Environmental Security and Labor Migration in Nepal

Sundar S. Shrestha[1] and Prem B. Bhandari[2]

Paper for presentation at the IUSSP's XXV International Population Conference, Tours, France,

July 18-23, 2005.

Abstract. *Drawing upon the new economics of migration, this paper empirically examines if changes in environmental security resulting from declining access to forest resources such as firewood shape labor migration in Nepal. The results from multinomial logistic regression models using the micro-level data from the Chitwan Valley of Nepal showed that, net of other factors, a decrease in access to forest resources increased the likelihood of migration of individual(s) for work regardless of destination, domestic or international. Results provide evidence that environmental insecurity leads to labor migration in an agrarian society where household production and consumption activities are intimately dependent on environmental resources. The research findings also suggest that labor requirements for household maintenance also play a role in household migration decision.*

Keywords: firewood collection, environmental degradation, access to forest, household maintenance, migration

[1] Graduate Student, the Pennsylvania State University, Department of Agricultural Economics and Rural Sociology, 308 Armsby Building, University Park, 16802,PA, USA, sss190@psu.edu

[2] Graduate Student, the Pennsylvania State University, Department of Agricultural Economics and Rural Sociology, 307 Armsby Building, University Park, 16802,PA, USA, pbb115@psu.edu

Environmental Security and Labor Migration in Nepal

Sundar S. Shrestha and Prem B. Bhandari

Introduction

Issues of environmental sustainability and poverty alleviation have been important policy concerns worldwide, particularly after the 1987 Brundtland Commission on Environmental and Development and the Millennium Summit 2000 (United Nations Country Team of Nepal 2002; Brundtland 1987; www.developmentgoals.org). Such a concern has an important standing in developing countries where the livelihood of most people is dependent on environmental resources such as forest products (Bluffston 1995; Shrestha 1997; Heady 2000). For instance, in Nepal, about two-thirds of households rely on firewood for cooking and heating, and an average household spends about 50 person-days for firewood collection in a year (Baland et al. 2004). In this context, it is plausible to think that any shock to the environment such as deforestation makes rural households environmentally and economically vulnerable in securing their livelihood. Additionally, the lack of alternative income prospects and other energy sources at the local level further aggravate the problem. The policy concerns over the degradation of forest resources are also due to externalities that extend beyond the national boundary (Mertz 1991; Myers 1986).

A large body of literature has examined causes of deforestation and linked their impacts on population (Filmer and Pretchet 2002; Loughran and Pritchett 1997; Nerlove 1991; Dasgupta and Maler 1997; Biddlecom et al. 2005; Agrawal et al. 2001), poverty (Baland et al. 2004; Bardhan et al. 2002; Lopez 1998), property rights and collective actions (Ostrom 1990; Jodha 1997). Similarly, some researchers have emphasized the need for a micro-level examination of the link between population and environment (for example, Marquette and Billsborrow, 1997). However, empirically little is known about the way in which households deal with environmental insecurity resulting from forest degradation. We believe that understanding the coping strategies to environmental insecurity by households is vital in addressing the environmental and poverty issues. Migration is regarded as one of the coping strategies among poorer households to maintain their livelihood (Gill 2003). It is often, however, a matter of debate and an empirical question whether environment degradation causes migration or the other way a round. While some researchers argue that environmental pressure

leads to human migration (for example, Kalipeni 1996); others believe that migration leads to environmental degradation (Bilsborrow 1992; Bilsborrow and Geores 1994; Bilsborrow 2002). Similarly, others argue that the link between migration and environment can operate both ways (Hugo 1996; Goria 1997).

In this study, we focused on only one aspect of the debate--whether changes in environmental security resulting from the access to forest resources shape migration decisions of agrarian households in Nepal exclusively for work (we called it labor migration). We examined two research questions: i) to what extent a change in time to collect firewood from forest/common land influences a household's labor migration decision? and ii) does the change in time to collect firewood affect the choice of migration destination- within Nepal or abroad?

Concept of Environmental Security

The notion of environmental security is context specific. In developing countries like Nepal, environmental security has more to do with a household's ability to meet the demand for environmental resources in production and consumption activities. In this study, environmental security is conceived as an opposite of environmental degradation such as deforestation. The measurement of deforestration is complex at least at the micro-level. The access to forest resources, measured in terms of time to collect firewood, is commonly used as an indicator of environmental degradation (Baland et al. 2004; Filmer and Pritchett 2001; Kumar and Hotchkiss 1988; Biddlecom et al. 2005). The premise of using this measure is that the degradation of forest resources leads to a decline in access to those resources, thus demanding more time to collect the same bundle of firewood. The time to collect firewood in entirety as a measure of environmental degradation may be misleading. Because time to collect a bundle of firewood is subject to the location of a household relative to forest/common land. This suggests a need of adjusting the distance of households to forest. Another issue regarding the use of time to collect could be associated with households' response behavior. Households' migration decisions in response to environmental shocks may not be instantaneous, but may require some adjustment period. Therefore, as the data allows, change in time to collect firewood from forest/common land between two points in time, 1996 and three years ago is sensible indicator of environmental security. One obvious question that arises is: do households that experience same level of change in firewood collection time perceive environmental risk to the same

extent? It may not because the time to collect firewood at the base year may be quite different among households, so it needs to be adjusted.

Link between Environmental Security and Migration

Various approaches and theories have been developed to explain the causes and consequences of migration in both internal and international context. According to the neoclassical economic model, migration is driven by the existence of labor surplus rural economy and labor deficit urban economy. The disequilibrium in labor supply and demand between the places and the resulting differential wages is the driving force of migration (Todaro 1969; 1994). The proponents of the new economics model of migration criticize the neoclassical economic model of migration being western-biased and not taking into account cultural differences in societies (Boyle et al. 1998). Boyle et al. (1998) argue that the combination of social, economic, and environmental factors encourage migration. Moreover, the existences of informal economies in developing countries, which are not accounted for in official statistics, mislead the neoclassical model of wage differences. The new economics of labor migration focuses not only on income maximization strategies of migrants but also on risk minimizing strategies (Skeldon 1997; Massey et al. 1998; Stark and Bloom 1985). This approach conceives that migrants' social and economic networks contribute to the greatest extent to migration decisions. Moreover, unlike the neoclassical economic model, which looks at an individual level, this model considers that migration is more of a family decision where in families exploit a wide range of opportunities spread across various destinations. Massey et al. (1998) noted that individuals may spread their labor over a period via seasonal migration. But such a strategy is costly in the case of international migration due to the involvement of heavy transaction costs. However, households can minimize risk by diversifying the household resources such as labor across various locations including international destinations. In developing countries, household perspective has received a special focus in explaining migration behavior in that it recognizes household maintenance as important as labor migration (Boyle et al. 1998). Similarly, Eliakim and Stark (1986) also believe that that family is often a decision-making unit in matters of rural-urban migration.

