



Analysis

Linking common property resource management to human capital outcomes

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ABSTRACT

In regions where common pool resources provide significant support to their surrounding communities, any climate change related shock could produce multiple livelihood repercussions. In this paper, a model explores how the health of common pool resources could impact upon human capital outcomes for communities that struggle to find alternate livelihood options when traditional means such as agriculture become unsustainable. The management of common pool resources is modeled as a strategic interaction process between two heterogeneous communities that are directly or indirectly dependent upon it. An unconstrained harvesting of common resources such as forestry not only depletes its stocks, but it also indirectly affects crop output through soil degradation. A number of situations are constructed where communities are able to successfully finance human capital accumulation through proper management of their common pool resources. However, results also warn that communities that are faced with limited opportunities towards accumulating human capital must plan ahead to prevent the depletion of their common resources below critical levels. When non-linear feedbacks to soil degradation emanate from low levels of common pool stocks, human capital outcomes as well as future livelihoods of such communities are threatened.

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1. Introduction

Common pool resources (CPRs) face the ‘tragedy of the commons’ problem (Hardin, 1968). When adequately maintained, however, they could provide additional support towards rural livelihoods. Marginal farmers and landless labor types are most directly affected by the depletion of CPRs as CPR based income comprises a higher proportion of their consumption. Then, there are agricultural farmers who may not need to rely directly on the CPRs but still benefit indirectly through the ecological services provided by CPRs. Dense forests can protect against soil erosion during heavy rainfall and flooding. Forests may also provide fodder to support farmers’ livestock, where livestock is often used as a hedging strategy to cope with prolonged droughts.

In the absence of property rights, social norms may endogenously evolve over how much CPRs to exploit and over the optimal maintenance of their stock, as has been argued in the literature (for instance, see Ostrom, 1990; Sethi and Somanathan, 1996). Ostrom (1996) lays out a number of circumstances where such social norms could evolve for the betterment of forestry resources. Some of these conditions relate to low discount rates of users, higher importance of forests to their survival, common interests, etc. Social norms may evolve to punish the harvesters or alternatively, those who do not contribute towards enforcing

norms could themselves be punished (see Sethi and Somanathan, 2006 for a model incorporating the latter). The type of social norms that may evolve towards the management of CPRs such as forests also depends upon the level of heterogeneity amongst communities that are dependent upon it. For instance, Kant (2000) points out that landed households with ruminants would depend upon the forests to sustain their livestock as well as to provide agricultural inputs such as composts, whereas landless and poor communities would be more concerned with direct consumption of forest resources for their survival (also see Poteete and Ostrom, 2004).

In some societies government may step in to enforce harvesting rules. For instance, Copeland and Scott Taylor (2004) describe three types of CPR economies — namely ‘Hardin’, ‘Ostrom’ and ‘Clark’. This classification ranks communities on their ability to sustainably manage their common pool resources as a function of the price at which such resources are traded. Specifically, Hardin economies do not exhibit any control over their resources even if the price of such resources becomes very high, whereas Clark economies are very responsive to price changes in terms of their ability to manage resources efficiently (Copeland and Scott Taylor, 2004). Bray et al. (2006) provide examples from Mexico, where democratization of the forestry sector in the late 20th century led to the emergence of community forest economies (CFEs) which were conducive towards the generation of social and natural capitals in such environments. While, De Blas et al. (2011) provide an example of significant internal and external conflicts in Cameroonian community forests that have led to less than desired outcomes.

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Very often, the interests of those who directly benefit from CPRs are found to be at loggerheads with those who indirectly depend upon such resources. For instance, landed farmers stand to lose from soil erosion caused by uncontrolled flooding, the effect of which can be mitigated through maintaining a dense forestry. Whereas, when faced with prolonged droughts and reduction in employment opportunities, landless wage earners tend to intensify their reliance on CPRs as their immediate survival is at stake. In this particular context, an optimal arrangement would be where the landed farmers participate in planting additional trees, whereas the landless are required to reduce grazing intensity of their small ruminants and reduce reliance on forest products for sustenance. However, differences in goals between different user groups often lead to conflicts and inequitable outcomes under such circumstances. Adhikari et al. (2004) provide evidence from common forestry in Nepal pointing to the fact that poorer households have reduced access to forestry products whereas well-off households are able to appropriate a larger share of the same. Pradhan and Patra (2013) also find evidence relating to higher difficulties encountered in joint forestry management when communities differ in their socio-economic conditions.

