s (Figure 14) (n=242).

Figure 14: Percent of respondents by Year Company was Founded (n=242)

Survey participants were asked to quantify their full-time and part-time employment. This information helps us formulate total employment in the Louisiana forest sector and subsequent percentage of green jobs in the industry. More than 40 percent of respondents reported having 5 full-time employees or less. Additionally, more than 90 percent of respondents reported 50 full-time employees or less. This data illustrates the nature of the Louisiana forest sector. Most activity in the state is carried out by small business, whereas a few large companies, mostly large sawmills and paper mills, represent the remaining activity. The 90
percent of respondents with less than 50 employees represent approximately 66 percent of the economic activity within Louisiana’s forest sector. Companies with more than 50 employees, or 10 percent of respondents, represent the remaining 33 percent of economic activity (Figure 15) (n=240).

![Figure 15: Percentage of Respondents by Full-time and Part-time Employment (n=240)]

3.5.2 Green Activity Attitudes and Behaviors

Respondent attitudes toward green activities were tabulated to evaluate potential drivers of green activity within the Louisiana forest sector. It is apparent that the term “sustainability” is well understood in the industry. With 80 percent of respondents reporting that sustainability is important to their company, we can infer that there is an understanding of the importance of business practices that focus of retaining resources for the future. There is also a prevalence of demand for green products. Almost half of respondents have requested green products from a
supplier or have had their customers request green products. Finally, more than half of respondents believe green practices add value to their company but few respondents are willing to incur additional costs to provide green jobs (Table 2).

**Table 2: Respondent Green Activity Attitudes and Behaviors**

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Yes %</th>
<th>No %</th>
<th>Sig. Diff. 2-tailed t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your company ever requested Green Products from a supplier?</td>
<td>204</td>
<td>46%</td>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>Have your customers ever requested Green Products?</td>
<td>202</td>
<td>51%</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>Are Green Practices a priority for your company?</td>
<td>194</td>
<td>35%</td>
<td>65%</td>
<td>**</td>
</tr>
<tr>
<td>Do you believe Green Practices add value to your company?</td>
<td>177</td>
<td>66%</td>
<td>34%</td>
<td>**</td>
</tr>
<tr>
<td>Do you believe that sustainability is important for your company?</td>
<td>196</td>
<td>91%</td>
<td>9%</td>
<td>**</td>
</tr>
<tr>
<td>Does your company prefer suppliers with Green Certification?</td>
<td>175</td>
<td>32%</td>
<td>68%</td>
<td>**</td>
</tr>
<tr>
<td>Is your company willing to incur additional costs to provide Green Jobs?</td>
<td>172</td>
<td>19%</td>
<td>81%</td>
<td>**</td>
</tr>
</tbody>
</table>

* Denotes significance at <0.05  
** Denotes significance at <0.01

It is important to examine specific Green Activity Attitudes and Behaviors compared to demographics such as Revenue, Current Green Job Percentage and Future Green Job Percentage. The percentage of respondents answering “yes” to the question, “Have your customers ever requested green products?” differed by respondent Revenue, \( \chi^2(1, N = 202) = 23.070, p = .041 \). The percentage of respondents answering “yes” to the question, “Does your company prefer suppliers with green certification?” did not differ by respondent Revenue, \( \chi^2(1, N = 175) = 15.817, p = .259 \) (Table 3). The remaining Green Activity Attitudes and Behaviors did not differ by respondent Revenue according to a Pearson Chi-Square.
Table 3: Correlation of Green Activity Attitudes and Behaviors to Company Revenue in 2009 (Pearson Chi-Square)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>( \chi^2 ) Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your company ever requested Green Products from a supplier?</td>
<td>204</td>
<td>14.266</td>
<td>.355</td>
</tr>
<tr>
<td>Have your customers ever requested Green Products?</td>
<td>202</td>
<td>23.070</td>
<td>.041*</td>
</tr>
<tr>
<td>Are Green Practices a priority for your company?</td>
<td>194</td>
<td>5.730</td>
<td>.955</td>
</tr>
<tr>
<td>Do you believe Green Practices add value to your company?</td>
<td>177</td>
<td>10.553</td>
<td>.648</td>
</tr>
<tr>
<td>Do you believe that sustainability is important for your company?</td>
<td>196</td>
<td>9.585</td>
<td>.727</td>
</tr>
<tr>
<td>Does your company prefer suppliers with Green Certification?</td>
<td>175</td>
<td>15.817</td>
<td>.259</td>
</tr>
<tr>
<td>Is your company willing to incur additional costs to provide Green Jobs?</td>
<td>172</td>
<td>8.495</td>
<td>.810</td>
</tr>
</tbody>
</table>

