OPTIMAL MANAGEMENT OF ENVIRONMENTAL AND RESOURCE STOCKS IN SPACE AND TIME

Abstract

Environmental and resource stocks evolve in time through accumulation of flows (natural flows, emissions, biological growth, harvesting) and spatial transportation processes. The stocks and the associate flows are associated with use (e.g. provisioning) and non-use (e.g. existence) values. The stocks are characterized by generalized heterogeneity associated with their location in space or specific characteristics such as species variety in an ecosystem or cohorts of a biological resource.

Stock externalities emerge in the management of stocks (pollutants, greenhouse gases and the harvesting of stocks of open access or common pool resources) when decisions taken by several decision makers (DMs), such as countries (in the case of GHG accumulation), firms, farmers, or fishers. Often DMs do not consider the impact of their actions on the objective (utility, profit, cost) of other decision makers, or the effects on natural resources. This generates strategic interactions, which may lead to outcomes which are inferior to the social optimum.

The research team of the University of Bologna (UNIBO) aims at developing a comprehensive model which can capture the many-faceted problem of managing environmental and resource stocks in space and time. In particular, the main research questions will focus on the following objectives:

1. Study management of environmental and resource stocks using optimal control (social optimum) or differential games (non-cooperative solutions Nash or Stackelberg) in the context of spatio-temporal stock evolution and spatial network in patchy environments. Derive policy rules that can implement the social optimum.
2. Explore biodiversity management and preservation of biodiversity and its useful services in the extended spatio-temporal domain, link it with area-number-of-species relations, and derive policy rules. Investigate the determinants of the policy to preserve multiple species and analyze possible actions by a regulator, or an ecosystem planner, to promote biodiversity preservation.
3. Study the impact of ambiguity and ambiguity aversion on optimal management.

Activity Plan

The AR is expected to actively participate in the development of the theoretical model and the numerical solutions, calibrations, or estimations. The AR is expected to be able to work with quantitative oriented software, such as Matlab, or Mathematica, R, or STATA.

During the first three months the AR will overview the relevant literature. In the next 6 months the AR will develop the core model working in close collaboration with the UNIBO research team. In the last three months the AR is expected to refine the research output and prepare a paper to be presented in workshops and international conferences in environmental and resource economics and finally submit the paper to a well reputed journal in the discipline.