



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

A Sustainable Future with Forest Products



KEN ZWICK

ASSISTANT DIRECTOR

WOOD, FIBERS AND COMPOSITES RESEARCH



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Forest Products Laboratory by the Numbers

- 136 Full Time Employees
 - 50 Scientists
- 189 peer reviewed publications in 2021
- 4 Locations
 - Madison, WI
 - Starkville, MS
 - Atlanta, GA
 - Orono, ME
- \$26 million budget in FY22
- \$800K /yr income from agreements
- Managed \$4.8 million in external contracts



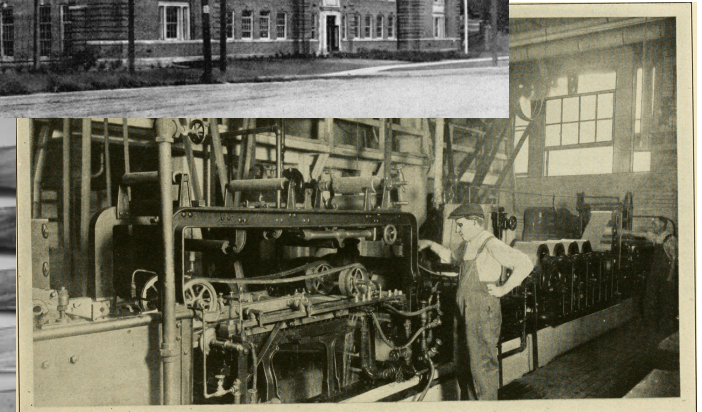
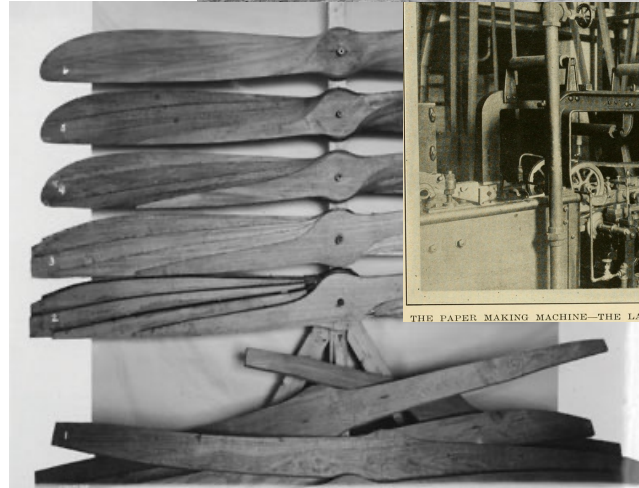
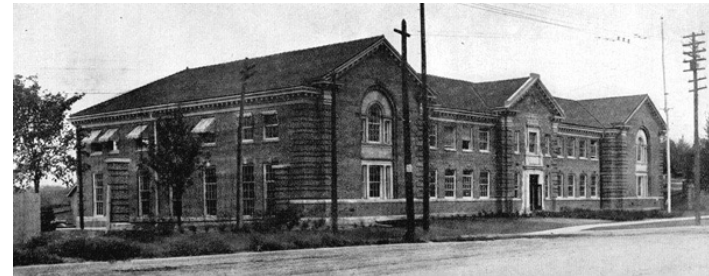


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Forest Products Laboratory - Public service since 1910

We are proud of our long history of service.

- FPL is responsible for many of today's wood-based technologies:
 - wood preservatives
 - glulam beams
 - oriented strand board
 - fiber-based packaging
 - Wood/plastic composites