Climate change could add to the mix of the above challenges by reducing forest cover and changing the composition of species within. The economic consequences of such changes have been estimated to be immense globally (see Hanewinkel et al., 2013; Thuoller et al., 2011). Climate change could lead to forest dieback, which will not only provide feedback carbon emissions to the atmosphere, but also change the nature of the soils (Peterman and Bachelet, 2012). The impact of climate change on forests in Asia has been particularly predicted to be high (Somaratne and Dhanapala, 1996; Zhao et al., 2005). Forest degradation in the Asia Pacific region has already contributed to low soil quality thereby reducing its ability to provide high quality or quantity crop yields (FAO, 1999). Furthermore, by reducing the carrying capacity of the CPRs, climate change will exacerbate the existing conflicts over CPR usage norms. Climate change would also reduce agricultural output and hence the demand for landless labor, thereby resulting in intensification of their reliance upon the CPRs.

In this paper, we explore another aspect of CPR management challenges, which has not been touched upon in the literature thus far. This concerns exploring the linkages between human capital and CPR stocks and how the maintenance or depletion of the latter could affect future human capital outcomes in small scale societies. The key question that is being posed in this paper is how those rural economies, which are struggling to transition out of sustenance based livelihoods through investment in human capital, will be affected by climate change related shocks to the CPRs? Further, how do social norms evolve under climate change related stress and what are the conditions under which such successful transitions may not materialize? These questions are addressed in the context of common pool resources in Asian economies.

Following Becker's seminal work on human capital (see Becker, 1964), a vast body of literature has emerged linking human capital outcomes to growth at national levels as well as associating it with differences in wages and national incomes of various countries. Human capital in the context of rural areas has been studied by Huffman (2001) and Taylor and Martin (2001). The roles of different types of institutions in different societies have also been explored recently by Acemoglu and Dell (2010) with respect to their impact on making schooling accessible and cheaper. However, how human capital outcomes are affected amongst CPR based communities, especially when climate change threatens the sustainability of such CPRs, is a question that has remained unexplored thus far.

In order to take up and address these important questions, a dynamic optimization model is developed that links crop output to the health of the CPRs. One community (the landed farmers) invests in human capital augmentation of their children and hence needs to have profitable agriculture to finance such human capital investments. The other community (the landless group) directly relies upon the CPR for their

sustenance. Both crop output and the CPRs are faced with the risk of climate change related shocks materializing in the future. Social norms endogenously evolve within this heterogeneous community over management of the CPR, as CPR depletion can indirectly and adversely affect crop output.

The literature addressing the evolution of social norms and capital supports this endogeneity assumption. For instance, Krishna (1994) provides an example from South India where social norms and social capital endogenously evolve with increasing resource scarcity. Water supply uncertainty promotes better water management through formation of collectives (that self-impose sustainable water use practices) whereas regions with relatively less water scarcity see no such endogenous institutional formations (Krishna, 1994). Group size also affects the successful enforcement of rules for governing CPRs, as smaller groups are found to be more effective towards harnessing collective action compared to larger groups. In smaller groups, the tendency to free ride is absent, whereas in the case of larger groups, collective action can be enforced only through punishments and coercion (Olson, 1965). In the context of joint forestry management, Ostrom (1996) argues that group heterogeneity can lead to differences in interests of the users and therefore agreeing upon and enforcing a common set of rules can be difficult and costly.

The next section provides the model outline. A formal dynamic optimization model is presented following the model outline. Results are derived through a numerical example. The paper concludes by discussing some of the insights that emerge through the modeling of the complex inter-linkages between climate change related threats to the sustainability of CPRs as well as the livelihoods and human capital outcomes of the communities that are directly and indirectly dependent upon it.

2. Model Outline

The model presented in this paper draws from cases of several farming districts in South India (in particular from Anantapur, see Conroy, 2001 for a background) where farming and forestry based communities have co-existed historically and were well supported by the surrounding common pool forestry resources. However, over time, as repeated droughts have made water scarce, it has affected the crop outputs of the landed communities. This has also adversely affected the demand for casual labor that was earlier supplied by the landless communities. When faced with reduced employment opportunities, the landless communities have increased their reliance upon common pool resources for sustenance thereby leading to its rapid depletion. This in turn has led to rapid soil erosion (from uncontrolled runoffs) and set off further feedback effects through significantly reducing crop outputs and demand for casual labor. This necessitated the need for stricter forestry management in order to prevent further soil erosion and improve the livelihood of the communities. There are examples from elsewhere of similar problems arising due to excessive forest degradation. Forestry is mostly relied upon by rural households for fuel wood consumption and livestock grazing in Kenya (Muchena et al., 2005). This has led to unsustainable rates of deforestation. In general, as result of deforestation, the rate of soil degradation in developing countries of Central America, Asia and Africa has been very high (Scherr, 1999).

In this section, we develop a modeling framework that incorporates some of the key challenges faced by two heterogeneous communities relying upon a CPR. Consider that there are two types of farmers, the landed and the landless categories. Additionally, assume that there are only two farmers, each representing their respective communities. The landed farmer grows a composite crop and the derived income is used to finance consumption and educational expenses of their children. The landless farmer relies upon the CPR for their livelihood sustenance such as through collecting fuel wood and grazing of small ruminants in the common lands.

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