Biomass as an Ecosystem Service: Co-Benefits of Forest Restoration

- Reduced Air Pollution from Pile Burning and more efficient wood stoves
- Reduced Risk of Reservoir Sedimentation
- Reduced Reliance on Fossil Fuels
- Fire Resilient Landscapes
- Mexican Spotted Owl Habitat
- Reduced Risk of Reservoir Sedimentation
- Insect and Disease Reduction
- Reduced Reliance on Fossil Fuels
- Forest Restoration
- Aspen
- Chestnut
- Longleaf Pine

Kate MacFarland and Dave Atkins
State and Private Forestry
US Forest Service
Framework for biomass within an ecosystem services context
Opportunities for demand and supply side financial mechanisms
Examples of these mechanisms
Policies related to woody biomass utilization
Implications for other ecosystem services
Ecosystem Services Framework

Disturbance (Natural and Manmade) → Ecological Structure → Ecosystem Functions → Ecosystem Goods and Services

Mechanisms that connect ecosystem goods and services to management
Biomass as an ecosystem service

- **Disturbance**
  - Fire
  - Hazardous fuels reduction

- **Ecosystem Structure**
  - Stand density
  - Wildfire condition class

- **Ecosystem Function**
  - Being resilient to fire
  - Filtering water

- **Ecosystem Goods and Services**
  - Reduced fire risk
  - Clean water
Biomass as an ecosystem service

Ecosystem Goods and Services

- Reduced fire risk
- Clean water

Results Without Utilization

Before

Results With Utilization

After
Biomass as an ecosystem service

- Being resilient to fire
- Filtering water

Ecosystem Functions

Forest after treatment

Sedimentation after catastrophic fire
“Without the fuel treatment effects of reducing flame lengths and defensible space around most houses, we would have had to pull back our firefighters. Many of the houses would have caught fire and burned to the ground.”

Jim Aylor
Fire Management Officer Alpine Fire District

Ecosystem Structure

- Stand density
- Wildfire condition class

2011 Wallow Fire, Arizona

High intensity fire
Fuel treatment
Residential area
Biomass as an ecosystem service

- Fire
- Forest management
Forest restoration costs are decreased as woody biomass value increases.

- Overstocked forest – high fire risk
- Forest is thinned
- Residues are burned in the woods
- Residues are removed from the woods
- Smoke, higher cost
- Renewable energy
**Example of Demand Side Mechanism**

- **Relationship of the price of biomass to the cost of forest restoration**

<table>
<thead>
<tr>
<th>Cost Per Acre of Forest Restoration</th>
<th>Business as usual</th>
<th>With biomass utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of thinning</td>
<td>$600</td>
<td>$600</td>
</tr>
<tr>
<td>Cost of piling and burning</td>
<td>$200</td>
<td>N/A</td>
</tr>
<tr>
<td>Cost of removing material from the woods</td>
<td>N/A</td>
<td>$200</td>
</tr>
<tr>
<td>Value of biomass</td>
<td>N/A</td>
<td>-$200</td>
</tr>
<tr>
<td>Total cost to the land manager</td>
<td>$800/acre</td>
<td>$600/acre</td>
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</tbody>
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California fire risk and SB 1122

- Orange color indicates fire risk
- Purple dots are hydroelectric power stations

The North Fork Feather River produces roughly 10% of California's hydroelectric power.
Example of Demand Side Mechanism

- Fuels for Schools
  - Savings to schools
  - Air Emissions Reductions

Pollutant Emission Rates for Wood Boilers and Fire Activities

- Darby Wood Boiler
- Thompson Falls Wood Boiler
- Wildfire
- Prescribed Burning
- Slash Pile Burning

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Darby Wood Boiler</th>
<th>Thompson Falls Wood Boiler</th>
<th>Wildfire</th>
<th>Prescribed Burning</th>
<th>Slash Pile Burning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter</td>
<td></td>
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<td></td>
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<tr>
<td>Nitrogen Oxides</td>
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<tr>
<td>Carbon Monoxide</td>
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</table>
Supply side mechanisms

- Addressing risk
Denver Water

Example of Supply Side Mechanism

Facility Protection Treatments
Example from Cheesman Reservoir
Policies

**Local**
- Rebates and other incentives

**State**
- Thermal RPS
- CA carve out

**National**
- USDA Rural Development and USFS work to leverage private investment in wood energy
Implications for other ecosystem services

- Integration of ecosystem service into other sectors
- Demand constrained or supply constrained?
- Importance of asking “what is your baseline?” and “what is ‘business as usual’?”
Fire Resilient Landscapes

Mexican Spotted Owl Habitat

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Ecosystem Services from Biomass Utilization