




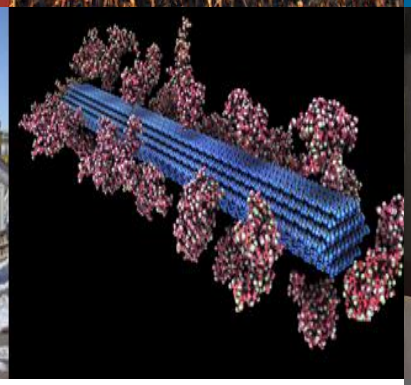


U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE Bioenergy Technologies Office (BETO) 2015 Project Peer Review

Carbon Cycling, Environmental & Rural Economic Impacts from Collecting & Processing Specific Woody Feedstocks into Biofuels

March 24, 2015
Technology Area Review

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Goal Statement

Woody biomass converted into durable wood products can sequester carbon for 20-70 years, offering an immediate carbon offset. Thus, there is a need to understand how woody biomass can also contribute to biofuels production without sacrificing this carbon storage benefit.

- Conduct regionally specific (PNW, SE and NE) LCA for biomass residues coming from the current commercial manufacturing systems
- Conduct regionally specific (PNW, SE and NE) LCA for SRWC are best suited for bioenergy production
- Use DOE process models to measure the LCA for using these woody feedstocks in BC and TC processes
- Evaluate the impacts on the LCA of variations woody biomass properties, e.g., MC, chemical composition and ash.
- Evaluate the trade-off for the use of wood biomass for durable wood products and biofuels

Quad Chart Overview

Timeline

- May 1, 2015
- May 1, 2018

Budget

	Total Planned Funding (FY 15-Project End Date
DOE Funded	1,281,883
Project Cost Share	251,150

Barriers

- Quantify sustainability (GHG, water, air quality, productivity, and yield) for regionally specific feedstocks from forest residuals and SRWC
- Life Cycle Analysis with allocation to non-energy products
- Characterize regional supply chain barriers

Partners

- CORRIM
  - NCSU
  - U of WA
  - SUNY
  - U of Maine
  - Consultants

Partners (Principal Investigators - PI)

Name	Institution	Task
Steve Kelley	NCSU	SE – Forest and SRWC LCA
Richard Gustafson	Univ. of Washington	PNW - SRWC
Elaine Oneil	Univ. of Washington	PNW - Forest Systems/ LCA
Tim Volk	SUNY	NE - SRWC
Aaron Weiskittel	Univ. of Maine	NE- Forest Modeling
Maureen Puettmann	Woodlife Consulting	Life Cycle Analysis
Leonard Johnson	Johnson and Assoc.	PNW - Harvest Systems / LCA
Larry Mason	Alternate Dimensions	Bioenergy Systems Analysis – Scale Barriers
Bruce Lippke	Lippke and Assoc.	Forest Operations

1 - Project Overview

- Initially funded with more of a focus on durable wood products
- After 1 yrs. funding suspended in 2012 due to DOE-BETO “cash flow” limitations
- Reinitiated with a narrowed scope and focus on providing information for GREET
- Specific goals include
  - the impacts of using mill and forest residues from current commercial operations (cost, quality and transportation issues)
  - additional emphasis on SRWC as a biomass resource for biofuels and as a alternative/supplement to commercial softwoods
  - understanding the implications of durable wood products as a “co-product”

2 – Approach (Technical)

- Use existing data sources, e.g., USDA NIFA Bioenergy CAPS (U of WA, NCSU, SUNY), USFS FIA datasets, CORRIM datasets to estimate the LCA burdens associated with the productions and collection of woody biomass, coupled to DOE process models to create well-to-wheels data set for GREET.
- Critical success factors
  - regionally specific information for both commercial softwood systems and SRWC.
  - different feedstocks have very different processing characteristics, e.g., softwoods very low yields in BC processes, high ash residues have low bio-oil yields in TC processes
  - to make this manageable will focus on common durable wood co-products
- Challenges
  - temporal aspects of durable wood products (20-70 yrs.) and commercial forests (30-50yrs)
  - will not include indirect land use and soil carbon changes (minimized by focus on current commercial forest lands)
  - great deal of variation in practices, regionally specific focus will reduce, but not eliminate these affects

2 – Approach (Management)

- As an “Analysis” project the main management success factor will be ensuring that the regional commercial production scenarios are comparable, and have consistent data quality

- The members of this CORRIM team have been working together for more than 10 years and have a track record of delivering LCA products for industry and government funders (CORRIM data is the basis of published EPDs)

- Data quality, consistency and sources are all key for GREET. CORRIM plans to follow boundary conditions/supply chain protocols already used for other GREET feedstock/process combinations

- The CORRIM team will work closely with the GREET team, and has already made plans to have CORRIM students/postdoc work at ANL with the GREET team

