Investigation of Regional CO$_2$ Absorption Potential using Wood Biomass

Tsuguki KINOSHITA (NIES)
Keisuke INOUE (The University of Tokyo)
Hiroshi KAGEMOTO (The University of Tokyo)
Yoshiki YAMAGATA (NIES)

5/9/2006 in UAM
Background

- The ratio of forest area is more than 60% in Japan.
- The cut of timber is 4MtC/year although the production of all artificial forest is 20MtC/year. (Primary reason is high labor cost and secondary reason is high transportation cost)
- Rotation period is now changing from 40 year to 80 year.
- Biomass use of timbers is very small but the oil price in Japan is much higher than other countries.
Objective

Construction of the model of wood biomass production cost and demands.
  • spatial distribution of production cost.
  • the most environmentally-friendly forestry system.

Features of this system

• Geographical Information Systems is used
• Future production of forests are forecasted by a ecological model.
• Price of round wood is calculated by world forestry trade model.
Outline of The Model

- Eco-system model or Inventory data
- World forestry trade model
- Cost calculation system on GIS (forest age, road, demand, etc.)
- Productivity of forest
- Round wood price
- Operation area, Rotation Period
- Road planning, etc.
Image of the model

Calculate the spatial distribution of total cost

- Forestry cost
- Transportation cost
- Manufacturing cost
**Target Area**

<table>
<thead>
<tr>
<th>Name</th>
<th>Area [ha]</th>
<th>Population</th>
<th>Ratio of forest area</th>
<th>Forest area per person [ha]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yusuhara</td>
<td>23,700</td>
<td>5,000</td>
<td>91%</td>
<td>4.3</td>
</tr>
<tr>
<td>Susaki</td>
<td>13,600</td>
<td>30,000</td>
<td>72%</td>
<td>0.33</td>
</tr>
</tbody>
</table>
Example: Total collecting cost of thinning wood
Collection area for big consumers (heavy oil users)

Rotation period: 40 years
Rotation period: 80 years

Pellet price: \$33/kg

\$33/kg = \$72/L (equivalent in heavy oil)

Pellet is a little expensive than heavy oil!
(Price of heavy oil is \$60/L in Japan)
**Collection area for household consumers (kerosene users)**

Rotation period: 40 years

Rotation period: 80 years

Pellet price: \(\$34/kg\)

\(\$34/kg = \$70/L\) (equivalent in kerosene)

Pellet is a little cheaper than kerosene!

(Price of kerosene is \(\$75/L\) in Japan)

Pellet price: \(\$35/kg\)

\(\$35/kg = \$72/L\) (equivalent in kerosene)

CO2 emission is reduced 7.4% in this case
**Long rotation or Short rotation?**

When the demand is limited in Yusuhara town,
Long rotation operation is better
Reason: reduction of CO2 emission is same.
benefit of forestry is higher.

When the demand of Susaki city is added,
Advantage of Long rotation operation
Benefit of forestry is higher

Advantage of Short rotation operation
Amount of CO2 reduction is larger

Which is better?
Long rotation or short rotation?

It is better to operate 80 years. But oil price rise further, 40 years is better.

If carbon tax is imposed, optimum rotation period become short.
Carbon tax v.s. CO\(_2\) reduction

Supply of wood biomass or CO\(_2\) reduction

Yusuhara, 80y, remainder

Yusuhara+Susaki, 80y, remainder

Yusuhara+Susaki, 40y, remainder

Yusuhara+Susaki, 40y, All Use

Oil price or Carbon tax

Actual (\$75/L)

\$100/t

\$300/t

\$900/t (\$140/L)
Conclusions

- The use of wood biomass is now realistic in regional level in Japan.
- But the control for global warming is small in region.
- Thinking long term benefit, to keep short rotation operation may be better than long rotation operation.
- Cooperation of the city and the region is necessary to keep short rotation operation.