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ABSTRACT BOOK

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non-skilled daily labourers. Feasible adaptation measures may be recommended with further to revive this resource dependent subsistence economy.

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Spatial and temporal variabilities of land uses as affected by global change: a focus on Mediterranean agriculture

C. Giupponi (1) ; V. Mojtahed (1)
(1) Ca' Foscari University of Venice, Venice Centre for Climate Studies, Venezia, Italy

At the global level, climate and socio-economic changes determine the patterns of the allocation and trade of resources in all markets. Top-Down computable general equilibrium (CGE) models, using only economics factors of production (capital and labour mostly) and ignoring natural resources constraints, look at the effects of global trends and generate trajectories of socio-economic indicators, such as prices of commodities in the global markets, volumes of trades, gross products per country and sectors. Those models are commonly used to analyse the evolution of global economies, under the pressure of climate change drivers, but their approach impose substantial simplifications in terms of spatial aggregation and limited consideration of temporal variabilities.

When considering adaptation of social and ecological systems to climate change, their inherent complexity and non-linearity and spatial and temporal variabilities put the usefulness of consolidated CGE approaches under question. As a consequence, other methodological approaches are explored, and in particular more and more scholars adopt a Bottom-Up approach, which utilises agent-based models (ABM). ABM's embrace a much finer spatio-temporal detail, in particular, with the ambition to analyse the behavioural diversity of agents, as a consequence of their diverse interactions with the surrounding environment and their bounded perceptions of the changing world.

This work explores the potential for integration of the two approaches, with ABM models being used to simulate land use change dynamics, with consideration of spatial (i.e. territorial) and temporal (i.e. climatic extremes and economic shocks) variabilities, driven by CGE models providing the macro-economic trends under the effects of global change scenarios.

We focus on how global change may affect land-use allocation at the regional level, under the influence of limited natural resources, land and water in particular. We specifically explore how constrains and competition for natural resources may induce non-linearities and discontinuities in agro-ecosystems behaviour.

With the purpose to develop an approach that could be implemented worldwide as a means for zooming down from the global to the regional scale, an ABM prototype was developed and run with readily available global databases in three [VM1] test areas around the Mediterranean Basin, in agricultural regions of Morocco, Italy and Spain[VM2] . Starting with extremely simplified and averaged settings; we sequentially introduce the available information about spatial and temporal variability and simulate the dynamics of water and land-use allocations and their consequences on economic performances. The coherency of the outcomes of ABM simulations with the macro trends provided by the CGE model is discussed in view of possible further developments in terms of improved integrated multi-scale simulation of global change scenarios and economic development.

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Low Emission Development Strategies in Agriculture. An Agriculture, Forestry and Other Land Uses (AFOLU) Perspective

A. Haruna, (1) ; A. De Pinto (1) ; G. Hyman (2) ; J. Tapasco (2) ; M. Li (3) ; HY. Kwon (1)
(1) International Food Policy Research Institute, Washington, DC, United States of America; (2) International Center for Tropical Agriculture, Cali, Colombia; (3) International Food Policy Research Institute, EPT, Washington, DC, United States of America

Resource use in many developing countries, from crop production to deforestation, is responsible for the bulk of greenhouse gasses (GHG) emissions. We also know that there are instances in which the agricultural and forestry sectors can provide low-cost climate change mitigation opportunities. From a technical point of view, reducing expected increases in GHG emissions in agriculture requires the adoption of transformative approaches in the use of resources. A growing body of literature analyzes the effects of alternative agricultural practices; the livestock sector has also been the target of research on mitigation opportunities and the mitigation potential of forests, soil and other biomass, has been amply analyzed as well. However, from a policy-making perspective, the design of low emission development strategies is an example of multi-objective decision making in which policies target the reduction of GHG emissions while other goals such as increasing agricultural productivity and food security or attaining objectives such as export goals or economic growth, are preserved. Furthermore, it is important to consider that all countries are part of a global economic system and it is critical that policies are devised with full recognition of the role of the international economic environment which can significantly affect the long-term viability and the budgetary implications of mitigation policies. The challenge at hand is therefore to reconcile the limited spatial resolution of macro-level economic models that operate at a subnational or national level with models that function at a higher spatial resolution, which allow to properly account for changes in carbon stocks and GHG emissions. To our knowledge there are only a few examples of analyses with similar objectives: Golub et al (2013) examined the impact on food consumption and income of implementing mitigation policies at national and regional levels. Schneider et al (2008) estimated mitigation potentials of U.S. agriculture with regionally disaggregated data and changes in welfare within the agricultural sector. Rutten et al. (2014) evaluated the effects of select climate change and economic growth scenarios on Vietnam's economy. Havlik et al. (2014) estimated the effects of transitioning to more efficient livestock production system on GHG mitigation and the economy. In this work we demonstrate that different models, all widely accessible to the public, can be brought together to help policymakers in their evaluation of trade-offs, opportunities, and repercussions of alternative mitigation policies in the agricultural sector. While the focus of this work is on Colombia, the analytical framework can be applied to any country interested in exploring country-wide effects and economic viability of climate change mitigation policies in agriculture. The approach is based on the use of public and widely accessible data and we believe that the flexibility and transparency of the approach proposed in this study can increase decision-makers' trust in the results. It appears clear from our analysis that policy-makers need substantial support in their decision-making process as the range of options they face can be very diverse and the effects of their decisions have important, and sometimes unexpected, repercussions. The effects of the policies we simulated cover the entire spectrum of potential outcomes. We find win-win policies (reducing land allocated to pasture increase revenues and carbon stock and reduces GHG emissions), policies with tradeoffs (limiting deforestation in the Amazon and a moderate increase in oil palm area increases carbon stock, decreases emissions, but reduces revenues) and policies that seem to generate clearly inferior results (substantial increasing the area allocate to oil palm cultivation reduces carbon stock, increases emissions and reduces revenues). Given the complexity of low emissions development strategies, modeling approaches, frameworks, and tools should be adaptable, open, and transparent. Modeling frameworks should be adaptable so that policy makers can explore the consequences of using different data sets and incorporate new information as it becomes available. Modeling frameworks and tools should be open to the inclusion of input from different models and transparent so that the robustness of the results can be assessed. We believe that the modeling framework proposed in this work fits these characteristics. Stakeholders, from government agencies, to producer and consumers' organizations to farmers, will benefit from policies devised with the support of solid evidence and the effects of which can be investigated and evaluated by all the parties affected.

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Implications of bioenergy production under various future land system pathways

F. Humpenoeder (1) ; A. Popp (1) ; J. Dietrich (1) ; B.