- The CORRIM team plans to conduct biweekly calls, report quarterly milestones, and will include constant feedback from the ANL GREET team

3– Relevance (1/2)

- Sustainability, with its very real and political overlays, is a major hurdle for the large scale commercialization of bioenergy systems.
  - Strategic analysis of barriers to woody feedstocks allocation to energy products based on life cycle analysis including allocation to solid wood products **(Barriers At-A,B,C)**

- GREET is an internationally recognized tool for measuring the sustainability impacts of different biomass production scenarios.
  - Quantify sustainability (GHG, water, air quality, productivity, and yield) for regionally specific feedstocks from forest residuals and SRWC that link to GREET **(Barriers St-C, AT-A,B,C)**

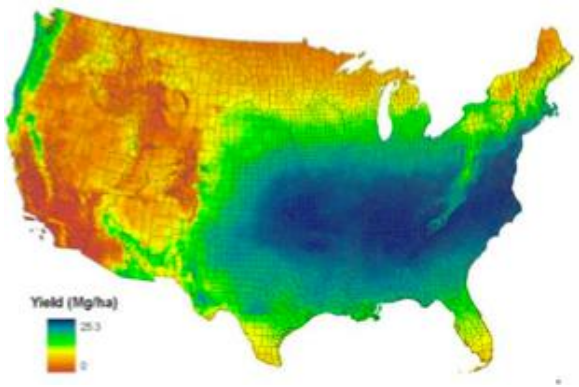
- Woody biomass systems, with the current demands for commercial durable wood products and the high sensitively to the unique aspects of forests, will attract even more attention than other biomass sources
  - Characterize regional supply chain barriers **(Barrier St-D)**

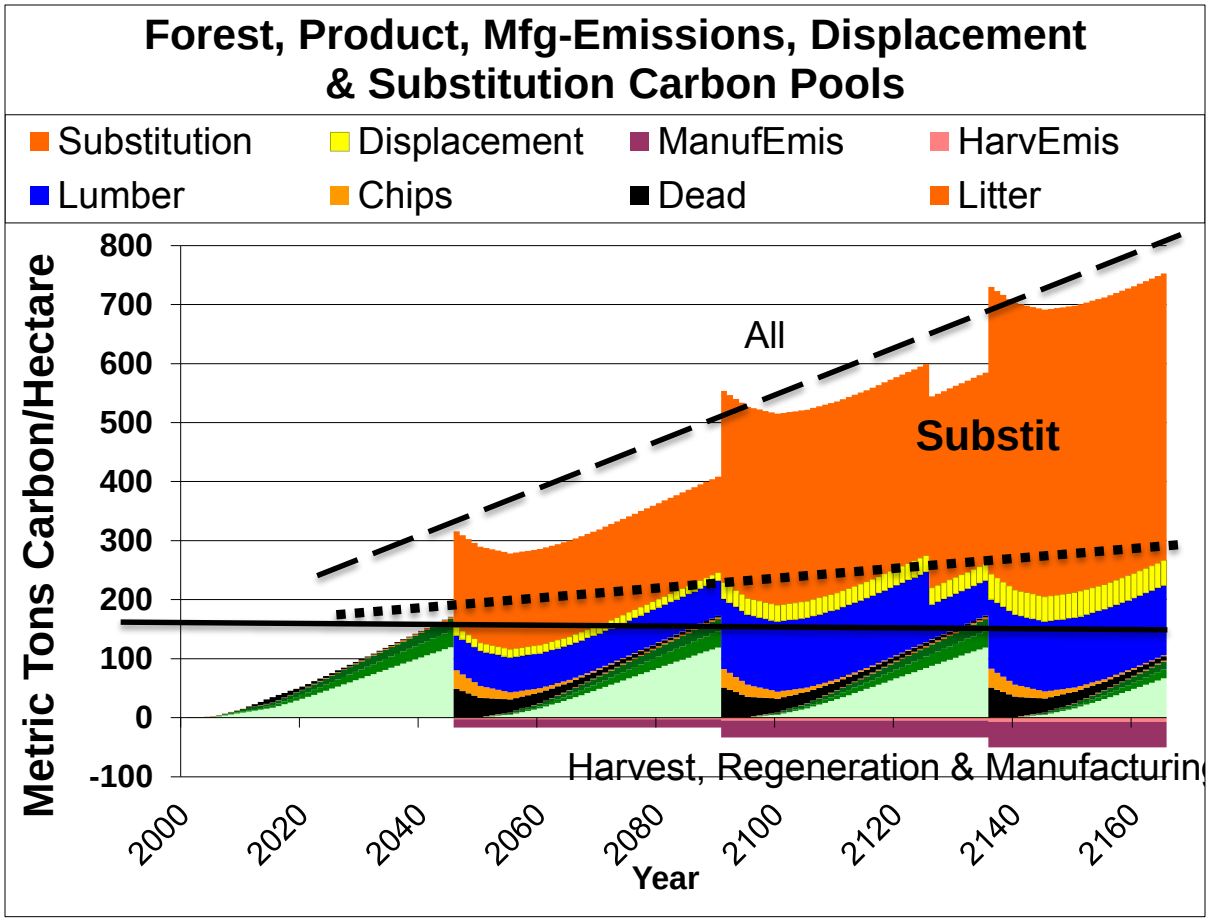
3– Relevance (2/2)

- The initial ‘customer’ for this work is the DOE GREET team. Additional customers include the USFS and the current wood products/pulp and paper industry, and rapidly growing wood pellet industry.