A variant of the new economics of migration argues that households send their members away from home for work not only for income but also to raise their level relative to other households in the society (Stark 1991 1985; Stark and Taylor 1989). A relatively deprived household more likely finds incentive to send its members away for work. An empirical research conducted in the Chitwan Valley provides proof of the relative deprivation hypothesis that households with relatively lower land holding, an important source of income among farm households are more likely to send their members away to work compared to their reference group (Bhandari 2004). Stark and Taylor (1991); explaining migration, further argued that the role of relative deprivation can be different between internal and international migration largely because of social and cultural discontinuities across the locations. In developing countries, where crop insurance is nonexistent, migration is considered to be a self-insuring strategy. Similarly, in an agrarian society, subsistence farming and small scale production make farming unprofitable and uncompetitive, resulting in a disincentive for farmers to continue with farming (Massey 1998).

One of the factors that impinge on migration decisions could be the minimum labor requirements for "household maintenance". Household maintenance implies the minimum amount of labor required for maintaining day to day household activities such as, farming, child care, household chores, and firewood collection. It is essentially governed by cultural values and also by existence of local labor market for the household production activities. An increase in environmental insecurity may demand more time for the collection of environmental resources such as firewood. In the absence of a labor market for these household production activities, an increase in demand for labor resulting from environmental insecurity has to be met and adjusted from within the household. Although the neoclassical economics and the new economics of migration frameworks suggest migration as an alternative strategy for environmentally deprived households, the household maintenance could play the other way a round depending upon the labor availability in a household. An increase in environmental insecurity, in contrast, may discourage migration if the increased time to collect firewood is greater than the reservation level for change in time to collect firewood. After taking care of other labor requirements for household production including leisure, the reservation level of change in time to collect firewood can be regarded as the representation of household maintenance in this study context.

We relate the theories of migration as follows. An increase in environmental insecurity resulting from increased time to collect firewood collection implies less access to environmental resources. Therefore, the relationship between environmental insecurity and migration can be both positive or negative depending upon the extent to which the labor market for household production activities are developed and the utilities households derive by adopting migration as a coping strategy to environmental insecurity. Given that environmental resources are primary inputs to household production and consumption activities, an increase in environmental insecurity would trigger poverty. Within the framework of neoclassical economics of migration, poverty induces a household's decision to migrate. Similarly, within the framework of new economics of migration, an increase in the uncertainty of household income, brought about by the environmental insecurity, induces households to adopt strategies that reduce the risk of environmental insecurity. So an increase in environmental insecurity increases the likelihood of migration. However, from a household maintenance perspective, an increase in environmental insecurity increases the demand for labor to collect environmental resources. In an agrarian society where labor market for household production activities such as firewood collection is trivial, the increased labor demand may have to be fulfilled from within the household. There is, therefore, a trade-off between household maintenance and migration. We argue that, after adjusting for other labor requirements for household maintenance, a household would be forced to send its members away from home to work in response to environmental insecurity if the change in time to firewood collection (ΔT) is less than the household' reservation level of it (ΔT^*). The household's reservation level of change in time to firewood collection to greater extent depends on the household composition of males and females and possible labor substitution between them. This provides an avenue for some internal adjustment of increased labor demand. For instance, if a household has a large number of members, the household would be more likely to be in a position to send its members away from home for work due to a surplus labor. This suggests that in order to estimate the net effect of environmental degradation, the factors associated with household maintenance such as number of males, females and who collects firewood needs to be adjusted.

Another important element in migration decision is the selection of destination. In the Nepalese context it can be within Nepal and abroad. Migration for work to India, East Asia and Arabian countries is common. As choices of these destinations have implications for the cost of

migration and also for seasonal labor demand and supply, the effect of environmental risks on migration decision can be expected to vary. Generally, the time period of migration abroad can be longer than the migration within Nepal. Therefore, choice of destination can be affected by labor availability and labor substitution possibilities associated with environmental insecurity.

The Setting

Situated between India in the south, east and west, and China in the north, Nepal is predominantly an agriculturally based country. The agriculture sector is overwhelmingly subsistent and closely linked with the forest. For both farming and household production, the forest serves as the primary source of input such as firewood, fodder and timber (Shrestha 1997; Bluffston 1995). Firewood accounts for major share of household energy. It is reported that 74% of households rely on firewood for cooking and heating (Baland et al. 2004). An average household collects about 5.8 bundles of firewood per month and spends on average 5 hours to collect one bundle of firewood. When the volume of firewood consumption and the labor demand for firewood collection is considered, we can expect that any shock in the forest environment would make people environmentally insecure in terms of sustaining their livelihood.

To mitigate this problem, the Nepalese government has introduced a series of policies through its Master Plan for the Forestry Sector (1998), and the Forest Act (1993). The Forest Act 1993 marks a shift in its approach toward democratizing the regulation of forests. Within this act, forest users are given the right to protect and properly use forest resources through the community forestry scheme in the Hills and the buffer zone community forestry scheme in the Terai of Nepal. Nevertheless, because of the ever-increasing population, the forest resources are always under pressure and in a state of continuous degradation. For instance, in the Terai, the forest area has decreased at an annual rate of 1.3% during the 1978/79-1990/91 (http://www/forestandcommunities.org/country_profiles/Nepal.html).

In Nepal, migration has been a livelihood strategy for more than two hundred years (Gill 2003). Literature shows that migration from the Hills to the Terai or from rural to urban areas is widespread (KC 2003; Gill 2003; Gurung 1998). Migration is believed to be a coping strategy to curb a *vicious cycle of* poverty, caused by a multitude of factors including environmental stresses (KC 2003). However, migration is the least researched area compared to

other demographic dynamics (KC 2003). Available studies mainly focused at the macro-level and the studies at the micro-level are largely confined to the Terai and the Kathmandu Valley, the capital city of Nepal. Moreover, much focus has been paid to the economic factors contributing to migration. The role of environmental degradation on migration is unclear, however. This environmental element has special relevance in Nepal since forests account for about 70% of energy source for cooking and heating (MOPE 1998) and has also a trans-boundary impact (Mertz 1991; Myers 1986).

