

Climate and Energy Policies in the Forest Sector: An Energy-Wood and Timber Market Model for Finland

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Future of the Finnish Forest Sector

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Background and Motivation

Global and national contexts of the Finnish forest sector are changing because of increasing demands for climate services and bioenergy from forests. To plan climate and energy policies, decision makers will need to know how to design efficient mechanisms for the provision of bioenergy and climate services within forest sector, and will need estimates of the economic and environmental effects of policy measures.

An approach focusing on forests' climate services is too narrow. Thus, ecosystem and especially climate services have to be identified within an integrated forest sector approach.

Objectives

To increase understanding of the mechanisms within a system of economic, technological and biophysical processes related to forest sector, bioenergy and climate issues.

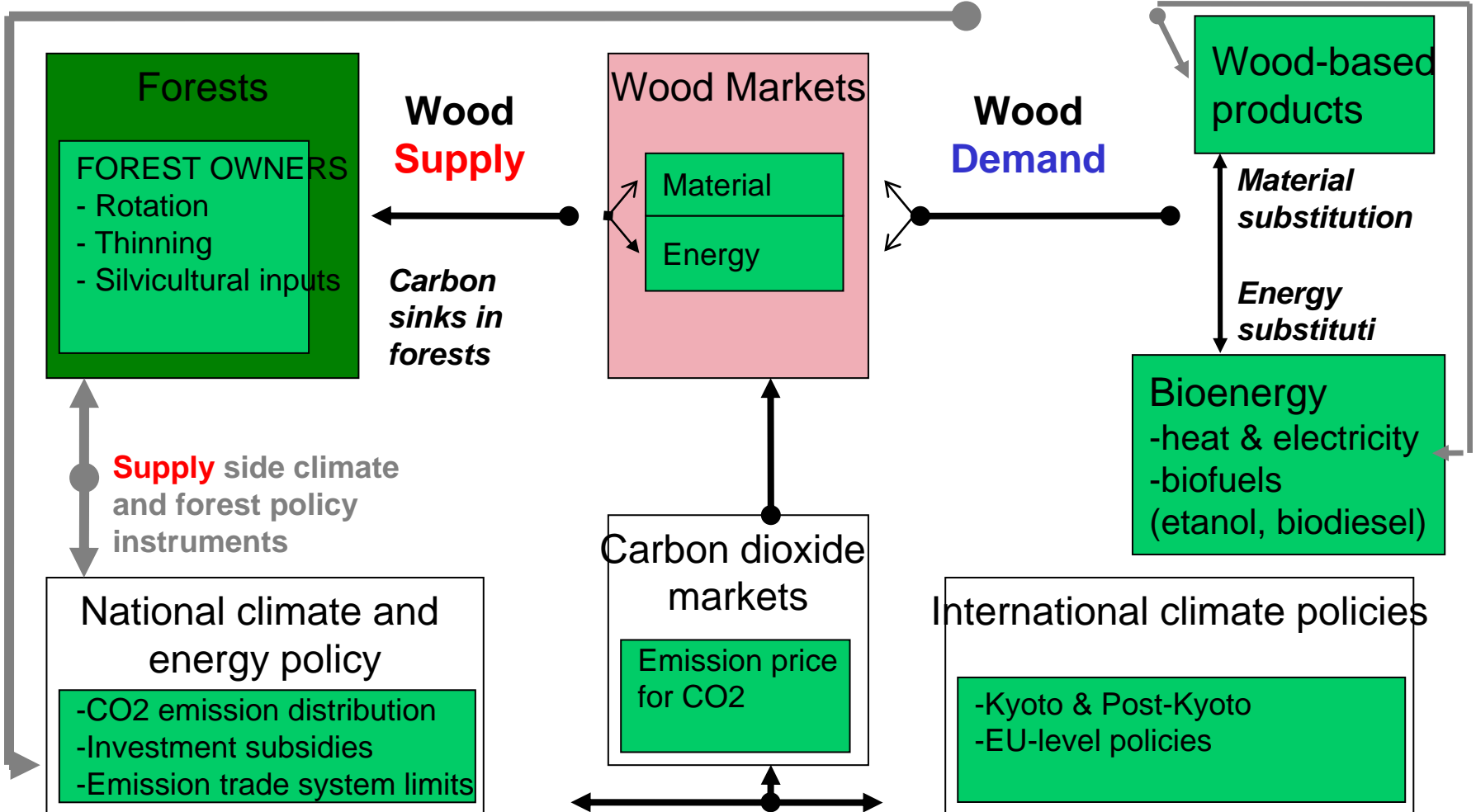
To have an enough accurate but yet simple market model to be able to identify and evaluate both supply and demand side climate policy instrument effects on market outcomes and forest structures.

