The Link Between Community Forestry Policies and Poverty and Unemployment in Rural Nepal

Authors: Dhakal, Bhubaneswor, Bigsby, Hugh R., and Cullen, Ross

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Bhubaneswor Dhakal, Hugh R. Bigsby, and Ross Cullen

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The present article examines the relationship between community forest management policies on the one hand, and income and unemployment in rural areas of Nepal on the other, by modeling the effect of forest management constraints on community forest use. Current government policy dictates the use of all community forestland for environmental conservation and limited timber production, and provides little scope for fodder and firewood production. Based on data from 259 households in 6 community forest user groups in 3 hilly districts (Dolakha, Kavre, and Nuwakot), the results show that the resources available from private lands and community forests under current policies are inadequate to fully utilize the family labor force of many rural households, and are insufficient to generate a bare subsistence income for the poorest households. The study shows that a policy change to community forest management using a more flexible agroforestry model could overcome rural unemployment problems and increase incomes while ensuring sustainable resource use from the forests.

Keywords: *Community welfare; community forestry; rural unemployment; forest policy; rural poverty; welfare maximization model; Nepal.*

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Introduction

One way of achieving the Millennium Development Goals (alleviating suffering from chronic hunger, social inequalities, and disease, and providing incomes sufficient for basic goods and services) is to increase household income and employment based on locally available natural resources. This is particularly true in mountainous regions, where there are many limitations on promoting the industrial and service sectors (Wymann von Dach et al 2006). The principles/elements of forest management internationally agreed on at the Earth Summit (1992) state that national policies should promote appropriate conditions that "achieve and maintain cultural identity and social organization, as well as adequate levels of livelihood and wellbeing, through, *inter alia*, those land tenure arrangements which serve as incentives for the sustainable management of forests…. Sustainable forest management and use should be carried out in accordance with national development priorities and on the basis of environmentally sound national guidelines" (Johnson 1993, pp 112–113).

Of specific interest is the use of community forest resources to complement private resources to provide basic needs and generate household income and employment in rural Nepal, where alleviation of poverty is a major challenge. Although Nepal has an economy based on agriculture, farmland occupies only 21% of the national land area (CBS 2003; Ives 2004). The area of farmland is not sufficient to meet employment and food needs, and 48 out of 75 districts have a food deficit (UNDP 2005). In addition, creation of sufficient off-farm income and employment opportunities is limited by institutional and resource constraints (Ives 2004). As a result, many rural people, particularly in isolated and remote mountain areas, persistently suffer from hunger and poverty (Ives 2004; UNDP 2005). Social problems related to poverty and unemployment have increased in recent years, and are worse in areas with food deficits and where people have little access to land (Murshed and Gates 2005). The incidence of poverty is more pronounced for marginal ethnic groups, the elderly, women, and children, who have little say, little access to resources, and fewer social opportunities (Huijbers et al 1996; Messer 1997; NPC 2003).

Forests occupy about 40% of Nepal's land area (CBS 2003) and have the potential to be an important complement to private agricultural land in providing for local communities. The importance of forests was recognized in the development of the community forestry program in Nepal, which brought management power and benefits from forest resources into local communities (Ministry of Forest 1988). However, despite the establishment of more than 13,000 forest user groups, the impact of the community forestry program on reducing rural poverty and unemployment is debatable (Dhakal 2005). There have been improvements in physical forest resources and the environment, and flows of community development funds from sales of forest products (Dongol et al 2002; Gautam et al 2002; Dhakal 2005). However, parallel with this, there has been a reduction in fodder and firewood supplies (Malla 2000; Dhakal et al 2005), and household income, employment, and livestock holdings have decreased (Bhatta 2002; Timilsina 2003). Since wealthier households have sufficient private landholdings to produce their own fodder, the effects of these reductions appear to have been disproportionately felt by the poorest households, women, and minorities (Agrawal 2001; Adhikari et al 2004; Dhakal 2006; Maskey et al 2006).

These negative outcomes raise a question about why devolution of management of public forestlands to communities and the addition of resources have generally not resulted in a significant increase in living standards. The answer to this question requires a framework that can incorporate the interaction of community forest

resources with local economies, and the effect of national forest policies on community forest management. One such framework is a constrained welfare maximization model. The remainder of this article outlines a welfare model of a community forest user group in Nepal, and the results of a study of the effects that different constraints on community forest use have on income and employment for a number of forest user groups in Nepal.