The Chitwan Valley, area studied here, is situated in the south central flat region of Nepal. Before 1950, the Valley was believed to be unsuitable for habitation due to the prevalence of malaria and deadly faunas such as snakes. It was densely covered with forest and the access to forest resources was not an issue. During the 1950s, the government of Nepal initiated a campaign to eradicate the endemic malaria and also introduced a resettlement program in the Chitwan Valley. Since then it has increasingly witnessed a continuous inflow of migrants from neighboring districts (KC 1998). The main motivation for migration to the Valley is fertile land and abundant resources for farming.

The Valley has become a hub for trade and commerce and one of the fastest growing areas in the country due to its transportation links to major cities of Nepal. As a result, the Valley has experienced ever-increasing pressure on natural resources such as forests and water. Originally, the Terai Tibeto Burmese people, particularly the Tharu inhabited the Valley. With the rapid inflow of migrants, now, the Valley has been the home of diverse ethnic groups such as High Caste Hindus, Hill Tibeto Burmese, Newar and others.

The Royal Chitwan National Park, which covers 932 square kilometers, serves as the main source of forest resources for inhabitants of the Chitwan Valley. The Royal Nepal Army has a responsibility of protecting this forest. As the forest is the main source of firewood, fodder, and timber there is always a conflict between park and people. To address this problem a large section of the forest has been designated as buffer zone community forest in which people participate in the protection of forests and have access to forest resources (http://www.cipec.org/research/nepal.html).

Data

We used the household-level data to examine the effect of environmental insecurity on labor migration. The data used in this study come from Population and Ecology Research Laboratory (PERL) based at Chitwan, Nepal. A baseline Agriculture Survey was administered by PERL in the Valley in 1996. A total of 1,805 households was selected using two-staged stratified cluster sampling technique (see Barber et al. 1997 for detail). Of the total sample households, 526 households have at least one member staying away from home for most of the time in the past six months. Of these 526 households, 378 had their members away exclusively for work, referred to as labor migration in this study, which accounts for 21% of the total sample households. Of the total sample households, 92% of them were found to use firewood for any purpose in the home. About 81% of these households reported that they collect firewood from forests and/or common lands. As this study especially looks at the relationship between migration and the change in time demand for firewood collection, the sample for the study constituted 1,074 households. Of those households, 12.5% and 11.2% households sent at least one member of the household away for work within Nepal and abroad, respectively.

Empirical Model

While neoclassical economics of migration considers an individual as a unit of analysis, the new economics of migration considers households as units of analysis. The migration issue we are interested in is the migration of member(s) of a household, which is entirely different from migration of an individual or a family as a whole. The migration of members of a household for work is a voluntary choice by a household. Although it seems that individuals are the ones who move away from home for work, we assume that the household is the decision making unit, so we have not included individual characteristics in the model but the household characteristics.

In this study, we used the discrete choice model considering that a household is the utility maximizer. A household chooses to send its member(s) away for work if the utility obtained from remittance earned afterwards is greater than that would be obtained if member(s) do(es) not leave home for work. Adjusting for other factors, the utility that a household derives can be limited to the assessment with respect to the time required for firewood collection. If a change in time required for firewood collection by a household between two points in time is

greater than the threshold level (reservation time) of change in time required for firewood collection, labor is available for migration for work and *vice versa*. So a household send its member(s) away from home for work if the utility gained from migrating is greater than utility gained from not migrating in response to environmental risks. With regard to choice of destination, households choose to send its members abroad if the utility derived from it outweigh either sending members away from home for work within Nepal or not sending at all. Similarly, a household may send members away from home for work within Nepal if the utility from such a decision outweighs the utility from not migrating.

Consider U_{ij} be the maximum utility i^{th} household derives if it chooses to participate in j^{th} migration alternative, i.e. 1, 2, or 3 where 1= a household chooses to migrate for work within Nepal; 2= a household chooses to migrate for work abroad; and 3= a household chooses not to migrate. The indirect utility function of a household can be written as follows.

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

Where, ε_{ij} is the stochastic disturbances term accounting for the influence of omitted variables. V_{ij} is the function of observable variables specified (refer to specification of variables) in the model. Probability that i^{th} household chooses a j^{th} alternative can be expressed as follows.

$$P_{ij} = Pr\,(U_{ij} > U_{iJ}), \quad j = 1, 2, 3 \text{ where } j \neq J$$

It is assumed that the difference between ε_{ij} and ε_{iJ} are iid and normally distributed. Now consider Y_i is the i^{th} household's migration decision with possible mutually exclusive and exhaustive choices either '1' = at least one member of a household migrated for work within Nepal or '2' = at least one member of a household migrated for work abroad and '3'= none of the members of a household migrated for work (or otherwise). This decision depends on the Y_i^*

$$Y_i = \begin{cases} j & \text{if } Y_i^* > 0 \\ J & \text{if } Y_i^* = 0 \end{cases}$$

Here J= the last category treated as reference category. Y_i^* is latent variable, which is assumed to be determined mainly by the explanatory variables specified in the models. Y_i^* which is continuous and is defined as follows.

$$Y_i^* = X_i\beta + \varepsilon_i$$

where X_i represents vector of other explanatory variables in the model including the change in time required by a household to collect firewood between two points in time (ΔT). β is the vector unknown parameter to be estimated and $\varepsilon_i \sim N(0, \sigma^2)$. The probability that at least one of member of i^{th} household migrate for work can be obtained as follows.

$$\begin{aligned} Pr(y_i=j) = \quad & Pr(Y_i^*>0) \\ & = Pr(X_i\beta + \varepsilon_i > 0) \\ & = Pr(\varepsilon_i > -X_i\beta) \\ & = F(X_i\beta) = \phi(X_i\beta) \end{aligned}$$

F is the cumulative distribution function of disturbances term, which is replaced by the logistic cumulative density function, ϕ. Then the probability that at least one member of the i^{th} household chooses not to migrate for work can be expressed as:

$$Pr(y_i = J) = 1 - \phi(X_i\beta)$$

Then, response probabilities of multinomial logit model are given by (Liao 1994):

The probability that $\Pr(y=j) = \dfrac{e^{\sum_{k=1}^{k} \beta_{jk} X_k}}{1 + \sum_{j=1}^{J-1} e^{\sum_{k=1}^{k} \beta_{jk} X_k}}$ therefore, $\Pr(y=J) = \dfrac{1}{1 + \sum_{j=1}^{J-1} e^{\sum_{k=1}^{k} \beta_{jk} X_k}}$

And Logit is $\log\left[\dfrac{\Pr(y=j)}{\Pr(y=J)}\right] = \sum_{k=1}^{k} \beta_{jk} X_k$

The Logit is linear in vector X. So based on the results from above estimation the log of the probability of choosing j^{th} alternative as opposed to J^{th} choice, $j \neq J$, can be obtained as follows (Wooldridge 2002),

$$\log\left[\frac{\Pr(y=j)}{\Pr(y=J)}\right] = X_k\left(\beta_{jk} - \beta_{Jk}\right)$$

We used odds ratio of multinomial logistic regression, which is given by

$$\frac{\Pr(y=j)}{\Pr(y=J)} = e^{\sum_{k=1}^{k} \beta_{jk} X_k}.$$

We hypothesize that, controlling for all other factors, an increase in time to collect firewood increases the likelihood that a household will send individual(s) away from home for work. For control variables, hypotheses are not formally specified here. However, the expected relationships with households' migration decisions are described in respective headings in the specification of models.