- DOE has invested heavily in GREET, which is now accepted as the gold standard for biofuels analysis. This work will insure that GREET has high quality LCA data on woody feedstocks, and that DOE has a understanding of the effects of variations in woody feedstock quality on biofuels production

Summary


Yield (Mg/ha)


Forest, Product, Mfg-Emissions, Displacement & Substitution Carbon Pools
Substitution
Displacement
ManufEmis
HarvEmis
Lumber
Chips
Dead
Litter
Metric Tons Carbon/Hectare
800
700
600
500
400
300
200
100
0
-100
All
Substit
Harvest, Regeneration & Manufacturin
2000
2020
2040
2060
2080
2100
2120
2140
2160
Year

Approach

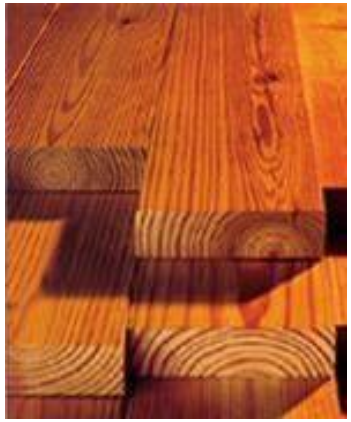
Softwoods

SRWC

LCI burdens

- Chemicals
- Fuels
- Planting stock

ALLOCATION ???



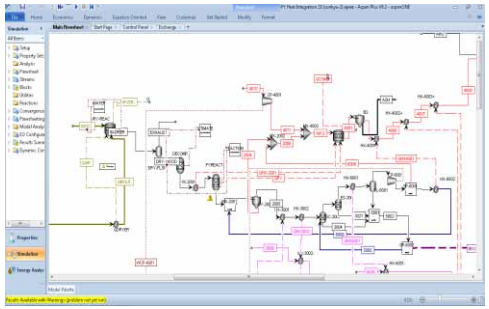
Approach

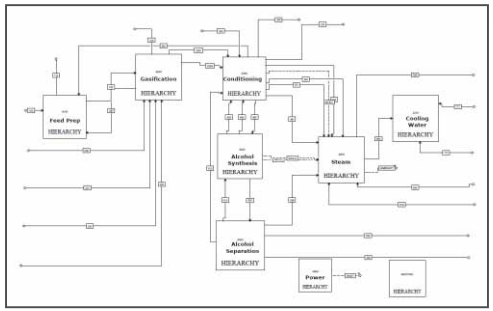
Key chemical attributes

BC Process
- Sugars, C6/C5
- Lignin
- “Reactivity”