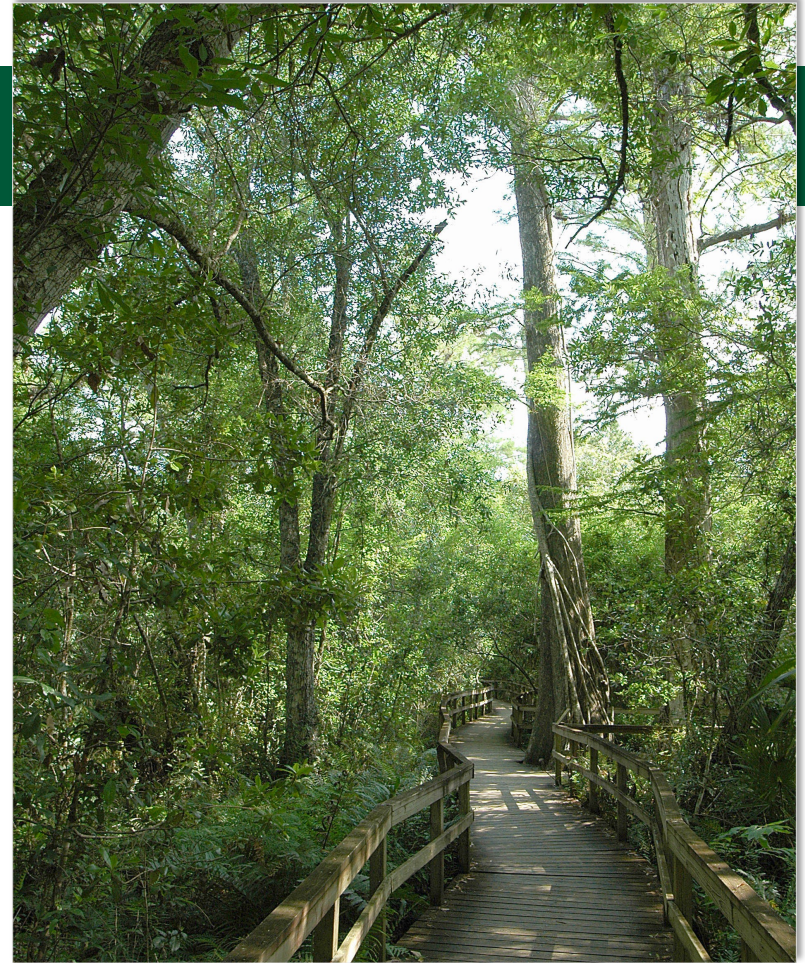
THE PAPER MAKING MACHINE—THE LABORATORY EQUIPMENT FOR CONVERTING WOOD INTO PAPER IS COMPLETE



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Our purpose

Make a sustainable future a reality with forest products – by showing how wood can reduce our dependence on greenhouse gas intensive materials like cement, plastic and oil.



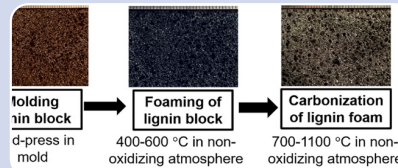


Sustainability

Reduce:

- Greenhouse gas emissions
- Water usage
- Pollution

In socially and economically sensible ways.



New
Products

Cleaner
Materials &
Processes

Biomass
Utilization

Wood Fundamentals



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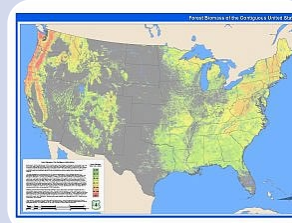
What Does Success Look Like?



Sustainable
Forest
Products
Grow



Pile Burning
is Reduced



Forested
Land Area
Grows



FEDERAL ACTIVITIES REPORT
ON THE BIOECONOMY

FPL is
Recognized
Leader in
Transition to
Forest
Bioeconomy



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Challenges and Opportunities



Climate Change



Managed Forests



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Challenges and Opportunities



Wildfires

WILDFIRE CRISIS
strategy

- +20 MILLION** Treating up to an additional 20 million acres of National Forest System lands.
- +30 MILLION** Treating up to an additional 30 million acres of other Federal, State, Tribal, and private lands.
- 10 YEARS** Developing a plan for long-term maintenance beyond the 10 years.

USDA UAS

Bipartisan Infrastructure Law



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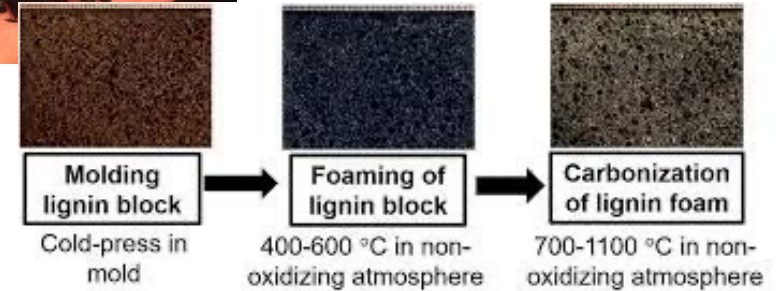


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Challenges and Opportunities



Wood Waste Piles



New Products and Markets





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Challenges and Opportunities



