Optimal control methods for conservation biology: a case of non-harvesting utility[1]

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The main purpose of this paper is to retrace the evolution of mathematical models focused on relation and interaction between economic growth, sustainable development and natural environment conservation. The starting point is a simple model of common-property harvesting, where renewable resource grows according to the course of nature. Further, this model is amended with defensive expenditures that favor the species growth. Apart from solely harvesting models, a transition model comprising both harvesting and non-harvesting values of wild biological species is presented. Preponderantly, all these models are designed to seek for long-term optimal and/or sustainable strategies for harvesting, where species preservation guarantees the profit stability for future generations and thus contributes to the economic development.

On the other hand, there is a group of purely non-harvesting models where anthropic activities and economic growth may have positive or negative impact on the natural evolution of wild species. Several scholars have proved that optimal strategies that are relatively good for harvesting purposes are not merely transferrable to the context of conservation of wildlife biological species with no harvesting value. However, existence of long-term conservation policies for all biological species (with or without harvesting value) cannot be guaranteed without having relatively large species populations at initial time. Therefore, all such strategies are incapable to enhance scarce population of endangered species and save them from eventual (local) extinction.

As an alternative, policy makers are compelled to design and implement short-term defensive actions aimed at enhancement of wildlife species populations. The latter is referred to as an emergent area of research in conservation biology.

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