Modeling community forest-based households

Household income depends on the outputs produced on private land (a_p), community forestland (a_c), and household labor endowment (L). Use of community forestland is constrained by government policy (G). The generalized decision-making problem for a household is then to

$$\text{Maximize } y = f\left(a_p, a_c, L, G\right)$$

$$\text{Subject to } \sum_{j=1}^{J} A_{rj}X_j \le b_r \text{ and } X_j \ge 0$$

where y is household income, X_j is a vector of decision variables (a_p, a_c, L, G), A_{rj} is a constraint function with r linear constraints and j decision variable matrices, b_r is a constant, and $X_j \ge 0$ denotes non-negativity of the decision variables. The specific model of community forestry used in the study is outlined below.

Household production system

In this model, it is assumed that a production (cropping) system can produce more than one product simultaneously and that marginal products are constant. Output of any good i under production system t on land type k is a function of yield per unit area with a production system on a land type (g_{itk}) and the area of land type k allocated to a particular production system by a household (a_{tk}). Land can include private land, land used under sharecropping, and common forestland. Products may be a single output from a production system or by-products. Total output of any particular good by a household (q_i) is then a function of how much land of various types the household allocates to different production systems.

$$q_i = \sum_{k=1}^{n}\sum_{t=1}^{m}\left(g_{itk} \times a_{tk}\right)$$

In a subsistence agricultural household, it is impractical to separate household production from household consumption. In this model, only labor that is hired (L_h) and production inputs that are purchased (I) are accounted for as costs. Household labor requirements for a particular output will be either a function of labor hours required per unit area (h^a_{tk}) and the area of land type k allocated to a particular production system t by a household (a_{tk}), or a function of output (q_i) and harvest productivity for that good (h^v_i). Total household labor (L) required is then

$$L = \sum_{t=1}^{m}\sum_{k=1}^{n}\left(h^a_{tk} \times a_{tk}\right) + \sum_{i=1}^{r}\left(h^v_i \times q_i\right)$$

The amount of hired labor (L_h) required is a function of available family labor (L_o) and the total household labor (L) requirement ($L_h = L - L_o$).

Net household income (y) is the difference between revenue and cost. In addition to producing output q_i with a farm-gate price of P_i, households are able to earn external income in the labor market (L_m), earning a wage rate (w). In practice, a household will either earn outside income (L_m) or employ outside labor (L_h), but will not do both. A household can also buy products (food, firewood, timber, and fodder) in the market (q^m_i) at market prices (p_i). Market prices will be higher than farm-gate prices ($p_i > P_i$). Total net income for a household is then,

$$y = \sum_{i=1}^{r}\sum_{k=1}^{n}\sum_{t=1}^{m}\left[\left(P_i \times q_i\right) - \left(L_h \times w\right) - I\right] + \left(L_m \times w\right) - \sum_{i=1}^{r}\left(p_i \times q^m{}_i\right)$$

Community welfare

In this model the community is structured as m different income groups with n households in each group. Income groups are categorized as poor (P), medium (M), and rich (R), based on sufficiency of household income from private landholdings to meet basic needs. In this study, poor households are defined as having insufficient private land to meet basic needs, medium households have just sufficient land, and rich households have a surplus of land to meet basic needs. The community forest can be managed for joint benefit and treated as another income group/household, or it can be treated as semi-private land if rights are allocated to individuals to make individual decisions over a particular area. The objective is maximization of community income (Y) across all households in each income group, including from community managed forests and all products subject to a number of constraints.

$$\text{Maximize } Y = \sum_{x=1}^{n}\sum_{z=1}^{m}\left[y_{xz}\right]$$

$$\text{Subject to } \sum_{x=1}^{n}\sum_{z=1}^{m}\sum_{t=1}^{r} a_{xztk} = a_k$$

$$L_{fxz} + L_{cxz} + L_{mxz} \le L_{xz}$$

$$\sum_{x=1}^{n}\sum_{z=1}^{m} L_{hxz} \ge \sum_{x=1}^{n}\sum_{z=1}^{m} L_{mxz}$$

$$q_{ixz} = d_{ixz}$$

$$y_{xz} \ge y^0_{xz}$$

TABLE 1 Policy scenarios.

