



Where gathering firewood matters: Proximity and forest management effects in hedonic pricing models for rural Nepal



Mani Nepal^{a,*}, Apsara Karki Nepal^b, Robert P. Berrens^c

^a South Asian Network for Development and Environmental Economics (SANDEE), PO Box 8975, EPC 1056, Lalitpur, Kathmandu, Nepal

^b International Initiative for Impact Evaluation (3ie), and International Center for Integrated Mountain Development (ICIMOD), Dhapakhel, Kathmandu, Nepal

^c Department of Economics, University of New Mexico, Albuquerque, USA

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ABSTRACT

A majority of rural, agricultural households in Nepal rely on forests for firewood and fodder. Access to the forest clearly matters, but might not be as simple as proximity if quality varies by management and property regime. Using two rounds (2003/2004 and 2010/2011) of nationally representative survey data for rural Nepal, we analyze the impacts of forest proximity and the type of management regimes on housing values. Results from hedonic pricing models indicate that relative to a housing unit that uses a private forest as its primary firewood source, the value of a similar housing unit using a government forest has a 10 percent (2010/11) to 20 percent (2003/04) lower value; the respective percentage reductions for a similar housing unit with community forest source are 7 to 10 percent. Given limited private forestlands, these results offer a measure of support for newly adopted collaborative and leasehold forest programs. In the former, government forests are collaboratively managed by local communities with the government, where revenues are shared equally. In the latter, degraded government forests are transferred to the rural poor for 40-year renewable terms so that households can conserve and use forest products privately.

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Introduction

Forests provide timber as well as non-timber products, such as, firewood, fodder, leaf and litters. These products are direct lifelines to rural communities, such as in Nepal and elsewhere, where rural households rely on access to forests for firewood to provide household energy, and leaf and litters for animals feed and beddings. More indirectly, the full suite of ecosystem services forests provide include watershed protection, soil conservation, biodiversity, and carbon sequestration. Forests can also be the source of natural amenities, providing on-site recreational use values, and even non-use values. Many of these services are not traded in a market. Thus, measuring the total economic value (TEV) that a forest provides is a complex task, requiring a mix of both market and non-market valuation approaches (Champ et al., 2003). For example, even though rural people extract forest products for their daily needs, there is no formal, explicit market for forest products in rural Nepal. However, the benefits from forest access to proximal or nearby rural residences, which represent one part of the TEV of forests, may be

capitalized into the value or price of housing units. If the quality of forest access varies by the type of forest management or property regime, then this might also affect the capitalization of forest access into rural housing values.

The hedonic pricing method (HPM) econometrically decomposes variation in the price of a heterogeneous good (e.g., a house) by variation in the characteristics of that good (Rosen, 1974; Taylor, 2003). The method is based on the assumption that individuals value the attributes of a good or the services it provides, rather than the good itself (Rosen, 1974). As such, HPM allows estimation of the marginal implicit price of a characteristic, say, proximity to a forest or wetland, which might affect the market price of a housing unit. While applications to investigate the effects of environmental characteristics on housing markets in developed countries are common, there is a dearth of hedonic pricing studies in low-income developing countries. This is mainly because of the lack of appropriate data on housing markets in these countries.

Using the hedonic pricing model (HPM), with two rounds of nationally representative, repeated cross-sectional data (2003/04 and 2010/2011) from the Nepal Living Standard Survey (NLSS), this study examines the impacts of proximity, and access to different types of forests, on residential property values for rural Nepalese households that gather firewood. The main objectives are to inves-

* Corresponding author.

E-mail address: mani.nepal@bus.illinois.edu (M. Nepal).

tigate two inter-related questions for a rural Nepalese setting: (i) do housing units become more valuable when they are closer to a forest?; and (ii) does access to different types of forest management or property regimes (where the household primarily collects firewood, etc.) affect housing values?

To date, most studies conducted in urban or semi-urban settings indicate that forest proximity and access bring positive value to residential properties (Tyrväinen and Miettinen, 2000; Thorsnes, 2002; Hand et al., 2008). However, HPM studies focusing directly on rural agro-forestry settings in low income developing countries are relatively limited. The HPM literature does not always indicate positive values for proximity to open space or undeveloped lands (Ham et al., 2012; Bin and Polasky, 2005). This analysis adds to the scant literature focusing on a low-income developing country context, and attempts to overcome the data issue by using owner-reported housing values from two rounds of a national survey.

The homeowner's response on the expected value of their house provides a unique opportunity to fill this research gap. There are inherent concerns about the reliability of self-reported housing values. However, prior research suggests that self-reported housing values can provide reasonable estimates of the market price with relatively small margins of error (Goodman and Ittner, 1992a; Kiel and Zabel, 1999; Agarwal, 2007; Gonzalez-navarro and Quintana-domeque, 2009). Thus, similar to developed country contexts that use national census products for HPM (Hand et al., 2008; Izón et al., 2010), this analysis uses self-reported housing values, from national surveys, to help evaluate the economic value of the different forest management regimes in rural Nepal.

