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Spatial-temporal aspects of cost-benefit analysis for park management: An example from Khao Yai National Park, Thailand

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Abstract

Using a model calibrated to Khao Yai National Park in Thailand, this paper highlights the importance of generating explicitly spatial and temporal data for developing management plans for tropical protected forests. Spatial and temporal cost-benefit analysis should account for the interactions between different land uses – such as the benefits of contiguous areas of preserved land and edge effects – and the realities of villagers living near forests who rely on extracted resources. By taking a temporal perspective, this paper provides a rare empirical assessment of the importance of quasi-option values when determining optimal management plans.

JEL classification: Q01; Q23; Q24; Q20

Keywords: Cost-benefit analysis; Spatial-temporal modeling; Tropical forest; Parks; Thailand; Quasi-option value; Protected areas; Non-timber forest products

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Introduction

Resource managers in tropical poor countries create and manage forest parks within a complex setting of ecological characteristics, local people's needs, competing land uses, and divergence between who bears costs and who captures benefits. Spatial challenges arise because positive and negative externalities across adjacent areas of land in different uses may influence both the benefits themselves – such as creating minimum habitat size – and the incidence of costs and benefits – such as whether park neighbors bear significant opportunity costs (Albers, 1996; Ferraro, 2002). Social and institutional challenges arise because of the complex policy and property rights setting in such countries and because park benefits accrue to a wide range of people, from neighboring villagers collecting vegetables to the distant populations that enjoy tropical parks' contributions to global climate control (Albers and Ferraro, 2006). Resource managers also face intertemporal challenges because the future benefits from these parks are often highly uncertain, and some changes in forest use are irreversible or reversible at a cost (Albers et al., 1996). Yet, although developing countries increasingly dedicate land to parks, few managers take these complex interactions into account in their park siting and management plans due, in part, to restrictive mandates, inflexible plans, and data/information limitations (Repetto, 1988; West and Brechin, 1991; Ghimire, 1994; Albers and Grinspoon, 1997).

This paper combines the modeling structure of Albers (1996) – which presents a model for tropical forest management and explores the interactions of spatial and temporal characteristics through stylized parameter values – with information and data from Khao Yai National Park (KYNP), Thailand to explore issues about park management decisions, incentives facing local people, and the need for spatial-temporal data. As is true for all tropical parks, sufficiently detailed spatial-temporal data do not exist to undertake a complete case study. But that problem is part of this paper's point; we make a case for the importance of generating spatial and temporal data for tropical forest management by grounding the analysis and discussion in an empirically-relevant range of values and parameters. The results from the calibrated simulation model demonstrate how forest managers and other stakeholders would manage the forested area differently depending on which spatial, temporal, and equity considerations they take into account. This paper demonstrates the usefulness of cost-benefit analyses to park management decisions, in addition to providing justification of a park as whole, when interactions between areas of different land use, the distributional impact of land use management zones, and temporal changes in values are accounted for. The paper also explores how cost-benefit analyses that identify the incidence of costs and benefits, rather than simply estimating a forest's total value, better equip park managers to address spatial issues and improve conflict resolution.

The following section provides background information about the spatial, temporal, institutional, and social aspects of tropical forest park management. The next section describes and solves a spatial-temporal optimization model for park management using KYNP as an example. Much of this section discusses dividing the