Louisiana Forest Products Laboratory

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LSU Agricultural Experiment Station
LSU Agricultural Center
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Louisiana Forest Products Laboratory
OVERVIEW

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Mission Statement

The Louisiana Forest Products Laboratory was created to enhance the wise use of our forest resources by helping Louisiana forest products industries expand production of value-added products, become more competitive in the marketplace and increase employment opportunities.

Background

The Louisiana Forest Products Laboratory (LFPL) was established in June 1992 through Legislative allocation of state funds to the LSU Agricultural Center in response to a need for increasing the manufacturing of value added forest products. It has been shown that revenue generated through additional processing of lumber in Louisiana is $.97 per $1 of lumber sales as compared with an average of $1.97 for surrounding states. This indicates there is a realistic potential of this processing sector to double, thereby greatly increasing economic revenues and employment. These increases would occur primarily in the more rural areas, nearer the resource and where revenues and employment are most needed.

Currently, this industry sector is composed primarily of small wood working shops. Approximately 75% of the 650 to 700 companies identified have 10 employees or less and 50% have four employees or less. Therefore, for the expansion suggested by the figures above to occur, the majority of work needs to be directed toward small to medium sized companies. This approach is being taken based on the premise that it is more advantageous to work in enhancing and expanding companies that are already in Louisiana, than trying to attract larger companies outside the state.

Funding is allocated by the State Legislature to the LSU Agricultural Center. Approximately $592,000 is budgeted from the Ag Center for LFPL operations, salaries and benefits. Not included in this allocation is LSU Agricultural Center overhead expenses as well as a forest products extension specialist housed in Knapp Hall. Outside funding by LFPL faculty through grants and contracts obtained at LSU have totaled $710,696 over the past four years from proposals totaling $3,085,000. An additional $4.5 million in grants are still pending.

LFPL Framework

All except one member of the LSU faculty and staff are on 100% research appointments. Louisiana Tech's faculty has split appointments between teaching and research. To fulfill LFPL's mission, however, research is combined with outreach efforts in cooperation with the LSU Agricultural Center's Cooperative Extension Service and with educational activities associated with graduate students. The framework, therefore, includes all three areas of research, outreach and education.

Program Area: ENVIRONMENTAL & SAFETY PROGRAM

Project Leader: Cornelis F. de Hoop, Associate Professor

Program Mission Statement

Provide information that will enhance worker productivity and safety, and mill efficiency while minimizing detrimental environmental effects.

Introduction

Insurance costs (especially workers' compensation) and environmental regulatory effects are often cited as limiting factors suppressing the development of the secondary wood products industry in Louisiana. By investigating worker accidents and developing techniques for improving safety and ergonomics, worker productivity and morale can be improved while lowering accident costs, indirectly reducing insurance costs. Compliance with environmental regulations will require capital investments and documentation efforts by mill operators. Cost-effective techniques are needed that will reduce pollutant output and maximize wood resource utilization. Improvements in all of these areas will improve the competitiveness of Louisiana forest products businesses.

1997 - 2000 Strategic Goals

- Produce baseline historical summaries and analyses on accidents and injuries in the various wood products sectors. These summaries will be used as starting points for in-depth analyses.

- Develop methods for comparing workers' compensation insurance premiums between states in selected wood products industries and produce comparisons. It is generally believed that worker's compensation premiums are higher in Louisiana than in most other states, but factors such as upset rates and experience modifiers cloud the real numbers.

- Produce information on the structure of workers' compensation costs in Louisiana's wood products industry. While accident rates and costs are significant factors in the cost of workers' compensation insurance, there may be other factors that need attention (possibly political) to further reduce overall worker's compensation costs.

- Establish which pollution parameters designated by EPA are significant to the wood products industry. Assist the industry in developing cost-effective methods to solve any existing pollution problems, minimize wood waste production, and utilize wood residues more efficiently.

Summary

Studies in Louisiana's logging industry and in other industries have shown that properly directed safety programs have a positive influence on worker training, morale and productivity, while directly lowering costs. Some environmental studies have also indicated that improved environmental controls result in better overall recordkeeping, more efficient utilization of consumable resources and improved overall efficiency. By knowing more about these topics as they apply to Louisiana industries, recommendations can be given that will help our firms be more competitive in the marketplace while providing better working and living environments for the citizens. A commitment of funding on the part of the LSU Ag Center and outside sources, and recruitment of graduate students interested in these topics will help bring these successes about.

