

A common property resource dynamic game with stock dependent utilities and asymmetric players

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Abstract

A common property resource game with stock dependent utilities and two asymmetric players is studied. Utilities of agents are derived from consumptive and non-consumptive ecosystem services. Agent i harvests an amount H_{it} at period t of a common property resource, and derives utility also through a non-consumptive ecosystem service provided by the existing stock S_t . Hence, the utility function of player i at period t is of the form $U_i(S_t, H_{it})$. In particular, for a given stock size, we assume that the dependence on harvesting of the one-period utility function of both players is of logarithmic type. In addition, players discount the future by using different discount factors δ_i . The stock dynamics is given by $S_{t+1} = (S_t - H_{1t} - H_{2t})^\alpha$, for $\alpha \in (0, 1)$. For two different specifications of the utility functions, we compare the results of different time-consistent solutions in terms of efficiency and profitability, and the evolution of the resource stock. In particular, in a noncooperative setting, we compute Markov-perfect Nash strategies. For the cooperative case, we consider two different frameworks. We compare the results obtained when using time-consistent cooperative equilibria, first, and recursive Nash bargaining solutions, later on. Finally, results are extended to the case of an arbitrary number of players, and some numerical examples are presented.

Keywords: Common property resources, asymmetric players, stock dependent utilities, time-consistent cooperative equilibria, recursive bargaining solutions

References

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