Modeling the effect of spatial policies on ecosystem services and human wellbeing

D. Geneletti (1,2)

(1) Department of Civil and Environmental Engineering, University of Trento, Italy (davide.geneletti@ing.unitn.it), (2) Sustainability Science Program, Harvard University, Cambridge, USA

Land use conversions rank among the most significant drivers of change in ecosystem services worldwide, affecting human wellbeing and threatening the survival of other species. Hence, predicting the effects of land use decisions on ecosystem services has emerged as a crucial need in land management. Research addressing the link between land use changes and ecosystem services has grown significantly in the last few years, even though it has rarely addressed the tools that most countries use to regulate the development of land: spatial plans. Spatial plans aim at implementing an overall strategy through regulations ("spatial policies") concerning the physical organization of land.

The paper presents a methodology aimed at empirically exploring how the implementation of different spatial policies can affect a set of ecosystem services in the future (water purification, soil conservation, habitat for species, carbon sequestration and timber production). Particularly, the study addressed the following three research questions:

Q1: What are the effects of different spatial policies on the production of services through time?

Q2: How changes in the production affect the actual benefits, hence human wellbeing?

Q3: What are the tradeoffs between different ecosystem services and wellbeing constituents, and how are they affected by the spatial scale of analysis?

The methodology is based on the generation of land use scenarios that simulate the implementation of different spatial policies through time. For each scenario, the production of key ecosystem services (e.g., water filtration, soil retention) is modeled and compared (Q1). The effects on the constituents of wellbeing (adequate livelihoods, health, etc) are then assessed by looking at spatially-resolved socioeconomic variables that estimate the appropriation of services by different groups of beneficiaries (Q2). Finally, the geographical and temporal patterns of tradeoffs are studied by disaggregating the results at different levels (from regional to sub-municipal) (Q3).

The study area is represented by The Araucanía (southern Chile), a region rich in natural resources, but affected by widespread poverty. Conclusions on the potential contribution of the approach to support spatial planning processes are provided.