Program Area: MARKETING AND ECONOMIC DEVELOPMENT

Project Leader: Richard Vlosky, Associate Professor

Program Mission Statement

Conduct marketing and economic development research in the forest products industry in Louisiana to identify opportunities for sustainable industry growth, increased rural employment and enhancing the value of the State's forest resources.

Introduction

Over two years of basic and applied research conducted by the Marketing Program at the Louisiana Forest Products Laboratory shows that there exists significant opportunity for further development in the forest products industry in Louisiana. Such development can not only increase the value of the State's forest resources, but can also create rural employment opportunities. Barriers to development of the industry economic development and marketing program are largely financial with additional funding necessary for staffing and research support.

1997-2000 Strategic Goals

- Expand and integrate industry data and information capabilities including Internet dissemination.
- Identify strategies that have been successfully applied to other industrial sectors and to wood products sectors in other states/regions. An emphasis will be placed on understanding successes of wood products industry transition to value-added opportunities accomplished in other states.
- Develop a baseline strategy for entry into secondary manufacturing based on industry structure and competitive analysis parameters. This strategy will focus on

development of the existing forest products value-added industry over recruitment of new companies to the state.

- Establish the prerequisites to LFPL marketing and industry development program success by developing strong government leadership, interagency cooperation, adequate program funding, and strong industry support.

Summary

Over two years of marketing and economic development research on the forest products industry in Louisiana indicates that there exists significant opportunity for expansion of this core area. Development goals of increased rural employment and enhancing the value of the State's forest resources can be furthered through such a focused effort. However, in order for success to become a reality, a concerted effort needs to be undertaken with commitment and financial support from the University and LSU Agricultural Center.

Program Area: **PROCESSING TECHNOLOGIES**

Project Leader: **Qinglin Wu, Assistant Professor**

Program Mission Statement

Conduct research in forest products processing to improve raw material quality, product performance characteristics, and production efficiency and capability for the value-added wood panel industry in Louisiana.

Introduction

The development of value-added forest products industry in Louisiana is largely dependent on quality raw material input and reduced production costs. By helping to increase capability and efficiency in the hardwood drying industry in the state, the producers, especially small to medium scale mills, can increase their product value, lower remanufacturing costs, and open new market opportunities. The U.S. south is becoming the largest producer of wood based panel products for both structural and nonstructural applications. Improvement of existing products and development of new products can lead to further expansion of the board industry and their uses in Louisiana or the south in general.

1997-2000 Strategic Goals

- Enhance value-added opportunities by improving efficiency and capability of the hardwood drying industry in the state. Research will focus on understanding hardwood drying facilities, activities, and costs; facilitating technology transfer

and training of mill personnel through workshops and support of existing training infrastructure; and developing procedures to reduce drying degrade in hardwoods.

- Help improve performance characteristics of panel materials used in the furniture and cabinet industry. An emphasis will be placed on determining selection criteria, performance characteristics, and production costs and efficiencies of furniture/cabinet panels in the secondary manufacturing industry; establishing a database on raw material input and costs; and developing high performance core stock for furniture applications.

- Help improve dimensional stability and durability of oriented strand board. Research will focus on investigating controlling variables for the swelling and strength retention behavior of structural oriented strand board; and developing recommendations to minimize the effects of these variables during manufacturing.

Summary

Among many opportunities in adding value to forest resources in Louisiana, hardwood drying is an important step. Improved capability and efficiency in the hardwood drying industry in the state can increase product value, lower remanufacturing costs, and open new market opportunities for the producers. Wood based panel products have been widely used in the secondary manufacturing industry as straight elements in furniture and cabinet construction. Understanding selection criteria, performance characteristics, and remanufacturing (laminating) costs of these products can lead to further expansion of their uses and reduction of overall production costs for the furniture industry. A strong commitment from the lab and LSU Ag Center to the program in funding and resources is essential to its success.

Program Area: SECONDARY WOOD PROCESSING PROGRAM

Project Leader: Vacant

Program Mission Statement

Assist with the profitability of existing secondary wood manufacturing facilities by developing techniques and technologies that, when implemented, will optimize the utilization of resources.

Introduction

Almost three years of basic and applied research conducted by the Secondary Wood Processing Program shows significant opportunities for further development in the forest products industry of Louisiana. Optimization of manufacturing

techniques and improvement in productivity can significantly help to increase value added by this industry in Louisiana. The main barrier for better development of this research program is the lack of a faculty position in this research area.