Policy	Description
Current policy	The forest is managed collectively but is only used for timber production. User groups are allowed an annual harvest of only 30% of mean annual increment (MAI) for hardwoods and mixed deciduous forests, and 50% of MAI for pine forests. Firewood and fodder collection are permitted from residual products.
Unconstrained community use	The community forest is modeled as a separate household in the community, maximizing its income through sales of outputs, and with no constraints on use for firewood, fodder, or timber. Since the community forest has no labor supply, it must employ others for production. As is common practice, households can purchase community forest output at a lower price than the market price to meet home consumption needs, with surplus products sold outside the local market.
Unconstrained lease	Similar to the unconstrained community use case, there are no constraints on use of community forest for firewood, fodder, or timber. However, in this scenario the community forest can be leased to individual households. This allows households with surplus labor to use community forests as if the land was under private management, effectively increasing the land available to a household. The community earns rent on the area leased to households, and earns income from products produced on the land remaining under community management.

The constraints are as follows: The total amount of land type k used by households x in income groups z and production systems t cannot exceed the total amount of that land type available in the community (a_k). Labor allocated by any household x of income group z to their own farm (L_{fxz}), to community forest activities (L_{cxz}), or to outside employment (L_{mxz}) cannot exceed available labor for that household (L_{xz}). Employment opportunities are limited to what is available in the community, so off-farm employment (L_{mxz}) cannot exceed local employment opportunities (L_{hxz}). Households are required to have minimum amounts (d_{ixz}) of certain goods to meet basic food, heating, and housing needs. There is also a restriction against making individual households worse off to maximize community income.

The potential to alleviate poverty and unemployment was evaluated by modeling the effect of different policy scenarios relating to the use of community forests (Table 1) and comparing this to the effect of current policy. Although the alternative policies are notionally unconstrained, since the objective is to maintain environmental benefits, cereal production is constrained to private land, and the only unconstrained activities allowed on community forests are some combination of fodder, firewood and timber production. As such, the alternatives represent an unconstrained agroforestry alternative. A number of studies have shown that agroforestry models provide sustainable land uses which contribute to biodiversity conservation, carbon sequestration and soil erosion control (Narain et al 1997; Montagnini and Nair 2004; McNeely and Schroth 2006). In the agroforestry model used in this study, trees are assumed to cover 40% of the land area and the cut-and-carry method is used for fodder supplies. As Gilmour et al (1987) showed, a reduction in forest cover makes little contribution to soil erosion unless there are very high livestock numbers or overgrazing. Since this study assumes a system where there is no grazing, fodder production should not disturb the soil. Yield information for the agroforestry parameters in the model are from the Master Plan (Ministry of Forest 1988) for firewood, fodder, and timber yields, and from Paudel and Tiwari (1992) for fodder yield using the cut-and-carry method. Forest product consumption information was obtained from Mahat et al (1987) and the Master Plan (Ministry of Forest 1988).

Data

Data for the model were collected using household surveys, user group surveys, and secondary sources. For the study, 6 community forest user groups in 3 districts (Dolakha, Kavre, and Nuwakot) of the mid-hill region of Nepal were selected on the basis of representative forest condition, type of forage gathering practices, age of the user group, forest size, and level of access to district forest office services. For the household surveys, a structured questionnaire was administered to female heads of 259 farming households in May–July 2003. The respondents were asked a range of questions, including the size of landholdings for all types of private lands, including share cropping, level of food sufficiency, family size, household labor, livestock holdings, and firewood and timber collection from community forests. Table 2 outlines the main characteristics of the case study user groups. The average landholdings of those covered by this survey are relatively high compared to the National Agricultural Survey 2002, which found 0.68 ha per household (hh) in Dolakha

TABLE 2 Characteristics of forest user groups surveyed (May–July 2003; HH = household).