Econometric results indicate that structural and neighborhood characteristics have expected effects on housing values. When different forest management or property regimes for accessing forest resources are ignored, then the implicit price of forest proximity (being closer to forest resources) is positive, as measured in time to collect firewood. However, proximity effects are no longer significant determinants of housing value when different forest management regimes are considered. Access to forests with different management regimes has different marginal implicit price effects on housing units, indicating that not all forests management regimes are valued equally. Access to private forests for gathering firewood and fodder always provides significantly more value than government-managed forests, across all model specifications. Access to community forests represents an intermediate case in that the housing value is lower than the case of access to private forests but higher than with access to government forests. Relative to a housing unit using a private forest as its primary firewood source, the value of a similar unit using a government forest has a 10 percent (2010/11) to 20 percent (2003/04) lower value on average; the respective percentage reductions for a similar unit with community forest source are about 7 to 10 percent.

Of particular policy relevance, these results provide support for a new government initiative in Nepal that started transferring management of some of the degraded government forests to local people as leasehold forests for a 40-year term (Sharma, 2016), and some of the still productive old growth forest to communities to be managed in collaboration with the government. More broadly, for both Nepal and other developing country contexts with agro-forestry settings, the results help demonstrate how forest access, and its interaction with forest governance, can be capitalized into housing values, a critical component of household wealth.

Background and Related Studies

Forests can be the source of both benefits and costs, which may vary greatly across different settings, for nearby housing units (Pearson et al., 2002). In a rural developed country setting, nearby

government-protected forest and wilderness access may be highly valued for recreation opportunities, especially for highly mobile nearby urban populations (Hand et al., 2008), although, when use rates are heavy, living too close may be a source of congestion or disamenities (Bin and Polasky, 2005; Ham et al., 2012). In a rural developing country setting where villagers heavily rely on agriculture for their livelihood, there can be complex interactions with forests (Le Goffe, 2000). Forests are sources of fuel for household energy and fodder for livestock. Living adjacent to a forest can pose a threat of wildlife damage to crops, and sometimes threaten human lives as well. Forests values may be reduced by natural events (e.g., wildfire or insect infestation (Price et al., 2010)) or degraded by poor management. Further, dense forests nearby agricultural land may lower productivity by preventing adequate sunlight. Critically, the type of forest ownership, and associated management, may alter off-site effects on nearby housing units.

The vast majority of rural Nepalese households earn their living or subsistence through agriculture, and use firewood for cooking and heating (Nepal et al., 2011a). Amacher et al. (Amacher et al., 1993; Amacher et al., 1999) provide early studies on the importance of fuelwood production and consumption in Nepal, where firewood collection is labor intensive, mostly done by women, and not dependent on hired labor. In a recent study, St Clair (2016) examines the intra-household labor allocation in firewood collection.

Since the late 1990s, there has been a rapid increase of out-migration of adult males from Nepal to the Gulf countries, India, Malaysia and South Korea for short-term work (Karki Nepal, 2015). Consequently, female-headed households in rural Nepal are increasing. Although many homes are still passed down through inheritance, remittances have helped create an active housing market. Given that women mostly do firewood collection, they are increasingly involved in making household decisions. Given the increasing trend of out-migration of rural people for short-term employment, the use of forest for firewood extraction might be expected to be declining. However, the successive rounds of Nepal Living Standard Surveys (1995/96, 2003/04, and 2010/11) indicate that the collection and use of firewood was increasing over those years (Nepal et al., 2011a). Amacher et al. (1999) describe the complex interdependence between agriculturally-dependent households and nearby forests.

Approximately 30 percent of the surface area of Nepal was forested in the mid-1990s. In part based on Ostrom's (Ostrom, 2012) seminal research that local communities can manage natural resources successfully under certain conditions, the Nepal Government introduced the Forest Act in 1993 and began experimenting with community ownership of forests. After a more than two-decades long effort of forest conservation applying community based-forest management, the forest area had expanded to 40 percent in 2010 (Government of Nepal, 2015).

In Nepal, forests can initially be categorized into two different primary land ownership types: national forests, and private forests.¹ National forests are those forests where land belongs to the government, and private forests are privately owned and managed (i.e., planted, nurtured or conserved by individuals on their personal land for their use following prevailing laws). National forests are further divided into government-managed forests, community forests, protected forests, leasehold forests, collaborative

¹ As noted in Nepal et al. (2007), prior to 1950, the Oligarchy *Rana* rulers considered Nepal's forests as their private property. After the 1950's democratic transition, the Forest Act of 1957 nationalized all types of forests. Given the absence of any enforcement of newly-created state property regimes, nationalized forests effectively became open access resources. Nepal experienced resulting massive deforestation (e.g., about 45 percent of land area was covered by forest until 1964, but only 29 percent by the end of 1990). The introduction of community-based forest management in 1990s helped to improve the situation.

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