The Wald chi-square test was used for testing individual coefficients. With regard to joint test or goodness of fit of the models, I have used pseudo R^2, and model Chi-square test. The model Chi-square test is used to test whether all the beta coefficients except intercept are equal to zero at K-1 degree of freedom. Where k = number of parameters including intercept term. As suggested by McFadden the pseudo R^2 is computed as $1-L_{ur}/\ L_0$ (Wooldridge 2002), where L_{ur} = log-likelihood function for an estimated model and L_0 = log-likelihood function in model without intercept.

Specification of variables

The variables specified in the models are described below.

Dependent variable

Migration of individuals from a household exclusively for work reasons is the dependent variable used in the study. It is well recognized that the measurement of migration is a difficult and complex task particularly in developing countries (Curan 2002), because migration varies by purpose, time, and destination. In this study, labor migration is defined as individuals staying away from home for most of the time in the past six months at the time of survey exclusively for work reason as used by Stark and Tayler (1991). Therefore, if any member of a particular household is away from home for work at least for three months, the individual is considered a migrant and the household is considered as a migrant household. Non-migrant households are other households that do not send any member away from home for work reasons.

The household survey asked whether "there are any household members who stay away from home most of the time in the past six months." This question records individuals who are away from home (migrants). A further question asked was "Is… (name) away because of work, study, or for some other reasons?" to reveal the reason for the move. A subsequent question

was asked to know whether the individual moved within Nepal or abroad by asking a question "Is……(name) in Chitwan (within district), in another place within Nepal or outside Nepal?"

Based on the information, we operationalized migration variable as: 1) If at least one member of a household stayed away from home within Nepal for work most of the time during the past six months (internal labor migration); 2) If at least one member of a household stayed away from home outside Nepal for work most of the time during the past six months (international labor migration); and 3) None of the members of household stayed away from home for work most of the time during the past six months (no labor migration).

Independent variables

Change in time to collect firewood. This is the change in time to collect firewood from the forest by a household measured in two points in time, in 1996 and three years ago. The information was collected by asking, "*Currently, how long does it take to travel to the place where the fire wood is, collect it, and bring it home?"* The response to this question was measured in minutes. An additional question asked was, "*Three years ago, how long did it take to travel to the place where the firewood was, collect it, and bring it home?"* The difference in the time required to collect firewood between three years ago and now was calculated and then used as the change in time to collect firewood.

As discussed before, the change in time to collect firewood between two points in time may not give a relative security of environmental resources because of the location of households relative to forest/common land from where firewood is extracted. So we have also included the time to collect firewood three years ago to adjust this effect.

Controls

Following factors were controlled in order to measure the net effect of the change in time to collect firewood on households' migration decision.

Land holding. The size of cultivated land is measured in Kattha of land (30 Kattha = 1 hectare). It is used as an indicator of income because farming is the main source of income in many developing countries. Measuring actual stream of income is difficult. Within the framework of relative deprivation hypothesis, land holding is the main factor that determines migration of individuals from a household (Bhandari 2004). As compared to households with

greater land holdings those with relatively lesser amount of land holdings are expected to be more likely to send members away for work. Land resources, both, land holding and land ownership negatively contribute to migration decisions (De Jong et al. 2002).

Livestock holding. Livestock is an integral component of farming in the Chitwan Valley and almost all the farming households keep some kind of livestock such as cattle, buffalo, sheep and goats. In this study, we considered only the number of large livestock. As livestock also account for an important source of household income and provides employment, it is expected that it will reduce the likelihood of migration.

Number of males and females in the household. Males and females make a pool of labor for household needs, farming, and labor supply in the market. A greater number of males or females in a household means more labor and some of them are likely to be available for work outside the home. Further, migration is sex selective in developing countries (Lee 1985). Similarly, participation in firewood collection can also be expected to be sex specific. Therefore, we specify both the number of men and number of women in a household separately in the model. Other factors held constant, households having more number of males and/or females are expected to release their members for work more than those with fewer members. However, the relation can be expected to be non-linear and concave. So we specify the squared terms of both the number of males and number of females separately in the model.

Toilet facility. The presence or absence of toilet facilities in the home is considered one of the indicators of socioeconomic status of the household in developing countries. It is a widely used indicator for household economic status (Mongometry et al. 2000; Bhandari 2004). Households with toilet facilities in the home are considered to be relatively well-off. Given that migration is a costly endeavor, relatively richer households can be more likely to migrate. A question was asked to obtain this information as, "*Do you have toilet at your home?"* and the response was dichotomously recorded as "yes" or "no."

Ethnicity. Ethnicity also affects a household's migration decision (Axinn and Barber 1999). Terai Tibeto Burmese (TTB) such as Tharu, Kumal and Derai castes are indigenous to the Chitwan Valley and people of other castes are basically migrants from all over the country. The livelihood of these diverse caste groups is varied in terms of their occupation, cultural practices, and family composition, which are expected to affect migration behavior. Castes are grouped into High Caste Hindu (HCH; for example, Brahmin and Chhetri), Low Caste Hindu

(LCH, for example, Damai, Kami, and Sarki), Newar, Hill Tibeto Burmese (HTB, for example, Gurung, Magar, Tamang, Rai, and Limbu), Terai Tibeto Burmese (TTB, for example, Tharu, Darai, and Kumal) and others. We expect that as TTB households are indigenous to the Valley they are less likely to migrate for work as compared to other ethnic groups. The TTB ethnic group is treated as the reference group in the estimation of model.