Selected Background Literature:

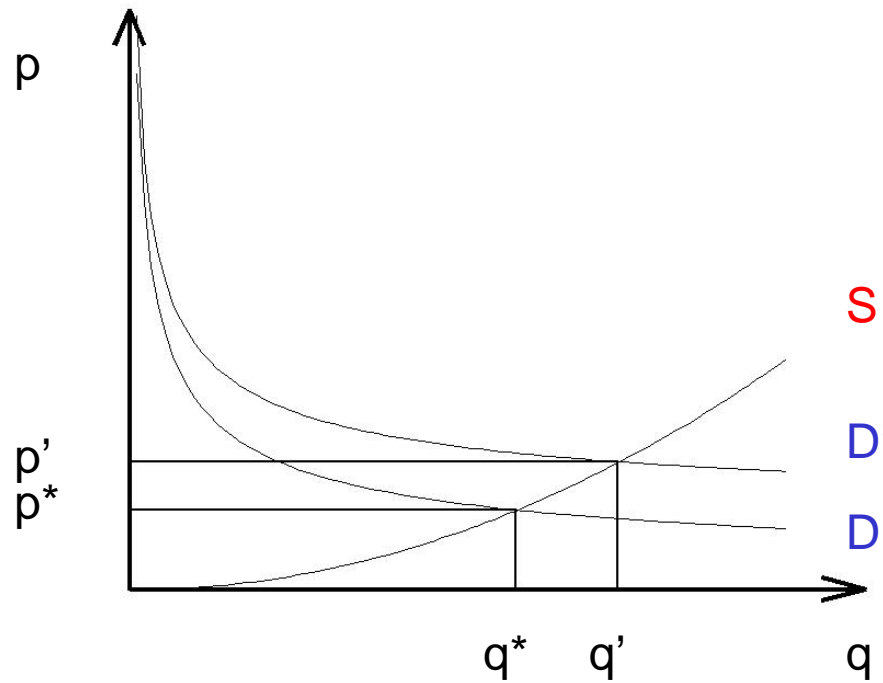
- ▶ Englin, J. and J.M. Gallaway 1993. Global Climate Change and Optimal Forest Management. *Natural Resource Modeling* 7(9): 191-202.
- ▶ Bolkesjo, T.F., E. Tromborg and B. Solberg 2006. Bioenergy from the forest sector: Economic potential and interactions with timber and forest products markets in Norway.
- ▶ Uusivuori, J. and J. Kuuluvainen. 2005. The Harvesting decisions when a standing forest with multiple age-classes has value *American Journal of Agricultural Economics* 87(1):61-76.

National wood markets and climate policy

Demand side climate and forest policy instruments



Equilibrium on Timber and Energy Wood Markets



Supply side

- ▶ Landowners maximize utility
- ▶ Supply=f(timber/wood prices, interest rate, replanting costs, thinning costs; wealth of owner, amenity preferences; forest structure, distance to energywood markets; policy parameters)
- ▶ Clearcutting and Thinning harvests
- ▶ Age-structured forests
- ▶ Logwood, pulpwood and energywood

Supply side : age-classes and timber category shares

- ▶ `timberContent(1,1,:)= [0.6, 0.4, 0.0];`
 - Timber content in the ageclass 1 [energy, pulp, log]
- ▶ `timberContent(1,2,:)= [0.0, 0.7, 0.3];`
 - Timber content in the ageclass 2 [energy, pulp, log]
- ▶ `timberContent(1,3,:)= [0.2, 0.3, 0.5];`
 - Timber content in the ageclass 3 [energy, pulp, log]

Demand side

- ▶ demand for pulpwood = $f(\text{prices of endproducts, pulpwood, labor, electricity})$
- ▶ demand for logwood = $f(\text{prices of endproducts, logwood, labor})$
- ▶ demand for energywood = $f(\text{prices of electricity and heat, energywood, substitutes, CO}_2 \text{ emission price})$

Demand side

$$q_d = Q_d p_1^{\varepsilon_1} p_2^{\varepsilon_2} p_3^{\varepsilon_3}$$

p_1 is the price of the end product

p_2 is the price of wood

p_3 is the price of a substitute

ε 's are price elasticities

Imported timber

- ▶ Pulpwood imports = $f(\text{price of pulpwood, transportation costs, export duties, stumpage in country of origin})$
- ▶ Logwood imports = $f(\text{price of logwood, transportation costs, export duties, stumpage in country of origin})$

Policy instruments

- ▶ Taxes and subsidies: supply and demand
- ▶ Investment subsidies: landowners, bioenergy
- ▶ Carbon rentals and payments
- ▶ Import/Export levies on timber
- ▶ Transportation subsidies
- ▶ Limits of Emission Trading System

Open questions:

- ▶ Stochastics
- ▶ Short-run vs. Long-run solutions
- ▶ Dynamics
- ▶ Data and Aggregation level (representative vs. stratified)
- ▶ Spatial structure

Expected Results

- ▶ Comparison of Cost-effectiveness of bioenergy subsidies and carbon rentals: climate benefits per costs
- ▶ Consumer, producer surpluses and tax collections
- ▶ Timber market impacts