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## A microeconomic analysis of household extraction of forest biomass goods in Ranthambhore National Park, India

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### Abstract

In a developing country such as India, the extraction of forest biomass by village households is a key management concern. A microeconomic model of the decisions regarding levels and sources of extraction of forest biomass is developed. Biomass extraction behaviour in a sample of 227 households living in, and close to, Ranthambhore National Park, India, is empirically examined. An empirical measure of spatial aspects of extraction is investigated. Village location, ownership of biogas, and caste are found to be key explanatory variables of forest biomass extraction.

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### Introduction

The objective of this paper was to study biomass (grazing, fuelwood and fodder) extraction from the Ranthambhore National Park. The biomass extraction from the park by a household is a product of (1) the total *level* of biomass extracted from all sources and (2) the *share* of biomass extracted from the park. The extraction of

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biomass is a key issue in the management of protected areas in developing countries. Protected area management often aims to reduce the share of biomass extracted from the park by restrictions on entry, monitoring, and in some cases, resettlement. Programmes such as encouraging the use of alternative fuels aim to reduce the level of extraction of biomass.

In a paper published in 1993, Amacher, Hyde and Joshee stated that there was a dearth of rigorous economic analyses in this area. However, about a decade later, Pattanayak et al. (2004) reported that there was a small but growing empirical economic literature on fuelwood. According to Hyde and Kohlin (2000), ‘the primary contention arising from this literature is that households follow systematic patterns of economic behaviour in their consumption and production of forest resources, and that policy interventions in social forestry should be analysed with regard to markets, policies and institutions.’

This literature has most commonly consisted of studies of fuelwood (Pattanayak et al., 2004), although Chopra and Dasgupta (2003), Bluffstone (1995), and Cooke (1998) also study NTFPs and the collection of fodder. In this paper, decisions regarding fuelwood, fodder and grazing are studied. All three are important not only in Ranthambhore, but in forests in developing countries in general.

The papers by Bluffstone (1995) and Bardhan et al. (2001) are written in contexts where the household extracts only from the forest. More commonly though, the household can extract wood from its own private land, village common land and even, in some cases, a protected area. Pattanayak et al. (2004) and Heltberg et al. (2000) distinguish between fuelwood from forests and private farmland. Managers of conservation areas increasingly express the need for a relatively undisturbed core area and buffer area, as a means of fulfilling ecological objectives along with providing surrounding human populations access to non-timber forest products. What influences spatial extraction patterns is a key question in protected area management (Robinson et al., 2002). Bluffstone (1995) found that the presence of an off-farm labour market helped stabilize forest stocks in Nepal. Robinson et al. (2002) demonstrate that variation in the opportunity costs of labour among villagers results in a spatial heterogeneity in aggregate extraction. A contribution of this paper is the examination of a quantitative measure of spatial extraction: of total biomass extraction by the household, what percentage comes from the park?

Amacher et al. (1993) pointed out that there could be a complementarity between agricultural labour and fuelwood, which is incorporated in the conceptual model in this paper. In addition, this paper allows for complementarity between grazing and fuelwood collection – villagers grazing livestock can also pick up fuelwood – and examines this empirically. Also, in this paper, fuelwood purchase is an option for the household, not only the purchase of commercial energy as in Bluffstone’s (1995) paper.

The conceptual framework used by papers in this literature are variants of agricultural household models, which include production as well as consumption activities. The papers by Heltberg et al. (2000), Amacher et al. (1996), and Bardhan et al. (2001) have conceptual models with explicit treatment of corner solutions. In this paper we follow Heltberg et al. (2000), in deriving relevant Kuhn–Tucker

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