



FACCE-MACSUR

## Model integration with economist perspectives

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## Summary

Models integration and possible contrasts with up-scaling activities has received increasing attention in recent years especially with respect to the relationship between farm-economics and biophysical assessments. Current bio-economic models that analyse the trade-offs between farm income and interventions on eco-bio-environmental parameters such as maintenance of biodiversity, reduction of erosion and nitrate pollution and more, include **static models**. Agricultural systems are facing a series of threats, including climate change, land degradation, price volatility and intensification processes, which put their long-term sustainability into question. The University of Basilicata in collaboration with local representatives from various sectors of production in the Basilicata region of Southern Italy has developed an integrated study to define a model system to assess the dynamics at play in rural territories. The study tested the explanatory usefulness of resilience theory for the Basilicata agricultural social-ecological system, applying the adaptive cycle as a diagnostic tool to explore the dynamics and trajectories of change in the coupled social-ecological systems, and evaluating the performance of social, economic and social capitals, which are subject to the same dynamics. The use of dynamic analysis of the social, economic and natural capitals as the key to interpret the various phases of the adaptive cycle of the two agricultural systems proved a powerful tool in analysing the relationships between resilience and sustainable development in rural territories. The adoption of capitals and their inter-relations proved fundamental to the elaboration of adaptation strategies which were compatible with patterns of sustainability. The adaptive cycle heuristic, despite some methodological difficulties, remains useful to describe processes of change in rural socio-ecological systems. There could be enormous potential in adopting these instruments to help identify of the needs of different territories and help the framing and implementation of rural policies.

*(Summary provided by the publisher)*

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## Introduction

Models integration and possible contrasts with up-scaling activities has received increasing attention in recent years especially with respect to the relationship between farm-economics and biophysical assessments. There are a few models focussed on this topic; however, these are generally economically focussed *with the models' objective functions remaining the maximisation of returns to agricultural production*. Moreover, economic/biophysical models integration brings up an additional complexity at scale level, where the functionalization of bio-economic models on broad areas does not properly address/assess environmental issues at the farm level.

Current bio-economic models that analyse the trade-offs between farm income and interventions on eco-bio-environmental parameters such as maintenance of biodiversity, reduction of erosion and nitrate pollution and more, have been well summarized and represent a valuable source of information (<http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/129231>). In a nutshell, these include **static models** such as the Tunisian Farm Model; the Farm System Simulator Model; the FarmDESIGN model; the Model of an Integrated Dryland Agricultural System (MIDAS); the Multi-Objective Decision support tool for Agri-ecosystem Management model and **dynamic models**, including The Cebalat Model and the crop growth simulation model (CropSyst).

Beyond the theoretical approach, it is a fact that agricultural systems are facing a series of threats, including climate change, land degradation, price volatility and intensification processes, which put their long-term sustainability into question. Many areas of the world are seeing the abandonment of agricultural activities in rural areas. The phenomenon is extremely complex both in terms of the nature of driving forces, which determine the rate of abandonment of agricultural activities, and in terms of its social, economic and environmental effects. Therefore, the dynamics of the agricultural sector, and of rural territories as a whole, are closely connected to the ability of both to manifest resilience. Within the last decade, progress has been made with respect to interdisciplinary investigation and modelling of coupled social-ecological systems (SES). Resilience theory, which proposes five heuristics to describe patterns of change (adaptive cycles, resilience, panarchy, transformability, and adaptability), has been suggested as a means of capturing dynamics in complex SES and as a useful framework since it accounts for system recovery and adaptation to exposures. Resilience theory suggests that key system components, and the focal scales at which they interact, are often best identified through strategies that partner experts with stakeholders who understand the system from different scales and perspectives.

In this context, the University of Basilicata in collaboration with local representatives from various sectors of production in the Basilicata region of Southern Italy, has developed an integrated study to define a model system to assess the dynamics at play in rural territories. In 2011, the Manifesto "Let's Think Basilicata" ("*Manifesto Pensiamo Basilicata*") was released in support of the formulation of regional policies and was intended as a tool, in itself, to promote initiatives aimed towards local and rural development. The study tested the explanatory usefulness of resilience theory for the Basilicata agricultural social-ecological system, applying the adaptive cycle as a diagnostic tool to explore the dynamics and trajectories of change in the SES, and evaluating the performance of social, economic and social capitals, which are subject to the same dynamics. The aim of the work was firstly, to test the effectiveness of the heuristic model of adaptive cycles in the diagnosis of the regional context and, secondly, to test the usefulness of this heuristic in fostering social learning and better defining policies and actions that meet local needs.

### **Main outcomes of this study opened promising avenues to profitably integrate farm-economics and biophysical models**

Overall, the analysis of the conception and development of the Manifesto “Let’s Think Basilicata” confirmed the potential of resilience thinking and the adaptive cycle heuristic, in particular, to constitute a framework capable of recognising dynamics and reciprocal relationships at play throughout time and space. This feature is seen to a greater extent in a participatory and inclusive dimension. The active involvement of stakeholders in the identification of the different phases of the adaptive cycle provided an opportunity for knowledge that can reasonably be considered as real social learning.

The use of dynamic analysis of the social, economic and natural capitals as the key to interpret the various phases of the adaptive cycle of the two agricultural systems proved a powerful tool in analysing the relationships between resilience and sustainable development in rural territories. Resilience, in fact, could coexist with unsustainable patterns of rural development. The adherence to the paradigm of modernisation came at the sacrifice of local values, accumulated knowledge, practices, traditions, production methods and cultural ways of life of rural communities, in particular those communities made up of agricultural family units. At the same time, the adoption of capitals and their inter-relations proved fundamental to the elaboration of adaptation strategies which were compatible with patterns of sustainability.

The adaptive cycle heuristic, despite some methodological difficulties, remains useful to describe processes of change in rural socio-ecological systems. There could be enormous potential in adopting these instruments to help identify the needs of different territories and help the framing and implementation of rural policies. Future research is needed in terms of development, both operationally and in strictly scientific terms, into these instruments through ongoing and ex-post assessments of actions adopted by the SES. Lines of research concerned with the assessment of the impact of policy instruments on the resilience of social-ecological systems are still in their infancy and will require further studies to investigate both the methodological and theoretical dimension.

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### **References**

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