* Denotes significance at <0.05
** Denotes significance at <0.01

It seems appropriate that respondents with higher Green Activity Attitudes and Behaviors would report higher Current and Future Green Job Percentages. The percentage of respondents answering “yes” to the question, “Have your customers ever requested green products?” differed by respondent Current Green Job Percentage, \( \chi^2(1, N = 208) = 20.003, p = .018 \). The percentage of respondents answering “yes” to the question, “Are Green Practices a priority for your company?” differed by respondent Current Green Job Percentage, \( \chi^2(1, N = 201) = 31.498, p = .000 \). The percentage of respondents answering “yes” to the question, “Is your company willing to incur additional costs to provide Green Jobs?” differed by respondent Current Green Job Percentage, \( \chi^2(1, N = 178) = 47.270, p = .000 \) (Table 4). Each Green Activity Attitude and Behavior differed by respondent Future Green Jobs Percentage according to a Pearson Chi-square (Table 5).
Table 4: Correlation of Green Activity Attitudes and Behaviors to Company Current Green Job Percentage in 2009 (Pearson Chi-Square)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>( \chi^2 ) Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your company ever requested Green Products from a supplier?</td>
<td>210</td>
<td>15.293</td>
<td>.083</td>
</tr>
<tr>
<td>Have your customers ever requested Green Products?</td>
<td>208</td>
<td><strong>20.003</strong></td>
<td>.018*</td>
</tr>
<tr>
<td>Are Green Practices a priority for your company?</td>
<td>201</td>
<td><strong>31.498</strong></td>
<td><strong>.000</strong>**</td>
</tr>
<tr>
<td>Do you believe Green Practices add value to your company?</td>
<td>183</td>
<td>11.736</td>
<td>.229</td>
</tr>
<tr>
<td>Do you believe that sustainability is important for your company?</td>
<td>204</td>
<td>5.596</td>
<td>.780</td>
</tr>
<tr>
<td>Does your company prefer suppliers with Green Certification?</td>
<td>180</td>
<td>6.475</td>
<td>.692</td>
</tr>
<tr>
<td>Is your company willing to incur additional costs to provide Green Jobs?</td>
<td>178</td>
<td><strong>47.270</strong></td>
<td><strong>.000</strong>**</td>
</tr>
</tbody>
</table>

* Denotes significance at <0.05
** Denotes significance at <0.01

Table 5: Correlation of Green Activity Attitudes and Behaviors to Company Future Green Jobs Percentage (Spearman Correlation)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>( \chi^2 ) Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your company ever requested Green Products from a supplier?</td>
<td>206</td>
<td>15.756</td>
<td>.072</td>
</tr>
<tr>
<td>Have your customers ever requested Green Products?</td>
<td>204</td>
<td><strong>21.718</strong></td>
<td><strong>.010</strong>**</td>
</tr>
<tr>
<td>Are Green Practices a priority for your company?</td>
<td>198</td>
<td><strong>33.967</strong></td>
<td><strong>.000</strong>**</td>
</tr>
<tr>
<td>Do you believe Green Practices add value to your company?</td>
<td>181</td>
<td><strong>19.645</strong></td>
<td><strong>.020</strong>*</td>
</tr>
<tr>
<td>Do you believe that sustainability is important for your company?</td>
<td>202</td>
<td>10.178</td>
<td>.336</td>
</tr>
<tr>
<td>Does your company prefer suppliers with Green Certification?</td>
<td>177</td>
<td><strong>21.486</strong></td>
<td><strong>.011</strong>*</td>
</tr>
<tr>
<td>Is your company willing to incur additional costs to provide Green Jobs?</td>
<td>176</td>
<td><strong>50.622</strong></td>
<td><strong>.000</strong>**</td>
</tr>
</tbody>
</table>