1997-2000 Strategic Goals

- Develop an array of tools that can help small and medium sized secondary wood processing companies to grow through increasing productivity of their operations.
- Setup a "business doctor" team to provide assistance to interested operations.
- Link southern yellow pine resource characteristics to product characteristics, including identifying commodities on stump, merchandising trees for optimal uses, and determining best processing methods.

Summary

Almost three years of processing research conducted by the Secondary Wood Processing Program developed a momentum in creating tools that help improve productivity, and hence, increase value added in secondary wood processing industry. This faculty position is slated to be filled in 1998.

Program Area: RECYCLING AND RESIDUE USE TECHNIQUES

Project Leader: Elvin T. Choong, Professor of Forestry (Affiliate Member of Louisiana Forest Products Laboratory)

Program Mission Statement

Better utilization of natural resources by maximizing utilization of wood fiber and recycled wood products for useful products and fuel, adapting smaller sized material to new uses, identifying the structural and energy efficiencies of wood, and expanding into non-traditional markets.

1997-2000 Program Goals

1. Develop new engineering wood products from smaller sized material and residue.
2. In harmony with the environment, minimize biomass material flows to landfill by effective use of renewable resources to provide useful products, use of recycled and recoverable materials not suitable for traditional product use.

Program Area: **WOOD PRODUCTS TRADE**

Project Leader: **W. Ramsay Smith, Professor and Program Leader**

Program Mission Statement

Enhance the trade of wood products domestically and internationally through increasing the knowledge of wood product properties and how their markets can be enhanced through processing techniques.

Introduction

We live in a global economy which we need to better understand and be active in. Through better understanding of global trade issues, markets can be identified for Louisiana forest products with emphasis on value added products. This includes wood product characteristics required in various markets, and hence, additional processing requirements. In addition, issues surrounding environmental concerns of wood products manufacturing, use and disposal are increasing. A better understanding of all factors involving their total use needs to be developed and compared to other material substitutes. With this understanding, decisions in regulating wood products manufacturing use and disposal can be scientifically based. These factors and issues will effect all wood products manufactured in Louisiana and their markets, especially in the longer term.

1997 - 2000 Strategic Goals

- Develop and maintain a database for international trade issues as they influence trade of Southern species and wood products in an effort to enhance their trade internationally.
- Develop a consortium of Southern universities to work on international trade issues with a federally funded research base.
- Develop a life cycle inventory and analysis database on Southern manufactured products in a consortium with CORRIM II member institutions.
- Develop and quantify information on differences in Northern, Northern Appalachian, Southern Appalachian and Southern hardwoods to determine marketing and/or processing techniques which may be used to increase worth of Southern hardwoods.

Summary

Through the research program outlined above, information will be developed to help Louisiana wood products companies better compete in the global economy we live in. This will allow market expansion for value added products, thereby increasing

economic expansion and stability and increase employment opportunities for our wood products-based communities.

Program Area: WOOD QUALITY INFLUENCES ON WOOD PRODUCTS MANUFACTURING PROCESSES

Project Leaders: Mark D. Gibson, Professor and George A. Grozdits, Research Associate, Louisiana Tech University

Mission

Provide information on the quality of Louisiana's wood resource that will foster a better understanding of wood as a raw material for a wide range of manufacturing processes, encourage efficient and competitive use of wood within the state, and maximize the sustainability and productivity of our forests.

Introduction

Through research in areas such as, intensive forest management-wood quality relationships, wood structure-properties-product performance relationships, primary and secondary wood processing, and microscopy and wood identification we are finding ways in which we can use Louisiana forests to produce viable products for statewide, regional, national, and international markets, while assuring a sustainable yield. Identification and quantification of the effects of intensive forest management practices on the yield and quality of wood from hardwoods and plantation-grown southern pines is critical if we are to efficiently use our woody source. Investigations aimed at understanding various wood properties and their influence on wood products manufacturing processes will be used to expand and improve both primary and secondary manufacturing.

1997 - 2000 Strategic Goals

- Establish correlation between intensive forest management practices and basic wood properties (wood quality). Expand efforts in the area of hardwood quality and properties by investigating the Louisiana hardwood resource, especially under-utilized species, and its suitability for wood-based products.

- Generate technical information on production rates and lumber quality from small sawmills. Develop information showing the benefits of small wood-lot operations and how they increase rural employment and development.

