Forest-based Bioeconomy Modelling Framework

Objective:
Adhering to the EU forest strategy*, our task is to provide a toolbox for assessment of policy issues and EU targets affecting the forest Sector (e.g., EUTR, LULUCF accounting rules on GHG, EU Biodiversity Strategy 2020, renewable energy, etc.)

The framework will enable assessment of

- market dynamics, e.g., the competition for wood-based resources from energy and material uses
- response analysis, i.e., estimations of the impact on forest resources: growing stock, carbon balance, biodiversity

* [http://ec.europa.eu/agriculture/forest/strategy/index_en.htm](http://ec.europa.eu/agriculture/forest/strategy/index_en.htm)
Forest Information System for Europe (FISE)*
Forest-based Bioeconomy Modelling Framework

comprises:

- an **accounting tool** for keeping track of sources & uses of woody biomass (WRB)
- an **economic** model of the (global) forest sector (GFTM)
- a **forest** resource model (EFDM)
- a forest owner **decision** model (EVA)

* http://forest-dev.jrc.it/
WRB - a balance sheet for wood

maps all sources and uses of woody biomass. Important feature: cascade uses

The Global Forest Sector Model (GFTM)

GFTM is a partial equilibrium model of the global forest sector.

- provides projections of consumption, production, and international trade of wood-based products (sawlogs, pulpwood, sawnwood, wood-based panels, pulp, paper, and wood pellets).

- GFTM will, e.g., be able to model the market implications of policies related to renewable energy, addressing questions like - what will be the consequences for the European pulp and paper industry of an increased demand for woody biomass for energy uses?

- GFTM is a stand-alone model, but also designed to interact with other models, e.g., forest resource models, assessing the market effects of, e.g., an increase in areas set-off for biodiversity and the resulting decrease in potential wood raw material supply, and providing harvesting demand to the forest resource model in return.
European Forestry Dynamics Model

**State**
Described by areas over age x volume x site x species x region x owner x.....

**Stemwood**
Assortments
- sawtimber
- pulpwood
- residues
.....

**Management**
Basic scheme that can be “shifted” to meet a demand
Characteristics

- based on NFI-data
- “non-spatial”
- country level
- matrix type — transitions between fixed states
- simple, fast, flexible
- involvement from MS
Status

- Even-aged – currently under development in 6 MS
- Non even-aged – the concept under development, to be tested in 7 MS next year.
Expected Value Asymmetries (EVA)

A tool for behavioral modeling of harvesting decisions

Forest Owners Heterogeneity

Policy Impact Analysis
Forest owner’s initial expectations concerning future demand and timber price

No policy:

- **EVA**
  - Harvest levels without any policy

Policy:

- **EVA**
  - NEW expectations concerning future demand and timber price

- **EVA**
  - Harvest levels after the policy
EVA-FOREST OWNER HETEROGENEITY

“(…) Many private forest owners do not regard their forest property as a source of continuous income, but manage it as a set aside resource for future needs. Other owners do not see any rationale for using their forests at all, because they are too small and the additional income would be relatively insignificant compared to their primary income. Other forest owners live in urban areas rather than the areas where their forests are situated and do not have the knowledge and the desire to actively utilize and manage the forests. (…) Finally, many forest owners do not want to harvest their forest at all, because they believe in nature conservation, recreation or other non-wood values of the forests (...)”

- Different typologies of forest owners are considered
- The variety of attitudes, objectives and behaviors characterizing each typology is represented by preference coefficients in forest owners’ utility function

Forest owners decide how much to harvest to maximize their utility under resource, market and economic constraints (e.g. growth rate, growing stock available, demand for wood, variance of timber prices, prices rate-change, risk free rate, long-run risk, etc.)

1 Mobilisation and efficient use of wood and wood residues for energy generation July, 2008 - Standing Forestry Committee
Inputs for the decision module:

Forest (EFDM):
- Growth rate
- Growing Stock available for harvesting

Markets (GFTM):
- Timber demand
- Variance of timber prices
- Prices rate-change

General economy:
- Risk free rate (bonds)
- Long-run risk

Preferences:
- Risk aversion
- Patience coefficient

Output: Forest owner/manager-specific harvesting level

- Urban Dweller
- Economic Man
- Elderly Couple
- Green Value
- Multi-objective Ownership
Policy impacts on forest owners/managers by modifying their expectations about the future (e.g. demand, prices), so that harvesting decisions are taken using updated expectations.

This idea can be nicely modeled using signals from economic information theory.

Signals:
- allow the policy to be perceived as “good” or “bad” in the forest owner perspective;
- allow the policy’s effects to be perceived as long lasting and/or time contingent;
- express the degree of confidence of the forest owner.
**FISE-**

Forest Bioeconomy Modelling Framework

**Exogenous: e.g., the energy model POLES**

- Energy demand for woody biomass
- Post-consumer wood
- SRC

**Wood Resource balance**

- Energy demand, net of recycled wood and SRC
- Forest ind. by-prod.
- Wood use, for pellets and material

**Economic forest sector model**

- GDP development
- Timber demand

**Response analysis**

- Growing stock, carbon balance, biodiversity,

**Forest resources:**

- EFDM

**EVA-H**

- ‘Actual’ felling, by owner type

**Exogenous sources**

- Exogenous sources
Impact of Environmental Disturbances

Erwin-Gudrun Cyclone (Denmark, Sweden, Estonia 7-9/01/2005)

The world’s largest wood stockpile (1 million m³ !)

Record Forest Damages over the past 30 years in Sweden

Excess wood supply

Growing stock, carbon balance, biodiversity,...

Growing stock available for harvesting, growth rate

Forest owners settle to wait for the prices to rise again and harvest is delayed

Lower timber prices


Thanks for your attention!