



**UNIVERSITA' CATTOLICA DEL SACRO CUORE
MILANO**

**Dottorato di Ricerca in Metodi Quantitativi per la Politica Economica
Scuola di Dottorato in Politica Economica**

Ciclo XXIII

S.S:D.: SECS-P/01; SECS-P/02; SECS-P/06.

*Modelling Land-using Activities for Climate Change
Policy: The Role of Forestry as a Mitigation Strategy*

Tesi di Dottorato di: Michetti Melania
Matricola: 3610948

Anno Accademico 2010/2011



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- Executive Summary -

Global warming has been acknowledged as one of the greatest threats that the planet is facing. Its solution calls for an unprecedented, coordinated action involving the effort of current and future generations. All sustainable climate mitigation means must be explored; developed and developing regions of the world must play their role to contain the effects, and the economic and natural systems are called to jointly contribute.

Natural forces, if preserved, might control climate change better than any organised human action or technology. Forest ecosystems, precisely designed to capture and store carbon dioxide, are to be envisaged as a cost-efficient climate mitigation option allowing to gain precious time before implementing more “capital-intensive” strategies. In such a picture any small scientific contribution in this field can be of extreme importance in supporting a decision making process in climate negotiations.

In this spirit, this work specifically aims to explore the potential role of forest practices within the European portfolio of climate abatement actions. This task is developed in three Chapters.

In the first Chapter, after framing existing modelling strategies, a following discussion highlights critical methodological aspects associated to the global and comprehensive representation of the land-use system. A special Section and Appendix 1.1 are devoted respectively to i) examine challenging aspects that must be faced when modelling forest-carbon sinks and sources and ii) depicts the role of forestry within climate negotiations. The development of this first part is intended to offer stimulus for further advancing the debate on land-use modelling strategies and to enable a better understanding of what developed in the following Chapters.

In the second Chapter a first climate policy exercise considers the case of Europe independently committed to reducing CO₂ emissions by 20% and 30% by 2020, compared with its 1990 values. The ICES computable general equilibrium model is used to assess the trade-offs among economic variables. Results for policy costs and achievements in emissions reduction are derived from a first scenario envisaging no role for forest ecosystem and a second one where forestry can actively play a part in achieving the European emissions abatement target. By means of an *off-line run*, between a partial equilibrium framework for the forest sector and a general equilibrium model, it is possible to reproduce the effects derived from including forestry in climate mitigation, without directly modelling the forest sector itself.

In a second climate policy exercise the aim of exploring the role of European forests in climate stabilization is maintained. Nevertheless, it is presented a much refined approach for modelling the forest sector and its features. The ICES model is properly modified to endogenize agents decisions on land-use allocation between agriculture and forestry. Improvements on the database and modelling frameworks allow accounting for land heterogeneity across and within regions and for land transfers between agriculture and forestry. The forest sector has been modified to track carbon mitigation potential resulting from both intensive and extensive forest margins, which have been calibrated according to results from a forest-sectoral model.

Analysing the role of forests in climate mitigation and adaptation is a complex matter. This is why economists must partake in, and are attracted to, understanding the socio-economic implications of controlling/influencing natural carbon sources and sink processes. With two alternative methodologies this thesis aims to contribute to analysing several important issues related to forest-based carbon mitigation, with the ultimate goal of exploring its role in coping with climate change.

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