- Apply our knowledge of basic wood properties to improve gluing and finishing processes. Modify PVA resins to attain species specific rather than product specific adhesives.

- Develop research methods for wood quality evaluations.

- Continue the transfer of information and technology related to wood quality and wood-based product performance to primary and secondary wood-uslng industries in Louisiana.

Summary

Wood quality research on the effects of fertilization, thinning, pruning, and agro forestry operations have shown that these silvicultural methods lead to specific wood quality traits and increased wood volume yields. Intensively managed sites can produce quality wood in a shorter time span; however, to maintain the economic viability of Louisiana's forests and the market competitiveness of our wood products, it is essential that we assure our forests produce wood of optimum "quality", not just optimum "quantity". This is especially true when one considers that tropical pine plantations are capable of growing larger volumes of wood than plantations in the Southern U.S.

Studies have shown that the width of the latewood portion of the growth ring, the amount of compression wood, the pitch content, and individual fiber characteristics influence sawing, machining, and sanding processes. In turn, these processes effect wood gluing and finishing. The better we understand the basic structure and properties of wood and the ways in which intensive forest management effects them, the more easily we can develop glues and finishes which meet specific product and species requirements.

The stated goals will be achieved within the framework of the LFPL mission as a result of funding from the LSU Agricultural Center-Louisiana Forest Products Laboratory, the Louisiana Tech University School of Forestry, the McIntire-Stennis Cooperative Forestry Research Program, and outside sources. Governor Foster's interest in the forest products industry within the state and the recent establishment of the Forest Products Industry Development Task Force which is charged with identifying opportunities for, and barriers to, growth and development in the value-added forest products industry in Louisiana will encourage maximization of Louisiana's forest resources.

LOUISIANA FOREST PRODUCTS LABORATORY
Current & Completed Projects

Project Sponsor	Title (P.I.)	Project Duration
(Bold denotes new projects.)		
ENVIRONMENT AND SAFETY PROGRAM		
DEQ/ EPA	Development & Demonstration of Control Measures for the Reduction of Pollutants in Stormwater Runoff from Forest Log Sorting & Storage Facilities. (C.F. de Hoop, K.S. Ro, M.D. Gibson, G.A. Grozdits)	Completed
McIntire/ Stennis	Reducing Accident Cost in the Forest Products Industry. (C. F. de Hoop)	10/95-9/2000
LFPL & Kafkas Univ., Turkey	Central Tire Inflation: Effect on Truck Driver. (C.F. de Hoop)	Completed
McIntire/ Stennis	Development of Control Measures for the Reduction of Pollutants in Logyard Stormwater. (C.F. de Hoop)	9/96-12/98
TVA/ SERBEP	Survey and Mapping of Biomass Energy Users and Producers in Louisiana. (J. Chang, C. F. de Hoop)	Completed
DEQ/ BRG	**Forest Infrastructure Restoration for Sustainable Transformation (FIRST) (C. F. de Hoop, J. Mitchell)**	**2/98-1/00**
TVA/ SERBEP	**Assessment of Air Emissions of Environmentally Friendly Firelogs from Agricultural and Wood Residues.(C. F. de Hoop, W. R. Smith, in cooperation with M. Buchart)**	**3/98-2/99**

Project Sponsor	Title (P.I.)	Project Duration
MARKETING AND ECONOMIC DEVELOPMENT		
La.Gov. Office of Rural Dev.	A Market-Based Strategy for Louisiana Secondary Wood Products Industry Development and Growth. (R. P. Vlosky, N. P. Chance)	Completed
USDA Forest Service	A Market-Based Analysis of Secondary Wood Products Industry Growth and Development Opportunities in Louisiana. (R.P. Vlosky)	Completed
Industry	Environmental Wood Products Certification: Implications for Corporate Strategy. (R. P. Vlosky, L. K. Ozanne, D. T. Wilson)	Completed
LFPL	Promoting Wood Products on the Internet.(R.P. Vlosky)	On Going
LFPL & School of F-W-F	Home Page Development for Louisiana Forest Products Laboratory, School of Forestry, Wildlife, & Fisheries, Society of Wood Science Technology. (R. P. Vlosky, R. Gazo)	On Going
Lincoln Univ.	Forest Products Environmental Certification: NZ Channel Members Perceptions and Willingness to Pay (R.P. Vlosky, L. Ozanne, H. Bigsby)	Completed
U.S. Dept. Commerce	A Market Based Strategy for Secondary Wood Products Industry Economic Growth and Development. (R. P. Vlosky)	8/96-6/98
Coordinating & Dev. Corp.	A Market Based Strategy for Secondary Wood Products Industry Economic Growth and Development. (R. P. Vlosky)	8/96-6/98
Industry	Internet Forest Products Marketing. (R. P. Vlosky)	Completed
MacArthur Foundation	Implications of Timber Certification in Central America & Impacts on Sustainable Management of the Tropical Rain Forest (R. P.Vlosky, Juan A. Aguirre, L. Ozanne)	3/96-6/98