* Denotes significance at <0.05
** Denotes significance at <0.01
Respondents reported attitudes toward Green Job Drivers such as Corporate Mandate, Increased Profits, Company Values, Federal Regulations, Government Incentives, State Regulations, Public Perception, Environmental Protection and Creation of Quality Jobs. Survey participants were asked to report potential for each Green Job Driver to spur green job growth on a five point likert scale. The mean attitude of each Green Job Driver differed significantly from the mean of 3 (neutral) according to a two-tailed t-test (Figure 16). The mean attitude towards all Green Job Drivers except Corporate Mandate was above neutral. One-way ANOVA analysis showed statistical significance between Company Ownership and the likelihood of Company Values to spur green job creation (Table 6) (n=208). A review of the survey data indicated that corporations were less likely to report Company Values as a significant Green Job Driver.

* Denotes significance at <0.05
** Denotes significance at <0.01

Figure 16: Potential of Green Job Drivers to spur green job creation.
Table 6: Green Job Drivers compared to different Company Ownership in 2009 (One-way ANOVA)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Mandate</td>
<td>210</td>
<td>1.526</td>
<td>.195</td>
</tr>
<tr>
<td>Increased Profits</td>
<td>210</td>
<td>1.005</td>
<td>.406</td>
</tr>
<tr>
<td>Company Values</td>
<td>208</td>
<td>2.495</td>
<td>.044*</td>
</tr>
<tr>
<td>Federal Regulations</td>
<td>211</td>
<td>.880</td>
<td>.477</td>
</tr>
<tr>
<td>Government Incentives</td>
<td>211</td>
<td>1.777</td>
<td>.134</td>
</tr>
<tr>
<td>State Regulations</td>
<td>212</td>
<td>.273</td>
<td>.895</td>
</tr>
<tr>
<td>Public Perception</td>
<td>212</td>
<td>.528</td>
<td>.715</td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>211</td>
<td>1.275</td>
<td>.281</td>
</tr>
<tr>
<td>Creation of Quality Jobs</td>
<td>212</td>
<td>1.190</td>
<td>.316</td>
</tr>
</tbody>
</table>

* Denotes significance at <0.05  
** Denotes significance at <0.01

3.5.3 Existing Green Jobs in the Louisiana Forest Sector

One particular goal of the study is to identify specific green activities that are taking place in the Louisiana forest products supply chain and understand changes that may take place in the future. Not only is the intent to understand green activities, but to estimate employment and wages generated in the green sector. Respondents reported an average of 12.7 percent green employment (n=232). These jobs fall into each green activity category; Renewable Energy (28.2%), Recycling and Waste Reduction (23.7%), Green Certification (14%), Energy Efficiency (12.3%), Education, Public Awareness and Compliance (8.5%), Pollution Reduction and Cleanup (8.3%) and Greenhouse Gas Reduction Energy (4.9%) (Figure 18) (n=667).

Survey respondents accurately reported a total of 667 green jobs. Divided by the total number of respondents, this represents an average of 2.7 green jobs per company. Extrapolating the number of green jobs per participating company by the total number of companies implies
total green employment in the Louisiana forest sector is 13,199 individuals. Using an average green job wage in Oregon’s forest sector of 18.73/hour as a proxy an estimated $494 million in annual wages can be attributed to all green jobs in the Louisiana forest sector. These green jobs provide employment in rural communities, enhance prosperity, and encourage special education and training.

