Effects of Wood Pellet Production on Forest Conditions in the Southeastern United States

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This presentation does not contain any proprietary, confidential, or otherwise restricted information.
US industrial wood pellet trade has been growing.
Key questions

• How does SE US pellet production for export to EU differ from business-as-usual case of no pellet production?
  Ø Under what conditions does the pellet industry complement or compete with pulpwood use?
  Ø Will pellet industry alter amount of land staying in the forest?

• Are there significant changes to key environmental indicators?
  Ø Biodiversity
  Ø GHG emissions
  Ø Soil quality
  Ø Jobs
  Ø Water & air quality
  Ø Preserving land as forest

• How can forest conditions be monitored & good practices implemented?
  Ø Analysis of USDA Forest Service’s Forest Inventory & Analysis (FIA) data
  Ø Best Management Practices (BMPs)

Participants on ORNL’s Bioenergy Study Tour helped address these questions
Private forest land in the SE is the “timber basket” of the US. Pellets come from those private lands.

Hewes et al. (2014)
Influences on SE US export wood pellet production

Parish et al. (2017)
Biomass stranded without markets ("unloved wood")

- Eventually burns or decays
- Reduces incentives to keep private lands forested
Opportunity created by European demand for pellets for biopower

The pellet industry constitutes < 1% of US forest products by weight in 2014 and is growing.*

*Stewart (2015)
When assessing effects of woody biomass, the counterfactual or reference scenario should be based on

• Historical conditions
  – Past agriculture cleared much of the SE US forests
    • For example - only 3% of original long leaf forest remains
  – Remaining old growth forests are largely protected

Sources: Davis 1996; Varner et al. 2005; Southern Forest Futures Report; Wear & Greis, 2013
When assessing effects of woody biomass, the counterfactual or reference scenario should be based on

- Historical conditions
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  - Remaining old growth forests are largely protected

- Realistic assumptions for future projections & risks of disturbances
  - Development is prime pressure for deforestation in SE US
  - Forest management decisions largely driven by demand for higher price forest products than pellets

Sources: Southern Forest Futures Report, Wear & Greis, 2013; Wear & Coulston, 2015
Status of Forests in US

• Systems are in place for
  – Monitoring, reporting, & regulating
  – Stewardship of public forests

• Examples
  – USDA’s Forest Inventory & Analysis
  – Public & private land conservation
  – State-driven programs
    • “Best management practices”
    • "State Forest Action Plans“
    • 1,500 state government entities implement forest policies & programs (Ellefson et al. 2002)

• Forestry & agriculture laws & regulations
  – Target air, water, & endangered species
  – Complex due to multiple layers of authorities: federal, s local, tribal
Methods: Analysis of USDA’s FIA data

USDA Forest Service’s Forest Inventory & Analysis

- Long-term survey
- All forests in the US
- Information on a variety of forest statistics
  - Forest area & location
  - Species
  - Tree size, growth, health, & mortality
  - Removals by harvest
  - Carbon accumulation
Over half of US wood pellets ship to Europe come from Norfolk/Chesapeake & Savannah ports

We looked for timberland changes in the two fuelsheds supplying these ports before and after export pellet production began in 2009.

Study area: focused on family-owned forests considering two fuelsheds that dominate exports of wood pellets to Europe from the SE US

Analyses
1. Compared forest conditions before & after periods when pellets were produced using the FIA
2. Examined National Woodland Owner Survey for these fuelsheds
Results: volume, area, number of dead trees, & carbon for “natural” stands and plantations in two fuelsheds pre & post 2009
Results: volume, area, number of dead trees, & carbon for “natural” stands and plantations in two fuelsheds pre & post 2009

<table>
<thead>
<tr>
<th>Timberland Characteristic</th>
<th>Savannah Fuelshed</th>
<th>Chesapeake Fuelshed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naturally regenerating stand volume</td>
<td>Increased</td>
<td>No change</td>
</tr>
<tr>
<td>Plantation volume</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td>Large-diameter tree area</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td>Medium diameter tree area</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Small diameter tree area</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Standing dead tree density of natural stands (#/ha)</td>
<td>Increased</td>
<td>No change</td>
</tr>
<tr>
<td>Standing dead tree density of plantations (#/ha)</td>
<td>Decreased</td>
<td>No change</td>
</tr>
<tr>
<td>Carbon content of soil and leaf litter</td>
<td>Increased</td>
<td>No change</td>
</tr>
<tr>
<td>Carbon content of live harvestable material</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td>Carbon content of dead non-harvestable material</td>
<td>Increased</td>
<td>No change</td>
</tr>
</tbody>
</table>

Conclusions from analysis of FIA data

- GHG sequestration and pellet production increased in SE US during a period of reduced timber harvesting.

- Calls for further study of effects on biodiversity of declines in # of standing trees/ha
  - Yet some recommend thinning & hardwood midstory control in pine plantations to provide habitat for declining bird species (consistence with use of biomass for energy & reducing risk of fire).
  - ORNL is focusing analysis on organisms potentially affected by such declines

Dale et al. (2017) For Ecol & Mgt
Income from pellet exports can encourage SE US forest owners to invest in forest management (e.g., thinning)

From E. Parish, V. Dale, K. Kline (2017) *World Biomass*
Land owners work to address their goals while obeying environmental laws.

Current approach: Employing loggers trained in BMPs

US Forests

Designated use: Do Not Disturb
Past Management Activities
Comparing Study Fuelshed Owners to SE Owners

How important are the following as reasons for why you currently own your wooded land?

- Nature/Biodiversity
- Protect water
- Wildlife Habitat
- Land Investment
- Legacy
- Hunting

Subset of data from Butler et al. (2016)
Consideration of noncorporate forest land owners’ perspectives regarding wood-based energy

Survey of ~900 family forest land owners in eastern US on biomass for energy:

- Concern for the environment is paramount
- Potential impacts on existing industries are a concern
- There was a willingness to support use of biomass for energy as long as
  1. Land health is not compromised
  2. The price is right

Hodges et al. (2016 & in prep.)
There is no one key for effective timber management, but having a bioenergy market can help#

- Reduce inefficiencies
- Improve forest habitat
- Reduce risk of fire & insect outbreaks
- Lower carbon emissions & mitigate effects of global climate change*
- Retain forests: as demand for wood increases, net forest area typically expands**
- Provide “green” jobs

# Dale et al. (2017a)
* Cowie et al. (2013)
** Miner et al. (2014), Stewart (2015)
Recommended practices

- **Accentuate benefits**
  - Identify & conserve priority biodiversity areas
  - Apply location-specific management of biofuel feedstock production systems

- **Attend to site selection & environmental effects in**
  - Selection & location of the feedstock
  - Transport of feedstock to the refinery
  - Refinery processing
  - Final transport & dissemination of bioenergy

- **Monitor, assess & report on key measures of sustainability**

- **Focus on what is “doable”**

- **Communicate opportunities & concerns to the stakeholders & get their feedback**

- **Employ adaptive management**
Thank you!

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References