Distance to center market. Narayangarh, one of the fastest growing markets in Nepal, is the center market in the Chitwan Valley with a relatively greater opportunity of jobs in services and industries. Distance to market is important because it is associated with commuting time and other transaction costs. It measures the accessibility to employment opportunities and services (Lee 1985). The laws of migration argued that people close to towns are less migratory than people in the suburbs and further apart (Lee 1966; Skeldon 1997). The distance to Narayangarh from a specific household is measured in kilometers and is expected to have a positive influence on migration behavior.

Who collects firewood? Men, women, and children are involved in firewood collection. However, the extent of their involvement may differ among households. As firewood collection demands a substantial amount of time, those who are involved in firewood collection could play an important role in migration decisions. Moreover, migration is sex selective and males are more likely to migrate for work than females (Lee 1966). To obtain the information on who collects firewood, the survey asked, "*Do men from your household collect firewood*? The response to question was dichotomous, "yes" and "no." A similar question was asked to get the information about women and children. As the involvement of these groups of people is likely to have different effect on migration decision, we specify the participation of men, women, and children separately in the model.

Sharecropping. Sharecropping is one of the strategies to cope with household's food deficit situation among poorer households. Households involved in sharecropping of others' land generally demand more labor for farming and therefore, are expected to be less likely to release their members for work away from home.

Use of non-wood fuel for cooking. Non-wood energy sources such as electricity, kerosene and cow dung are alternatives to firewood for cooking and heating. These alternative sources are relatively costlier than firewood but less labor demanding. So we expect that

households that use non-wood energy sources tend to save labor and are likely to supply more labor in the market for work.

Season. The seasonal migration is one of the features of rural livelihood strategies in Nepal (Gill 1993). Migration of individuals is affected by season because of the seasonal nature of farming and firewood collection. The household survey used in this study was conducted over the period of nine months, starting from March 1996 to December 1996. The migration status of households was determined by the absence of members of household during the last six months, considering the day of interview is the reference point. As the period considered is of six months, there is an overlapping of five months in the period for every successive month. So we specified the month of interview as a continuous variable, treating month as a season.

Change in transportation mode. Transportation of firewood from forests to home is physically strenuous and time consuming activity. Transportation of firewood by carrying on back (on foot) is the most common practice in the Valley. However, there are limited numbers of households that use oxen-pulling carts and tractors to transport firewood. The latter means of transportation are less time demanding compared to former ones. Overtime, there has been a shift of households from manual means of transportation to mechanical means. Hence, the means of transportation can be one of the factors affecting the change in time to collect firewood collection between two points in time. In order to obtain information on the transportation mode, the survey asked *"At the present moment, does your household transport firewood on foot, by bicycle, by cart or by some other means?* Similarly the survey further asked, *"Three years ago, did your household transport firewood on foot, by bicycle, by cart or by other means?* The response options were foot, cart, bicycle, and other. Based on response to these questions, we grouped other than by on-foot means to 'non-foot' category. The change in means between two time period is either of 'no change,' 'on-foot to non-foot,' or 'non-foot to on-foot.' We created two dummy variables each for 'on-foot to non-foot,' or 'non-foot to on-foot,' treating 'no change' as reference category. We expect that compared to households that did not change the mode of transportation, the households that did change from 'on-foot' to 'non-foot' are likely to demand less amount of labor for firewood collection and release more labor for work away from home. And those switching from 'non-foot' to 'on-foot' are expected to have just the opposite behavior.

Results and Discussion

Descriptive Results

Table 1 reports the summary statistics of variables determining the households' decision to send its member away from home for work. The average time to collect one bundle of firewood three years ago (in 1993) was reported to be about 6 hours, which is comparable to that reported by Baland et al. (2004). The time required for the collection of firewood by households that sent their member away for work was greater than that by non-migrant households. The mean difference, however, is not statistically significant, while, the changes in time required collecting firewood during three years time period was statistically different among households of three migrating statuses. On average, the households with members migrating within Nepal experienced a greater increase in time to collect firewood than those with members that migrated abroad and that did not migrate at all. Note that though non-migrating households experience a decline in time to collect firewood on average there are considerable variations in the changes in time. The results clearly show that households in Chitwan Valley during 1993-1996 were differently impacted in terms of access to forest resources. The average land holding among sample households is slightly more than five-sixth of a hectare. Slightly more than one-fifth households reported to have rented in land for sharecropping. The average number of large animals is 2.9. About 64% of the households have toilet facilities in the home. About a quarter of the households reported that they also used non-wood energy sources such as kerosene and electricity for cooking and heating.

Table 1: Descriptive statistics of variables by households' migration status

Variables	Migrated within Nepal (n=134)		Migrated Abroad (n=120)		Non Migrant (n=820)		Total (n=1074)		F-Ratio[1]
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Time to collect firewood three years ago (Minutes)	370.37	233.42	375.08	226.14	342.97	211.70	349.98	216.31	1.84
Change in time to collect firewood (Minutes)	11.27	111.38	3.71	123.28	-16.76	131.33	-10.97	128.45	3.64*
Total land (Kattha#)	27.60	22.97	23.30	19.69	26.25	23.51	26.09	23.05	1.18
Number of large livestock	2.93	2.23	2.93	2.08	2.94	2.12	2.94	2.13	0.00
Toilet at home (Yes=1)	0.75	0.44	0.66	0.48	0.62	0.49	0.64	0.48	4.14*
Use non-wood fuel (Yes=1)	0.31	0.47	0.28	0.45	0.22	0.42	0.24	0.43	3.13*
Sharecropping (Yes=1)	0.26	0.44	0.23	0.42	0.29	0.46	0.28	0.45	1.08
Total number of males	3.43	1.94	3.34	1.40	2.71	1.34	2.87	1.46	22.02***
Total number of males^2	15.52	23.06	13.11	11.18	9.13	9.73	10.37	12.55	18.8***
Total number of females	3.38	2.18	3.44	1.66	2.77	1.54	2.92	1.67	14.75***
Total number of females^2	16.13	27.03	14.59	13.62	10.04	13.54	11.31	16.02	11.37***
Who collects firewood?									
Children (Yes=1)	0.13	0.34	0.10	0.30	0.13	0.34	0.13	0.33	0.49
Women (Yes=1)	0.93	0.26	0.97	0.18	0.86	0.35	0.88	0.35	7.68***
Men (Yes=1)	0.59	0.49	0.50	0.50	0.78	0.41	0.72	0.46	28.81***
Distance to center market (Kilometer)	10.15	3.37	9.51	3.19	9.22	3.40	9.37	3.39	4.49*
Ethnicity									
High Caste Hindu (HCH)	0.54	0.50	0.40	0.49	0.46	0.50	0.46	0.50	2.47
Low Caste Hindu (LCH)	0.15	0.36	0.20	0.40	0.12	0.33	0.13	0.34	2.91
Hill-Tibeto Burmese (HTB)	0.13	0.34	0.28	0.45	0.17	0.38	0.18	0.38	5.59**
Newar	0.02	0.15	0.07	0.25	0.05	0.22	0.05	0.21	1.44
Interview month	6.73	2.43	6.88	2.55	6.80	2.53	6.80	2.51	0.10
Mode of transportation									
On-foot to non-foot	0.04	0.19	0.02	0.13	0.02	0.15	0.02	0.15	0.73
Non-foot to on-foot	0.01	0.12	0.03	0.16	0.01	0.12	0.01	0.12	0.48