3.5.4 Future Growth of Green Jobs in the Louisiana Forest Sector

The development of renewable energy projects stands to increase green employment in the Louisiana forest sector. Survey respondents projected an average green job growth of roughly 30 percent in the next five years (Figure 18) (n=232). Survey participants were asked to report Green Activity Categories that were represented by future green job growth. Future green job growth falls into each green activity category; Recycling and Waste Reduction (28.4%), Renewable Energy (28%), Green Certification (14%), Energy Efficiency (12%), Education, Public Awareness and Compliance (8.5%), Pollution Reduction and Cleanup (8%), and Greenhouse Gas Reduction (5%).
Education, Public Awareness and Compliance (22.2%), Green Certification (10.8%), Energy Efficiency (10.3%), Renewable Energy (10.3%), Pollution Reduction and Cleanup (7.2%) and Greenhouse Gas Reduction Energy (4.1%) (Figure 19) (n=194). Positive attitudes towards green products and practices are sometimes tied to higher revenue and higher full-time employment according to a weak correlation. Positive attitudes toward green products and practices are tied to higher numbers of current green jobs and higher expectations of green job growth in the next five years. Information on green activities and their importance in today’s economy is necessary to spur green job creation within Louisiana’s forest sector.

Figure 18: Current Green Job Estimate and Five Year Growth Estimates reported by respondent companies (n=232)
3.5.5 Misconceptions

Survey participants were asked to identify specific green jobs in their company across seven green job categories. They were asked to provide a brief description of the green activity and estimate the number of employees whose primary job fell into one of these categories. Misconceptions about green job categories were apparent in survey respondents (Table 7). Only 81 percent of green activities reported by respondents were accurate (Figure 20). Education on the importance of green activities is necessary to eliminate misconceptions about green employment in the Louisiana forest sector. Accurate knowledge of green activities will facilitate greater understanding of the Louisiana forest sector green arena.
Table 7: Examples of accurate and inaccurate Green Job Activities Descriptions reported by respondent companies

<table>
<thead>
<tr>
<th>Green Job Category</th>
<th>Accurate Green Job Activities</th>
<th>Inaccurate Green Job Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education, Public Awareness and Compliance</td>
<td>Certification Training Director</td>
<td>Safety Officer</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Insulating Homes</td>
<td>Every Employee Practice Energy Efficiency in Office</td>
</tr>
<tr>
<td>Green Certification</td>
<td>LEED and FSC Certifications</td>
<td>Each Employee in an FSC Certified Operation</td>
</tr>
<tr>
<td>Greenhouse Gas Reduction</td>
<td>Carbon Capture and Sequestration Research</td>
<td>Hybrid Fleet Drivers</td>
</tr>
<tr>
<td>Pollution Reduction and Clean-Up</td>
<td>Manage Facility’s Storm Water Run-off</td>
<td>Maintains Cleanliness of Repair Shop</td>
</tr>
<tr>
<td>Recycling and Waste Reduction</td>
<td>Manufacture Products from Recycled Materials</td>
<td>Every Employee Participates in Office Recycling</td>
</tr>
</tbody>
</table>

Figure 20: Percentage of accurate and inaccurate Green Job Activities Descriptions reported by respondent companies (n=793)
3.6 Literature Cited
CHAPTER 4: CONCLUSIONS AND LIMITATIONS

4.1 Conclusions

Many factors influence the growth of green jobs in the U.S. and throughout the world. Climate change and the energy crisis are prompting industry, government officials and the public to find innovative ways to reduce dependence on fossil fuels (Chapple et al., 2011). Recent natural and man-made disasters changed public perception on environmental awareness. The Macondo blowout in the Gulf of Mexico on April 20, 2010 and publicity on the dangers of hydrofracking have demonstrated volatility of new energy exploration technology. The March 11, 2011 earthquake and tsunami in Japan demonstrated the potential danger of nuclear power generation when radiation leaked from reactors for more than three weeks. Governments and industry are changing the way they do business and subsequently changing the way they hire.