Project Sponsor	Title (P.I.)	Project Duration
ISBM	Distributor-Supplier Partnership Relationships. (R. P. Vlosky, E. Wilson, D. Wilson)	Completed
Macon Ridge Dev.Council	A Market-Based Strategy for Louisiana Secondary Wood Products Industry Development and Growth. (R. P. Vlosky, P. Chance)	Completed
McIntire/ Stennis	Identifying Market Opportunities for Louisiana Secondary Wood Products. (R. P. Vlosky)	1/95-12/99
Industry	Quick Response & Bar Coding Technologies; Wood Products Suppliers and Home Center Buyers. (R. P. Vlosky)	Completed
ISBM	Extranets: Impacts on Marketing and Business Relationships (R. Fontenot)	9/97-12/98
United Nations Envir. Prog.	**Contingency Evaluation for Tropical Environmentally Certified Products. (R. P. Vlosky. Juan Aguirre)**	**24 months**
The Research Institute for Small and Emerging Businesses	**Small Business Use of the Internet and World Wide Web: Institute for Current Status and Projected Trends (R. P. Vlosky)**	**9/97-12/98**
USDA Forest Service S. Research St. LFA, LDAF	**Environmental Certification: Alternative Strategies for Non-Industrial Private Forest Landowners in the for Southern United States (R. P. Vlosky)**	**1/98-6/99**

PROCESSING TECHNOLOGIES

McIntire/ Stennis	Increasing lumber value & quality through quality drying. (Q.Wu)	6/96-5/2001
LFPL	Selecting panel materials by furniture and cabinet manufacturers in Louisiana. (Q. Wu)	1/97-5/99

Project Sponsor	Title (P.I.)	Project Duration
LFPL	Workshop assistance, lumber drying. (Q. Wu, T. Shupe, W.R. Smith)	On Going
LFPL	Cypress Lumber Stain. (W.R. Smith, Q. Wu)	Completed
Industry	**Establishing basic plywood properties for R.O.M. Lumber Co. (Q. Wu)**	**2/98-4/98**
LEQSF-RCS	**Dimensional stability and durability of oriented strand board I. (Q. Wu)**	**6/97-5/99**
USDA-NRICGP	**Dimensional stability and durability of oriented strand board II. (Q. Wu)**	**12/97-11/99**
Industry	**Veneer Dryer Performance Analysis. (W.R. Smith & Q. Wu)**	**Completed**
Industry	**Quality charactistics in drying Red Oak lumber. (W. R. Smith & Q. Wu)**	**Completed**
LFPL & Indonesia	**Dryability classification of 25 Indonesian woods (E.T. Choong)**	**Completed**
LFPL, USDAFS & Univ.Suriname	**Effect of pre-heated finger on performance of finger joints (E.T. Choong, C.Y.Hse, and P. Peneux)**	**1/98-12/98**
LFPL	**Effect of previous drying on shrinkage and moisture content on some Southern bottomland hardwoods. (E.T. Choong, T. F. Shupe, M. D. Gibson, G.A. Grozdits, O.V. Harding)**	**Completed**
SECONDARY WOOD PROCESSING		
LFPL	WOOD - Modeling Program For Furniture Production. (R. Gazo, C. F. de Hoop, R. Beasley)	Completed