[1] One-way ANOVA *** = p<0.001 **=p<0.01 *=p<0.05 # 30 Kattha = 1 Hectare

The number of both males and females among migrant households is greater than non-migrant households. The involvement of children, women, and men in firewood collection account for 13%, 88%, and 72% respectively, showing that firewood collection is mainly of female's job followed by male's and children's.

The average distance to center market among migrant households is greater than that among the non-migrant households. By ethnicity, the proportion of High Caste Hindu (46%) is the highest followed by Hill Tibeto Burmese (18%), Low Caste Hindu (13%), Newar (5%), and Terai Tibeto Burmese (3%). Households switching from 'on-foot' to 'non-foot' mode and 'non-foot' to 'on-foot' mode for transporting firewood between two points in time account for 2% and 1% of sample households, respectively.

Multivariate Results

The odds ratios from multinomial logistic regression estimated for the migration of members of households exclusively for work reason are presented in Table 2. Column 2 in Table 2 shows the odds of migration of members of households within Nepal as compared with non-migration and column 3 presents the odds of migration abroad versus non-migration. Both, negative log likelihood and model Chi-square coefficient show that models best fit the data. About 17% of the variation in the dependent variable is explained by the model (McFadden pseudo R-square value = 0.17).

Migration for work within Nepal

Results show that the change in time to collect firewood showed a strong and positive effect on households' decision to send their members away from home for work within Nepal, net of other factors including time to collect firewood three years ago. Households that experienced increased time to collect a bundle of firewood by one hour compared to three years ago are about 12% more likely to migrate for work within Nepal. This finding supports the hypothesis of new economics of migration even in the context of environmental risks. In Nepal, most households are both production and consumption units. Market for household activities such as firewood collection is virtually non-existent. Hence, an increase in environmental risk (referred as environmental insecurity) increases the likelihood of migration for work for

maintaining livelihood, suggesting that migration for economic reasons is an important coping strategy to environmental degradation among rural households.

Another important finding that can be drawn from the analysis is that a household's socioeconomic environment that dictates the labor supply and demand dynamics is equally important in labor migration decisions. Households that used labor-saving non-wood fuel alternatives such as gas, and kerosene were significantly more likely to send their members away for work. This labor demand and supply dynamics can also be substantiated by the results of number of males and females in the household. The presence of more males in a household significantly increased the likelihood of sending members away for work. The coefficient for number of females is not significant but the sign is as expected. Similarly, results show that who in the household is engaged in firewood collection matters in migration decision. Compared to households that did not engage males in firewood collection, households that engaged them in it were 69% less likely to send members away from home for work within Nepal. This result together with the result for the number of men highlight that firewood collection and migration away from home for work are two competing activities for men in rural Nepal.

We expected that if households have large numbers of females and they are involved in firewood collection, males can be released for work away from home, but the results from migration with Nepal did not statistically support this. In an agrarian context where the labor market for household production activities is virtually nonexistent and the demand for labor for household production process has to be fulfilled largely from within the households, every household should have a threshold level of labor requirements for the maintenance of household activities. Households may be able to send their members away for work only if the household labor supply is above the threshold level (minimum level for household maintenance). Above result indicate that labor availability for household maintenance is important in migration decision.

Table 2: Odds ratio estimates from multinomial logistic regression for the effects of environmental degradation on migration of member(s) of household for work (n=1074)

Variables	Within Nepal *vs* None	Abroad *vs* None
Time to collect firewood three years ago (Minutes)	1.001*	1.001*
Change in time to collect firewood (Minutes)	1.002*	1.002*
Total land (Kattha#)	0.986*	0.985*
Number of large livestock	0.952	0.958
Toilet at home (Yes=1)	2.329**	1.289
Use non-wood fuel (Yes=1)	2.262***	1.329
Sharecropping (Yes=1)	0.951	0.891
Total number of males	1.750**	2.591***
Total number of males^2	0.981	0.946
Total number of females	1.180	1.990**
Total number of females^2	0.999	0.953+
Who collects firewood?		
Children (Yes=1)	1.177	0.775
Women (Yes=1)	1.535	3.019*
Men (Yes=1)	0.310***	0.216***
Distance to center market (Kilometer)	1.199***	1.084*
Ethnicity		
High Caste Hindu (HCH)	1.722	3.859*
Low Caste Hindu (LCH)	1.661	5.735***
Hill-Tibeto Burmese (HTB)	1.138	9.045***
Newar	0.574	6.217**
Interview month	0.944	0.991
Change in mode of transportation		
On-foot to non-foot	2.173	0.748
Non-foot to on-foot	1.136	2.096
Chi-Square	253.58***	
McFadden Pseudo R-Square	0.17	

*** = p<0.001 **=p<0.01 *=p<0.05 # 30 Kattha = 1 Hectare

The odds ratio for land holding is less than one and is statistically significant. This result is consistent with the findings of Bhandari (2004) that individuals from a relatively deprived household are more likely to migrate. The effect of the holding of large animals is insignificant but the sign is as expected. Having a toilet in the home is another indicator of socioeconomic status of households. Generally, richer households tend to have toilet facilities in the home. The odds ratio is more than 2, indicating that relatively well-off households are more likely to send individuals for work. This could be because these household are better able to meet migration costs.

The distance to center market turns out to be another significant factor. Those living farther away from market center are more likely to migrate for work, compared to those who reside around center market. This result is consistent with Ravinsteen's theory (Lee 1966, 1985) that individuals farther away from the town are more likely to migrate compared to those close to the town due to relative differences in the income earning prospects. The results show that the ethnic background of a household is not a strong predictor so far as migration for work is within Nepal. Similarly, the change in mode of transporting firewood found to have no significant effect on the likelihood of migration for work within Nepal.