Green jobs offer unique benefits to both employers and employees. For employers, green jobs foster innovation, cost-savings and positive public perception. For employees, green jobs provide skilled employment, an above-average wage and stability (White and Jason, 2008). Green collar jobs are vital to meet growing world energy demands while limiting the effect on the ecosystem. Green job creation has become a priority for government and industry to mitigate negative environmental effects and keep up with the green energy market.

The Louisiana forest sector offers unique opportunities for green collar employment. Many green jobs already exist in the sector including the fields of renewable energy and recycling. Members of the forest sector are unique because they have focused on sustainability before the green movement began. The nature of our forests as a renewable resource gives the forest sector potential for high percentages of green employment. It is important to understand changes in green activities and attitudes to ensure future green job growth in the Louisiana forest sector.
There are several conclusions that may be drawn from the study of green jobs in the Louisiana forest sector. First, education is necessary to convey an unbiased and accurate understanding of green jobs and the green activities that make them possible. The study found that 19 percent of reported green activities were inaccurate. Government and industry associations must educate business owners on the benefits of green activities. Companies that realize the true nature of green activities and their importance in the economy can create quality green employment.

General attitudes and behaviors toward green activities in the Louisiana forest sector are positive. Survey respondents reported that governmental, economic and societal influences are all likely to create green jobs. It is promising that companies understand the value of green activities. However, if incremental costs are incurred to increase green jobs, there may be a negative impact effect on a company’s bottom line. Sixty-three percent of respondents are unwilling to incur these costs. It is suggested by many that government intervention in the form of incentives and regulations may be necessary to realize substantial green job growth in the future. In summary, the business of forestry is sustainability; resources must be managed and protected to ensure future success of the industry. This infers that concurrent green jobs will be part of the supply chain employment profile into the future.

4.2 Nonresponse Bias

Nonresponse bias is important to address in survey research. Although the most commonly recommended protection against nonresponse bias is the reduction of nonresponse itself, it is possible to address nonresponse bias by sampling nonrespondents (Armstrong and Overton, 1977). The Tailored Design Method addresses nonresponse by issuing a follow-up postcard and second mailing to nonrespondents (Dillman, 1999). A comparison of first and
second mailing responses with independent samples t-tests showed no statistically significant differences at $\alpha=.05$. Open-ended questions were not compared between first and second mailing responses. According to parallels between first and second mailing respondents, we assume that there is no nonresponse bias present in the survey data.

4.3 Research Limitations

Research limitations arise from the lack of understanding of green job activities apparent in the Louisiana forest sector. Limitations due to small response rate pose issues with data analysis. Non-normality issues arise because of a small data set. It is difficult to make estimations and conclusions with complete certainty because of the nature of the data. Results and conclusions of green jobs in the Louisiana forest sector are only exploratory and may be biased. Further research should be performed on education practices necessary to inform industry participants and spur the creation of additional green jobs in the Louisiana forest sector. Additionally, research on indirect green job employment created by the Louisiana forest sector would provide greater understanding of overall green activities in the industry.

4.3 Literature Cited


APPENDIX: LOUISIANA FOREST SECTOR GREEN JOBS SURVEY

Section I. Company Profile

1. Does your company participate in any level of the forest products supply chain in the state of Louisiana? (please answer YES or NO)
   
   o NO → If NO, please stop here and return the survey in the postage paid envelope.
   
   o YES → If YES, please continue to Question 2.

2. What type of ownership is your company? (please choose only one answer)
   
   o Private
   o Corporation
   o Family Trust
   
   o Partnership
   o LLC
   o Other (please specify) ____________________

3. In which state is your company headquarters located? ____________________

4. In which year was your company founded? ____________________

5. Which activity below best describes your company’s participation in the Louisiana forest products sector? (please choose one answer)
   
   o Forestry and Logging
   o Paper Manufacturing
   
   o Wood Product Manufacturing
   o Furniture Manufacturing
   
   o Periodical/Newspaper Publication
   o Brokerage
   
   o Distribution
   o Other Print Media

6. Which of the following operations does your company currently have located in Louisiana? (please choose all that apply)
   
   o Manufacturing
   o Sales
   o Retail Location
   
   o Timberland
   o Distribution
   o Administrative
   
   o Marketing
   o Warehousing
   o Wholesale Location
   
   o Corporate Headquarters
7. Please list the facilities your company has located in Louisiana and provide a brief description of each one.

