Reprint of: Linking conservation and welfare: A theoretical model with application to Nepal ☆, ☆☆

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A R T I C L E   I N F O

A B S T R A C T

Theoretical articles linking conservation and welfare find a negative relationship between these two variables while empirical studies show that land protection may be positively related to welfare. Several authors attribute this empirical result to the development of ecotourism in protected areas. We thus argue that the gap between the theory and existing empirical results is partly explained by the fact that most theoretical models do not account for a productive activity on protected land. Therefore, we develop a theoretical model in which conservation allows developing an alternative sector and show that the relationship between conservation and welfare is U-shaped. We test this theoretical prediction using Nepalese data and find that conservation combined with ecotourism is indeed positively related to local welfare.

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1. Introduction

The establishment of protected areas is a widespread practice designed to curb environmental degradation. Between 1990 and 2014, the world's protected areas cover rose from 13.4 millions km^2 to 32 millions km^2 (United Nations Environment Program (UNEP), 2014). However, the approach is often criticized as limiting the expansion of agriculture and natural resource extraction, especially in poor regions where this practice is not negligible (Adams et al., 2004; Ferraro and Hanauer, 2011). Indeed, in Central and South America, more than a quarter of land territory is protected while in Asia and Africa, protected areas cover nearly 15% of the territory (Deguignet et al., 2014). Since natural resource exploitation often represents the main source of income for the poorest populations (Organisation de Coopération et de Développement Économique (OCDE), 2009), some authors maintain that goals of conservation and poverty alleviation are conflicting and thus cannot be achieved simultaneously (Sanderson and Redford, 2003; Adams et al., 2004). On the other side, empirical studies have shown that under certain conditions, the establishment of protected areas have resulted in an increase of welfare for local populations (Andam et al., 2010; Sims, 2010; Ferraro and Hanauer, 2011; Robalino and Villalobos-Fiatt, 2015). These authors argue that land protection can increase welfare if the opportunity cost of

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conservation is lower than the benefit generated by alternative uses of the land (Sims, 2010; Ferraro et al., 2011; Ferraro and Hanauer, 2011).

The main objective of this paper is to start reconciling the theoretical and empirical evidence on the link between conservation and welfare. The theoretical models developed so far are rare. Moreover, they usually exhibit a negative relationship since they assume that conservation is a constraint on the optimal use of land. Conversely, empirical studies have shown the existence of a positive relationship between land protection and welfare. Authors often suggest that this result is due to the development of ecotourism inside protected areas. Yet, in most theoretical models, protected land remains excluded from any productive activity. We argue that this partly explains the gap between theoretical and empirical results.

We develop a two-sector model: Extractive and environmental. As in Robalino (2007), conservation exogenously restrains production in the extractive sector. However, in our model, conservation allows an alternative (environmental) sector to develop. This is consistent with several authors[1] who suggest that the development of ecotourism as an alternative sector to agriculture may have contributed to increase welfare in Thailand, Costa Rica, Bolivia and Nepal's protected areas. To our knowledge, this is the first attempt to integrate in a theoretical model an alternative, income-generating sector that develops because of conservation. We examine how the optimal social welfare varies with an increase in conservation policies. We find that, when conservation is low, there is a negative relationship between conservation and welfare. Then, from a certain level of conservation, the relationship between conservation and welfare becomes positive. We argue that this is due to the trade off between the opportunity cost of conservation, generated by the extractive sector, and the conservation benefit, generated by the environmental sector. Our theoretical results are thus consistent with the empirical literature. Finally, the empirical testing conducted on Nepalese data shows results that are in line with our theoretical conclusion.

The remainder of the paper is organized as follows. In the next section, we discuss the related literature. Then, we develop the theoretical model and detail the relationship between conservation and optimal welfare. In Section 5, we examine the empirical validity of our model with Nepalese data. We finally conclude and highlight the main findings of the study.

2. Background

The few theoretical analysis on the link between conservation and welfare are typically developed from the von Thünen model's basic assumption (1926). This assumption states that land is allocated to its optimal use, which is determined by its geographic location, in particular its distance from a major city (Angelsen, 2007). Therefore, authors studying the effect of conservation on welfare, basing their analysis on this type of model, generally obtain pessimistic results since conservation policies constrain the optimal use of land. For instance, Robalino (2007) develops a two-sector model to study the effect of conservation policies on income distribution. He concludes that conservation limits agricultural expansion and lowers farmers' income and consumption. Robinson et al. (2008) and Robinson and Lokina (2011) integrate in their models temporal and spatial components that affect households decision-making. They conclude that conservation policies cause negative effects on the welfare of households located around protected areas. In both cases, authors attribute the welfare decrease to distance costs since households have no longer access to the resources located near their residence. Finally, Anthon et al. (2008) examine the effect of taxing the use of forest resources on heterogeneous agents' welfare. They conclude that the poorest households must assume the burden of the tax since their income is relatively more dependent on natural resources. Intuitively and as pointed out by Sims (2010), should it be assumed that a protected area limits the use of the land without generating other local-level benefit, diminishing marginal returns will lead to a decrease in total rent. Moreover, workers will have to relocate to other sectors. Labor supply will increase, which will in turn result in a real wage decrease. Therefore, the main intuition is that conservation policies will reduce local economic welfare by limiting land use choices.

However, the empirical literature on the relationship between conservation and welfare is more mitigated. Lewis et al. (2002), Lewis et al. (2003) as well as Duffy-Deno (1998) find no significant effect of land conservation on employment and wage growth rates in the United States. Badyopadhyay and Tembo (2010) rather show that the establishment of protected areas in Zambia had some positive impacts on certain households' income located around the areas, but that it also increased income inequalities. Conversely, other authors conclude in recent studies that protected areas can improve significantly the situation of the poor. Andam et al. (2010), Sims (2010), Ferraro and Hanauer (2011), Ferraro et al. (2011), Canavire-Bacarreza and Hanauer (2013) and Robalino and Villalobos-Fiatt (2015) find that protected areas in Thailand, Costa Rica and Bolivia have contributed to economic development. Moreover, when controlling for certain geographic and socio-demographic variables, they find that the positive effect is more important in localities where the poverty rates are higher.[2] According to them, the opportunity cost of conservation is lower since these localities are often characterized by a low agricultural potential. The authors also suggest that ecotourism development within these areas might have generated an income that was sufficient to compensate the loss caused by land use restrictions. Besides, Yergeau (2015) shows that the positive relationship between protected areas and welfare in Nepal tends to get stronger in areas where ecotourism

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[1] Including Andam et al. (2010), Sims (2010), Ferraro and Hanauer (2011), Ferraro et al. (2011), Canavire-Bacarreza and Hanauer (2013), Ferraro and Hanauer (2014), Robalino and Villalobos-Fiatt (2015) and Yergeau (2015).

[2] Except for Canavire-Bacarreza and Hanauer (2013) who find that not adding controls over-estimates the effect of conservation on poverty reduction.