Migration abroad for work

The results in column 3 reveal that as in the case of migration within Nepal, households that are environmentally more insecure are more likely to send their members abroad for work as well. The odds ratios are the same as for migration within Nepal. This result suggests that, the environmental insecurity induces labor migration, regardless of destinations. Plausible reasons for similar results between domestic and international destinations could be as follows. Labor migration abroad is mainly to India. And because of open border, cultural similarity, and short distance to enter into India from Chitwan Valley, the transaction cost of migration between domestic and international destination may not be substantial.

The presence of number of both males and females is quite important in migration decision to work abroad. The effects of the number of both males and females variables are positive and statistically significant. In the case of number of males, the relationship turned out to be concave. The coefficient for females which was not significant in the case of internal migration is now significant in the case of international migration. This could be associated

with the length of migration, which may be longer in the case of international migration than the internal. As the roles undertaken by migrating members have to be fulfilled by some other members of households, the labor requirements for maintaining a household seems rather crucial in migration decisions to work abroad. As in internal migration, households that did engage males in firewood collection were significantly less likely (by 78%) to send their members abroad for work. The coefficient for female's involvement in firewood collection, which was not significant in internal migration, is now highly statistically significant. Households that did engage females in firewood collection are three times more likely than households that did not engage females in firewood collection to send its members abroad for work. This result indicates that as migration abroad for work is mainly men's job, the number of males and females as well as substitution between male and female labor is rather vital in migration decision to work abroad.

The odds ratio for toilet in the home and use of non-wood energy which were significant in the case of migration within Nepal turned out to be insignificant in explaining the migration abroad for work. Interestingly, the effect of ethnicity, which was statistically not significant in the case of migration within Nepal (except marginally for High-Caste-Hindu) is statistically highly significant in the case of migration abroad. As compared to Terai-Tibeto-Burmes, all other ethnic groups were significantly more likely to migrate for work abroad. Since individuals belonging to the Terai-Tibeto-Burmese groups are indigenous to this setting, they are less likely to move abroad. Moreover, this could be due to the underlying household economic structure and social networks, because individuals of TTB may prefer to continue farming in their community rather than going away for off-farm jobs abroad

Conclusions

This study empirically examined the effect of environmental insecurity on households' migration decision for work. The results showed that increased environmental insecurity, measured in terms of access to forest resources, increased the likelihood of migration regardless of destinations. This finding supports the hypothesis of new economics of migration even in the context of environmental risks, suggesting that migration is one of the coping strategies to environmental insecurity followed by rural households in Chitwan Valley of Nepal.

In the Chitwan Valley, the labor requirement for household maintenance is mostly supplied from within the household itself and the labor market for certain household activities such as firewood collection are essentially limited. The results of economic and household composition characteristics indicate that migration of individuals away from home can well be associated with households' maintenance requirements of labor. In particular, results showed a negative and strong impact of males' participation in firewood collection on migration decision. The causation may also run in other direction such that if households decide not to send men away from home for work they could be available for firewood collection, suggesting for a possible simultaneity between migration and men's participation in firewood collection. We aim to look at this issue in our subsequent research.

Taken together, the results provide evidence that labor migration is important coping strategy to environmental insecurity to secure livelihood. Such a diversification of labor resources may affect the labor availability for other economic activities such as farming and protection of forest resources (Cooke 1998.). From a sustainable development policy perspective, the results suggest that the management of forest resources and poverty alleviation seems possible by providing economic opportunities at local level, which could be an important issue for future research.

Acknowledgements

We thank Dr. David Abler and Dr. Sal Oropesa, respectively Professor of Agricultural, Environmental and Regional Economics and Demography and Professor of Sociology, the Pennsylvania State University (PSU) for their invaluable comments on the paper. We are deeply thankful to the Department of Agricultural Economics and Rural Sociology (AERS), PSU for travel grants. We are also grateful to the IUSSP for providing grants for Sundar's travel. Thanks are due to Dr. William G. Axinn, Professor of Sociology, University of Michigan for proving data as well as partial funds for Prem's travel. We duly acknowledge Dr. Steve Smith, Professor and the head of the department of AERS, PSU for his partial support from his own salary savings and his encouragements.

References

Aggarwal, R., S. Netanyhu, and C. Romano. 2001. "Access to Natural Resources and the Fertility Decision of Women: the Case of South Africa." *Environment and Development Economics* 6: 209–236.

Baland, J. M., P. Bardhan, S. Das, D. Mookherjee, R. Sarkar. 2004. "The Environmental Impact of Poverty: Evidence from Firewood Collection in Rural Nepal." Paper Presented at the Commons in an Age of Global Transition: Challenges, Risks, and opportunities, The Tenth Conference of the International Association for the Study of Common Property, August 9-13, Oaxaca, Mexico.

Barber, J. S, G. Shivakoti, W. G. Axinn, and K. Gajurel. 1997. "Sampling Strategies for Rural Settings: A Detailed Example from Chitwan Valley Family Study, Nepal." *Nepal Population Journal* 6:193-203.

Bhandari, P. 2004. "Relative Deprivation and Migration in an Agricultural Setting of Nepal." *Population and Environment* 25(5): 475-499

Biddlecom, A. E., W. G. Axinn, and J. S. Barber. 2005. "Environmental Effects of Family Size Preferences and Subsequent Reproductive Behavior in Nepal." *Population and Environment* 26(3):183-206.

Bilsborrow, R. E. 1992. "Population Growth, Internal Migration and Environmental Degradation in Rural Areas of Developing Countries." *European Journal of Population* 8:125-148

Bilsborrow, R. E. 2002. "Migration, Population Change, and the Rural Environment." ECSP Report, 8:69-94.

Bilsborrow, R. E. and M. Geores. 1994. "Population Change and Agricultural Intensification in Developing Countries." Lourdes Arizpe, M. Priscilla Stone and David C. Major (Eds.) in *Population and Environment: Rethinking the Debate,* Boulder, San Francisco, Oxford. Pp. 171-207

Bluffstone, R. 1995. "The Effect of Labor market Performance on Deforestation in Developing Countries under Open Access: An Example from Rural Nepal." *Journal of Environmental Economics and Management* 29: 24-63.

Boyle, P, K. Halfacree and V. Robinson. 1998. "Exploring Contemporary Migration." New York: Addition Wesley Longman.

Bruntland, G. (ed.).1987. "Our Common future: The World Commission on Environment and Development." Oxford: Oxford University Press.

Cooke, P. A. 1998. "The Effect of Environmental Good Scarcity on Own–Farm Labor Allocation: The case of Agricultural Households in Rural Nepal." *Environment and Development Economics* 3: 443-469.