<table>
<thead>
<tr>
<th>Facility Description</th>
<th>City/Parish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. On average, how many **full-time** employees worked for your company during 2009? (please choose one answer)

- [ ] 5 Employees or less
- [ ] 6-10 Employees
- [ ] 11-25 Employees
- [ ] 26-50 Employees
- [ ] 51-75 Employees
- [ ] 76-100 Employees
- [ ] More than 500 Employees

9. On average, how many **part-time** employees worked for your company during 2009? (please choose one answer)

- [ ] 5 Employees or less
- [ ] 6-10 Employees
- [ ] 11-25 Employees
- [ ] 26-50 Employees
- [ ] 51-75 Employees
- [ ] 76-100 Employees
- [ ] More than 500 Employees

10. Please indicate your company’s revenue in 2009. (please choose one answer)

- [ ] Less than $50,000
- [ ] $50,000 - $99,999
- [ ] $100,000 - $249,999
- [ ] $250,000 - $499,999
- [ ] $500,000 - $999,999
- [ ] $1,000,000 - $2,499,999
- [ ] $1,000,000,000 or greater
- [ ] $2,500,000 - $4,999,999
- [ ] $5,000,000 - $9,999,999
- [ ] $10,000,000 - $24,999,999
- [ ] $25,000,000 - $99,999,999
- [ ] $250,000,000 - $499,999,999
- [ ] $500,000,000 - $999,999,999
Section II. Green Job Categories

1. Please estimate the number of employees whose primary job function (more than 50% of their time) is in each of the seven following green activity categories. Please refer to Enclosed Table– Defining Activity Categories to complete this section of the questionnaire. (please choose only one activity category for each employee whose primary job function falls in a green category)

<table>
<thead>
<tr>
<th>Activity Category</th>
<th>Job Description</th>
<th># of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Renewable Energy</td>
<td>Ex. – Oversee renewable energy production at paper mill</td>
<td>2</td>
</tr>
<tr>
<td>B. Energy Efficiency</td>
<td>Ex. – Develop energy efficient building products</td>
<td>3</td>
</tr>
<tr>
<td>C. Greenhouse Gas Reduction</td>
<td>Ex. – Daily operation of greenhouse gas reduction technology</td>
<td>1</td>
</tr>
<tr>
<td>D. Pollution Reduction and Cleanup</td>
<td>Ex. – Manages facility’s storm water runoff</td>
<td>1</td>
</tr>
<tr>
<td>E. Recycling and Waste Reduction</td>
<td>Ex. – Manufacture products from recycled materials</td>
<td>12</td>
</tr>
<tr>
<td>F. Green Certification (Ex. – SFI, FSC, Green Tag, American Tree Farm)</td>
<td>Ex. – Oversees FSC certification of wood products</td>
<td>1</td>
</tr>
<tr>
<td>G. Education, Public Awareness, and Compliance</td>
<td>Ex. – Provide training to employees responsible for EPA compliance</td>
<td>2</td>
</tr>
</tbody>
</table>
### Section III. Attitudes toward Green Activities

1. Please answer the following questions to the best of your knowledge. (please choose only one answer)

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
<th>Don’t Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your company ever requested Green Products from a supplier?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Have your customers ever requested Green Products?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Are Green Practices a priority for your company?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Do you believe Green Practices add value to your company?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Do you believe that sustainability is important for your company?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Does your company prefer suppliers with Green Certification?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Is your company willing to incur additional costs to provide Green Jobs?</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

2. Please indicate the likelihood of each of the following to spur Green Job creation at your company. (please choose only one answer for each row)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Very Unlikely</th>
<th>Somewhat Unlikely</th>
<th>Neutral</th>
<th>Somewhat Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Mandate</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Increased Profits</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Company Values</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Federal Regulations</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Government Incentives</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>State Regulations</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Perception of Company</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Creation of Quality Jobs</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>