Project Sponsor	Title (P.I.)	Project Duration
LFPL	Workshop Assistance, Plant Layout & Technical Issues. (W.R. Smith, R. Gazo, L. Hannaman)	Completed
LFPL & Industry	Plant Analysis and Incentive Programs. (R. Gazo, T. Ray, W. R. Smith)	Completed
LFPL	Opportunities for Horizontal Diversification in Manufacturing Value-added Wood Products. (R. Gazo, R. P. Vlosky)	Completed
LFPL	LAM - Labor and Material Tracking. (R. Gazo, R. P. Vlosky)	Completed
LFPL	Increasing Productivity in Cabinet Shops. (R. Gazo)	Completed
LFPL	Small Cabinet Shop Facts: Face-Frame vs. Frameless Cabinets. (R. Gazo)	Completed
LFPL	Benefits of Sorting Lumber by Grade Prior to Rough Mill Processing. (R. Gazo)	Completed
RECYCLING AND RESIDUE USE TECHNIQUES		
LFPL & USDA McIntire/Stennis	An Investigation of Wood/Plastic Composites From Recycled Solid Waste. (E.T. Choong, C.Y. Hse)	10/94-9/98
TVA/ SERBEP	Biomass Energy Resources in Louisiana. in Louisiana (W. R. Smith, C. F. de Hoop)	11/96-6/98
LFPL, USDAFS	Recycling of Utility Poles for Useful Engineered Wood Products. (E.T. Choong, C.Y. Hse)	Completed
LFPL USDAFS McIntire/ Stennis	An Investigation of Rice Husk as a Supplemental Raw Material for Manufacture of Wood Composite Products. (E.T. Choong, C.Y. Hse)	7/94-9/99

Project Sponsor	Title (P.I.)	Project Duration
TVA/ SERBEP	**Development of an Environmentally Friendly Firelog From Agricultural and Wood Residues. (W. R. Smith, C. F. de Hoop, in cooperation with M. Buchart)**	**9/97-11/98**
WOOD PRODUCTS TRADE		
Industry	Timber Supply in the Lower Mississippi Valley (C.F. deHoop, W.R. Smith, M.E. McDill)	Completed
CORRIM	Consortium for Research on Renewable Industrial Materials.(W. R. Smith)	On Going
LFPL	Hardwood Lumber Market Perceptions with Respect to Origin (W.R. Smith)	1/97-3/98
LFPL	Wood Export Database Development (W.R. Smith)	On Going
FRA (Fund for Rural America)	**FRA Gulf-States Forest Products International Trade Center (W. R. Smith)**	**9/97-3/98**
WOOD QUALITY INFLUENCES		
LFPL & USDA	Effect of silvicultural treatments on certain mechanical and physical properties of wood composites. (E.T. Choong)	Completed
LFPL & McIntire/ Stennis	Influence of Bulking Chemicals on Water Transport and Drying Stress.(E.T. Choong)	Completed
McIntire/ Stennis	Formation and Properties of Juvenile Wood in the Four Major Southern Pines. (M. Gibson, G. Grozdits)	Completed
McIntire/ Stennis	Gulf Coastal Plain Oak Log Grades, Lumber Grade Yield and Value Tables. (M. Gibson, G. Grozdits)	On Going
LA Tech FPL	A comparison of juvenile and mature wood properties in the four major southern pines. (M. Gibson, G. Grozdits)	On Going

Project Sponsor	Title (P.I.)	Project Duration
LA Tech FPL	Mechanical Properties -- Strength and stiffness of plantation- grown southern pine. (M. Gibson, G. Grozdits)	On Going
LA Tech FPL	Juvenile - Mature Wood Relationships -- Correlation of visual estimates, specific gravity and fiber length in locating the demarcation zone between juvenile and mature wood. (M. Gibson, G. Grozdits)	On Going
LA Tech FPL	The effect of fertilization on specific gravity, radial growth, and juvenile wood proportion in a loblolly pine plantation.(M. Gibson, G. Grozdits, T. Clason)	On Going
LA Tech FPL	The effect of pruning, spacing, and thinning on the wood quality of loblolly pine. (M.. Gibson, G. Grozdits, T. Clason)	On Going
LA Tech LFPL	Merchandizing solutions for standard hardwood pulpwood-size logs. (M. Gibson, G. Grozdits)	On Going
LA Tech FPL	Evaluation of degrade in red oak lumber due to air-drying and kiln-drying from the green condition. (M..Gibson, G. Grozdits)	On Going
LA Tech FPL	**The effect of fertilization on lumber quality in plantation loblolly pine. (M. Gibson, G. Grozdits, T. Clason)**	**On Going**
LA Tech FPL	**Fiber length, specific gravity, and juvenile/mature wood relationships for fertilized loblolly pine. (M. Gibson, G. Grozdits, T. Clason)**	**On Going**