

Title: **The Paradox of Private Efficiency and Social Inefficiency with Common Resources: Efficiency and Technical Change in Renewable Resource Economics**

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Abstract: This paper contributes to the literature on economic efficiency, technical change, bioeconomic modeling, and renewable resource economics in general by introducing output-oriented Debreu-Farrell technical inefficiency and technical progress into normative static and dynamic bioeconomic models of a fishery and examines the economic and policy ramifications for the open-access Nash and sole-owner Pareto optimums. We consider output augmenting, exogenous and disembodied technical progress that directly affects the production technology, such as the adoption of electronics and subsequent learning by doing that facilitate the finding of fish. We examine a modified Golden Rule or fundamental equation of renewable resource economics. Introduction of technical inefficiency and technical progress into the static model allows for any number of steady-state equilibrium levels of fishing effort, resource stock, and yield for both the open access and sole owner optimums, each equilibrium conditional upon the state of technology and technical inefficiency. Introducing technical change and technical inefficiency into a dynamic model creates a modified Golden Rule in which there is no longer a steady-state equilibrium. Instead, the optimal level of the stock declines over time, because the unit profit increases due to technical progress. In contrast, in the absence of technical progress the standard Golden Rule shows that cost savings from a larger resource stock favor a larger stock that then remains stationary. Finally the paper discusses the policy implications.