Section IV. Forward Growth in Green Activities

1. Does your company currently have any projects that may create Green Jobs? (please answer YES or NO)
   - NO → If NO, please go to Question 2.
   - YES → If YES, please indicate which activities below describe the project/projects.
     (please check all that apply)
     - Renewable Energy Development
     - Waste Reduction
     - Energy Efficiency
     - Compliance
     - Greenhouse Gas Reduction
     - Green Certification
     - Pollution Reduction
     - Education
     - Recycling
     - Public Awareness
     - Other (please specify) ____________________________

2. Do opportunities exist for current employees to move into a Green Job category? (please check YES or NO)
   - YES
   - NO

3. Please estimate what percent of your company’s employees currently have Green Jobs.
   (please check only one answer)
   - 0-5%
   - 6-10%
   - 11-20%
   - 21-30%
   - 31-40%
   - 41-50%
   - 51-60%
   - 61-70%
   - 71-80%
   - 81-90%
   - 91-100%

4. Please estimate what percent of your company’s employees will have Green Jobs in five years.
   (please check only one answer)
   - 0-5%
   - 6-10%
   - 11-20%
   - 21-30%
   - 31-40%
   - 41-50%
   - 51-60%
   - 61-70%
   - 71-80%
   - 81-90%
   - 91-100%

Thank you for taking the time to complete this survey. Your answers will help us develop a better understanding of the Green Activities currently taking place in the Louisiana Forest Products Sector and the trends that will lead to future growth of these Green Activities.
Definitions and Examples

A. **Renewable Energy** – research, development, production, storage and distribution of energy that comes from natural and sustainable resources. Examples include:

- Biomass production  
- Energy production

B. **Energy Efficiency** – research, development and implementation of technologies and practices that use less energy to provide the same level of energy service. Examples include:

- Insulating homes and businesses  
- Increasing energy efficiency of production

- Design and construction of LEED certified buildings

C. **Greenhouse Gas Reduction** – research, development and implementation of technologies and practices to reduce greenhouse gas emissions through approaches other than renewable energy generation and energy conservation. Examples include:

- Converting fleet vehicles to alternative fuels  
- Carbon capture research

D. **Pollution Prevention and Cleanup** – research, development and implementation of technologies and practices to minimize or prevent the adverse impacts of pollution on the natural environment and human health. Examples include:

- Manufacturing natural/biodegradable products  
- Wastewater treatment

E. **Recycling and Waste Reduction** – research, development and implementation of technologies and practices to collect and recycle materials and waste water. Examples include:

- Packaging waste reduction  
- Manufacturing products from recycled materials

F. **Green Certification** – certification of products or practices that ensure sustainability. Examples include:

- SFI  
- FSC  
- Green Tag  
- American Tree Farm

G. **Education, Public Awareness, and Compliance** – providing training in the application of technologies and practices; activities to develop and enforce environmental regulations; and increasing public awareness of environmental issues. Examples include:

- Providing industry certification training  
- Increasing public awareness

- Emissions monitoring  
- Environmental permitting
VITA
Ryan D. Olson was born in 1988 in Kenner, Louisiana. After successfully completing and
honors program at Ecole Classique High School in Metairie, Louisiana, he was accepted into the
School of Business at the University of New Orleans. Ryan’s studies focused on business
administration, marketing and management, including two marketing internships with The
Ehrhardt Group and Heiner Brau Microbrewery. He received the Bachelor of Science in
Business Administration with a minor in management in May 2010. In the June 2010 he
enrolled at Louisiana State University (LSU) to pursue a master’s degree in renewable natural
resources with an area of concentration in forest products marketing under Dr. Richard P.
Vlosky. While progressing towards the completion of his master’s degree in renewable natural
resources, Ryan also pursued a minor in environmental sciences with the Department of
Environmental Sciences at LSU. His Master of Science degree has a strong emphasis on
biomass, biofuels, and green jobs.