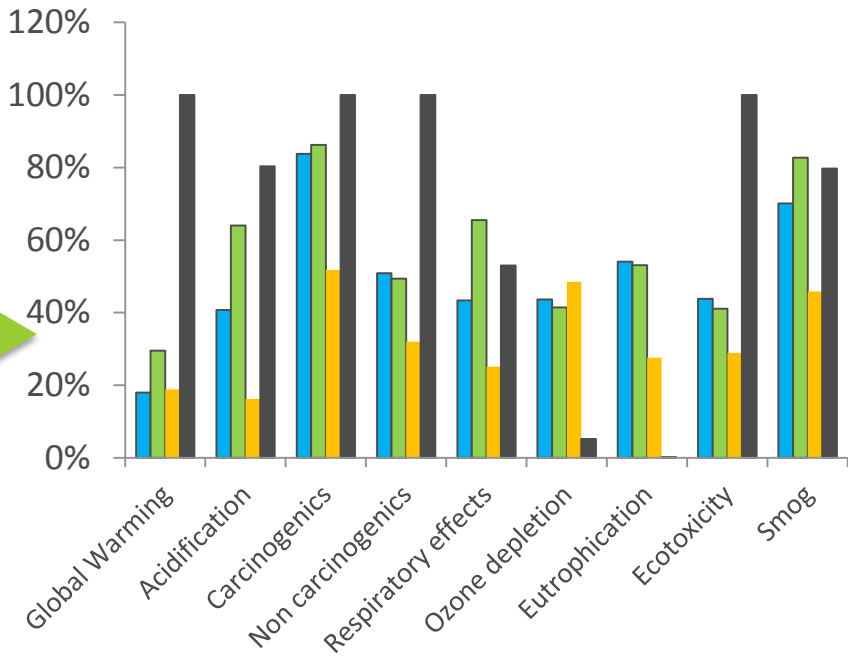
TC Process
- MC
- Carbon
- Ash

DOE Process models



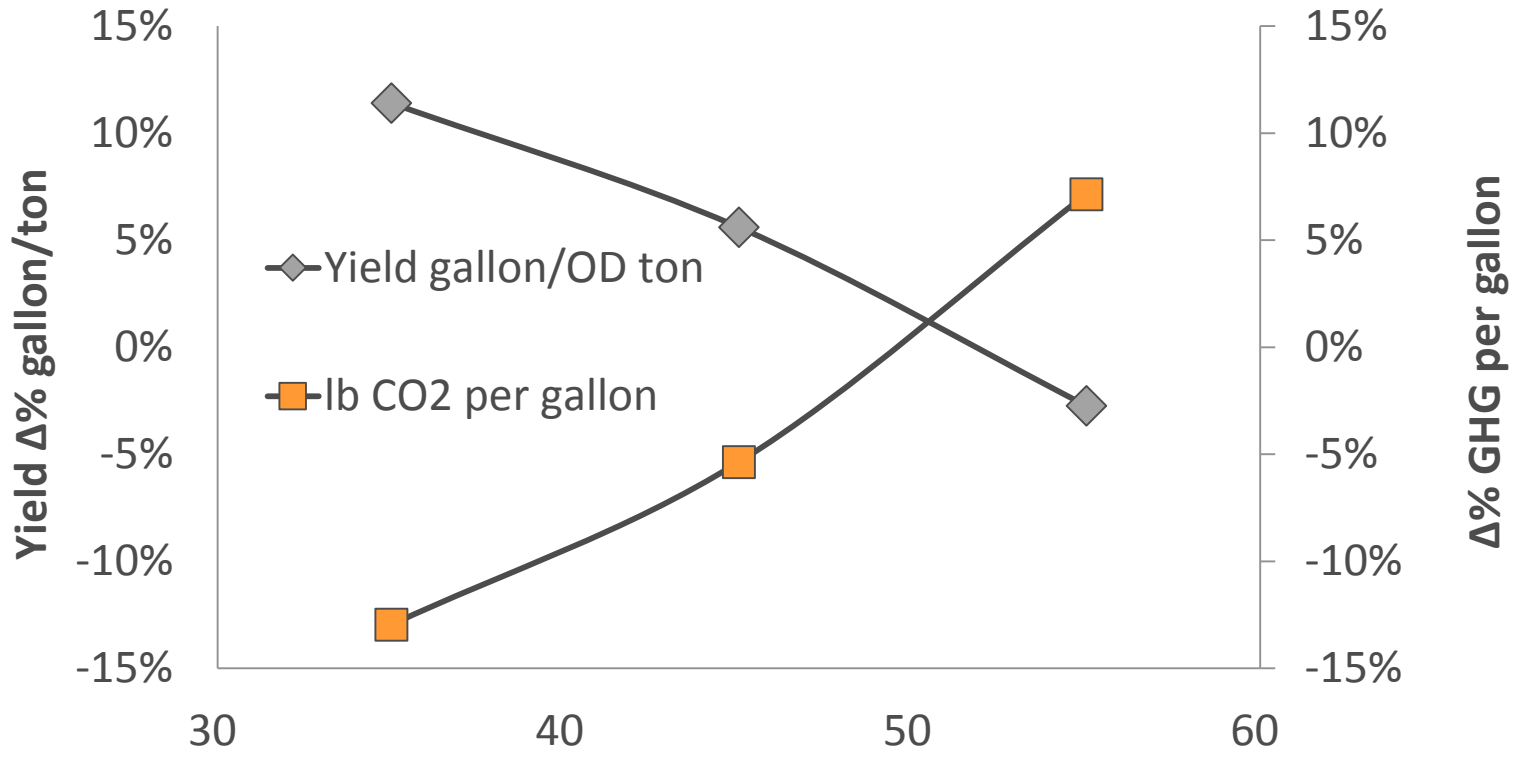


LCA Attributes



Thermochemical Results for Pine

- Effects moisture content



Summary

- CORRIM has 20 yrs. of experience on LCA on durable wood products, primary data for current EDPs
- Focused on providing representative input for woody biomass into GREET

- Regional focus, with commercial softwoods, SRWC
- Includes both BC and TC conversion processes
- Leverage USDA NIFA CAP investment in excess of $65 mil

- Durable wood “co-products” and the time scale for the carbon capture are both challenging
- Forests are complex, and emotional