Retirements



Now Hiring



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FPL Current Emphasis Areas



Nanotechnology



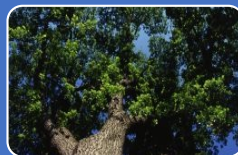
Advanced Composites



Biorefinery



Advanced Structures



Sustainability and Forest Carbon



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FPL Emerging Emphasis Areas



Green Building/Construction

- Nanocellulose in Cement and Asphalt
- CLT Tall Buildings
- Lignin and Carbon Foam Structural Insulation Panels



Renewable Packaging

- Paper and Board
- Films/Barriers
- Single Use Plastic Replacement



Wood to Value

- Biochar
- Biorefinery
- Cellulose Nanomaterials
- Lignin
- Hemicellulose



Sustainability and Forest Carbon



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Wood Products Research



Building and Fire
Science



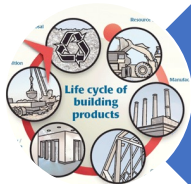
Engineering
Properties of Wood



Durability and
Wood Protection



Wood Anatomy



Economics and Life
Cycle Analysis



Engineering
Mechanics Lab



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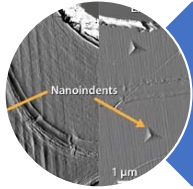
Wood, Fibers and Composites Research



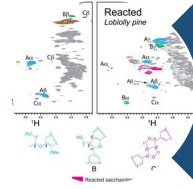
Engineered
Composites



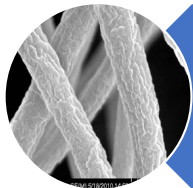
Institute for Microbial and
Biochemical Sciences



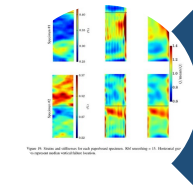
Forest Biopolymers



Analytical Chemistry and
Microscopy Lab



Fiber and Chemical
Sciences

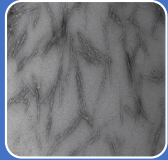


Paper Test Lab



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WFCR Research Emphasis Areas



Nanotechnology



Advanced
Composites



Biorefinery



Renewable Packaging



Green Building



Pyrolysis/Biochar



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Forest Wood Waste



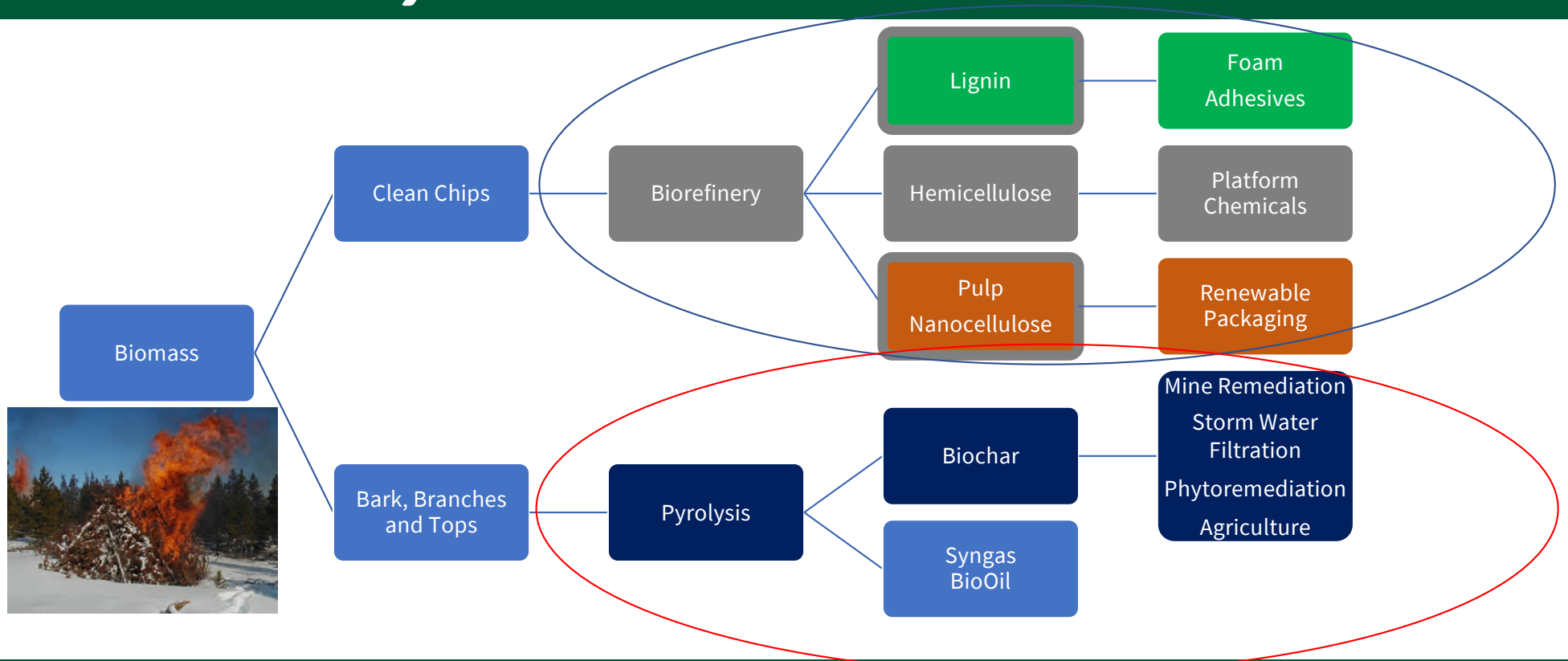
50 million acres of restoration =
600 million metric tons of biomass