Curran, S. R. 2002. "Migration, Social Capital, and the Environment: Considering Migrant Selectivity and Networks in Relation to Coastal Ecosystems." In W. Lutz, A. Prskawetz, and W. Sanderson, Editors, *Population and Environment: Methods of Analysis*, Population and Development Review, a supplement to, Volume 28, pp 89-125

De Jong, G. F, A. Chamratrithirong and Q. Tran. 2002. "For Better, For Worse: Life Satisfaction Consequences of Migration in Thailand." *International Migration Review*, Forthcoming.

Filmer, D. and L. H. Pritchett. 2002. "Environmental Degradation and the Demand for Children: Searching for the Vicious Circle in Pakistan." *Environment and Development Economics* 7 (1): 123-146

Gill, G. J. 2003. "Seasonal Labor Migration in Rural Nepal: A Preliminary Overview." Working Paper 218. London: Overseas Development Institute.

Goria, A. 1997. "Environmental Security and Migration: The Role of Environmental Factors as Determinants of Migration Flows in Pakistan." *FEEM Newslette*r 3:4-8

Gurung, H. 1998. "Nepal Social Demography and Expressions." Kathmandu: New Era.

Heady, C. 2002. "Natural Resource Sustainability and Poverty Reduction." *Environment and Development Economics* 5:241-258.

Hugo, G. 1996. "Environmental Concerns and International Migration." *International Migration Review* 30:105-131.

Jodha, N. S. 1990. "Poverty, Environmental Resource Degradation: Alternative Explanations and Possible Solutions." Paper Presented at the India-50 Conference, University of Sussex, UK.

Kalipeni, E.. 1996. "Demographic Response to Environmental Pressure in Malawi." *Population and Environment* 17(4):285-308.

KC, B. K. 2003. "Migration, Poverty, and Development in Nepal." Economic and Social Commission for Asia and Pacific. ESID/EGM/INF 10. Bangkok: ESCAP.

KC. B. K. 1998. "Trends, Patterns, and Implication of Rural to Rural Migration in Nepal." Kathmandu: Center Department of Population Studies, Tribhuvan University, Nepal.

Kumar, S. K. and D. Hotchkiss. 1988. "Consequences of Deforestation for Women's Time Allocation, Agricultural Production, and Nutrition in Hill Areas of Nepal." Research Report 69, Washington, D.C: International Food Policy Research Institute.

Lee, E. S. 1996. "A Theory of Migration." *Demography* 3: 45-57.

Lee, S. H. 1985. "Why People Intend to Move: Individual and Community Level Factors of Out-Migration in the Philippines." Boulder: West View Press.

Liao, T. F. 1994. "Interpreting Probability Models: Logit, Probit, and Other Generalized Linear Models." Sage University Papers: Quantitative Applications in the Social Sciences, 07-101. Thousand Oaks, CA: Sage.

Lopez, R. 1998. "Where Development Can or Cannot Go: The Role of Poverty-Environment Linkages." In B. Pleskovic and J. Stiglitz(eds.) *1997 Annual World Bank Conference in Development Economics*. Washington DC: World Bank.

Loughran, D. and L. Pritchett. 1997. "Environmental Scarcity, Resource Collection, and the Demand for Children in Nepal.", Poverty, Environment and Growth Working Paper Series No. 19. Washington, DC: World Bank.

Marquette, C.and R. Billsborrow. 1997. "Population and Environment Relationships in Developing Countrties: A Select Review of Approaches and Methods." In B. Baudot and W. Moomaw (eds.) *The Population, Environment, Security, Equation*: New York: McMillian.

Massey, D. S, J. Arango, G. Hugo, A. Kouaouci, A. Pellegrino, and J. E. Taylor. 1998. "World in Motion: Understanding International Migration at the end of the Millennium." New York : Oxford University Press.

Metz, J. J. 1991. "A Reassessment of the Causes and severity of Nepal's Environmental Crisis." *World Development* 19(7): 805-820.

Ministry of Population and Environment (MOPE). 1998. "Nepal Population Report." Kathmandu: National Planning Commission, Nepal.

Montgomery, M. R., M. Granolati, K. A. Burke, and E. Paredes. 2000. "Measuring Living Standards with Proxy Variables." *Demography* 37:155-174.

Myers, N. 1986. "Environmental Repercussions of Deforestation in the Himalayas." *Journal of World Forest Resource Management* 2: 63-72.

Nerlove, M. 1991. "Population and the Environment: A Parable of Firewood and Other Tales." *American Journal of Agricultural Economics* 73: 1334-47.

Ostrom, E. 1990. "Governing the Commons: The evolution of Institutions for Collective Action." Cambridge: Cambridge University Press.

Prennushi, G. 1997. "Rural-to-Urban Migration and Its Implications for Poverty Alleviation." *Asia-Pacific Population Journal* 12: 3-16.

Shrestha. S. S. 1997. "Improvement of Hill Farming Systems of Nepal: An Optimisation of Farm Plans and the Analysis of the Impact of New Technologies." Unpublished Thesis. Reading: The University of Reading, UK.

Skeldon, R. 1997. "Migration and Development: A Global Perspective." England: Longman.

Skeldon, R. 2002. "Migration and Poverty." *Asia and Pacific Population Journal* 17:67-82.

Stark, O. 1984. "Rural-to-Urban Migration in LDCs: A Relative Deprivation Approach." *Economic Development and Cultural Change*: 475-486.

Stark, O. 1991. "Migration of Labor." Cambridge: Blackwell Publishers.

Stark, O. and D. E. Bloom. 1985. "The New Economics of Labor Migration." *American Economic Review* 75 (2):173-78.

Stark, O. and J. E. Taylor. 1989. "Relative Deprivation and International Migration." *Demography* 26:1-14.

Stark, O. and J. E. Taylor. 1991. Relative Deprivation and Migration: Theory, Evidence, and Policy implications." Policy, Research and External Affairs Working Papers-656, Washington DC: World Bank.

Todaro, M. P. 1969. "A Model of Labor Migration and Urban Unemployment in Less Developed Countries." *The American Economic Review* 59:138-48.

Todaro, M. P. 1994. "Economic Development." 5th Edition. New York: Longman.

United Nations Country Team of Nepal. 2002. "Nepal Millennium Development Goals. Progress Report 2002." Kethmandu: United Nations House, Nepal.

Wooldridge, J. M. 2002. "Econometric Analysis of Cross Sectional and Panel Data." Cambridge: The MIT Press.