If pile burned:
= 1 Billion metric tons CO₂
= 20% of US annual emissions
= air quality decline
= water quality decline
= lost recreation opportunity
= fire risk





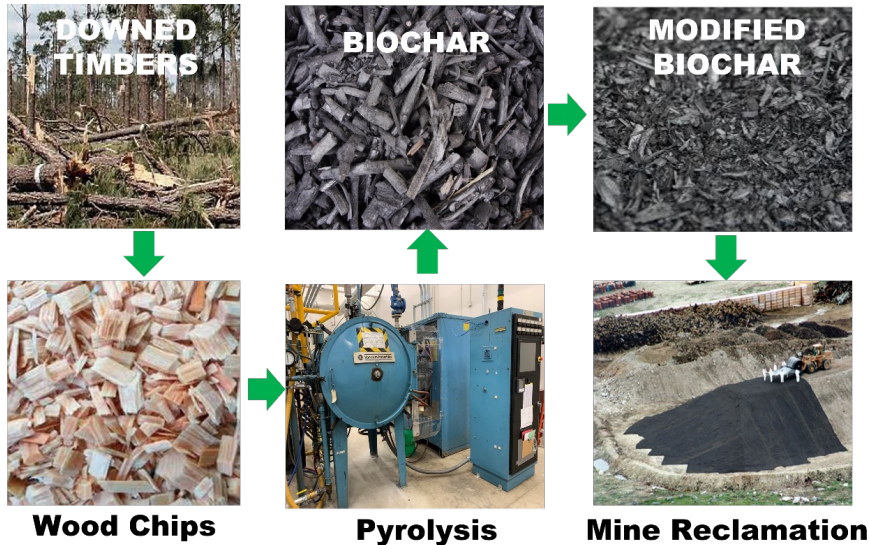
Woody Biomass -> Value





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Near Term – Biochar for Mine Reclamation



Opportunity = Biochar

- Sequester Carbon
- Retain Water and Improve Soil Health
- Mine reclamation
- Clean Urban Stormwater Runoff
- Enhance Phytoremediation



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Long Term – Cellulose Nanocrystals for Cement



Opportunity = Cellulose NanoCrystals for Cement

- 0.1% CNC makes cement 20% stronger
- 1 mt of CNC can:
 - Enhance 6500 mt of concrete
 - Reduce GHG emissions by 160 mt
 - Save \$15,600 in cement costs



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Long Term – Cellulose Nanocrystals for Cement



Sidewalk study at Oregon State is in progress to demonstrate maximum GHG reductions

Opportunity = Cellulose NanoCrystals for Cement

- Global concrete usage is 4.1 billion mt, emitting 8% of world GHGs
- All could be enhanced with 4 million mt of CNC
 - Avoiding 650 million mt CO₂



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SUMMARY

- Sustainable future through forest products
- Emerging Research Areas
 - Green Building
 - Renewable Packaging
 - Biochar
- Woody Biomass Challenge
 - Phase 1 = Biochar
 - Phase 2 = Biorefinery (renewable packaging, green building)



Thank you!