Forest user groups	Private landholdings (ha/HH)			Average community forest area (ha /HH)	Labor force (person/HH)	Consumers (unit/HH)	Estimated altitude of locality (m asl)
	Poor HH	Medium HH	Rich HH				
Khorthali	0.40	1.06	2.03	0.35	3.4	4.6	1800–2600
Siddeswori	0.24	0.78	2.06	0.42	3.0	6.0	800–900
Chapanigadi	0.67	1.03	2.75	0.90	3.6	6.2	1200–1400
Banshkharka	0.46	0.76	1.08	0.83	3.1	4.9	1300–1500
Bidur	0.29	0.88	1.18	0.62	3.3	8.6	700–1000
Suryamati	0.42	0.73	0.93	0.62	2.8	5.9	700–800

District, 0.55 ha/hh in Karve District, and 0.53 ha/hh in Nuwakot District (CBS 2003).

Incomes in the model are estimated assuming that all forest user groups fully use their timber product allowances up to the government policy limit. However, the Bidur user group is currently unable to fell any timber because they have not done a mandatory forest inventory. For policy modeling, this constraint is maintained under the current policy option, but removed for the other options. In each user group, households were grouped into poor, medium, and rich categories based on level of household food sufficiency from private landholdings obtained in the survey. For the purposes of this study, households with a food deficit are classed as poor, those with just sufficient food are classed as medium-income, and those with a food surplus are classed as rich.

Data common to all households, such as yields, prices, or labor requirements, were collected from local market surveys, key informants, and secondary sources (Dhakal 2005). In addition, it was necessary to make some assumptions due to a lack of data. In particular, it was assumed that a person is available to work only 265 days in a year, and that all households practice the cut-and-carry method of fodder collection from community forests to feed their livestock. This practice generally requires more labor than other grazing practices.

Results and discussion

The results are presented in terms of changes in income, employment, and land use patterns for each of the forest user groups with each policy.

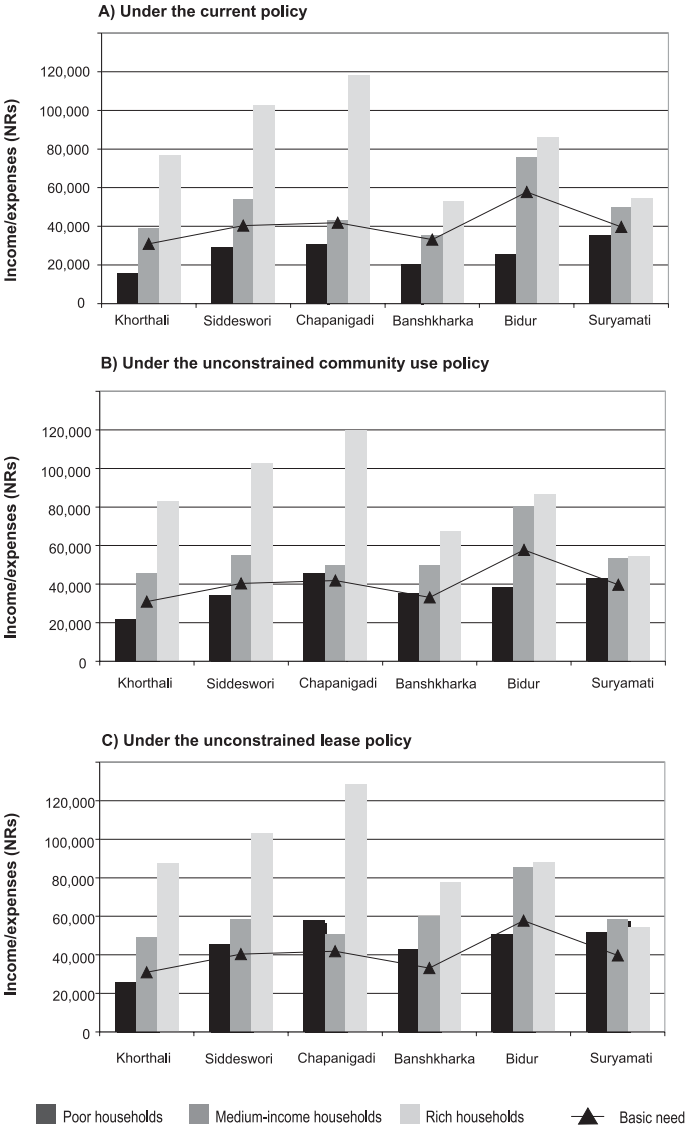
Income

Figure 1A shows household income under the current policy. The vertical bars are average household incomes for each income group, which includes both on-farm and off-farm income. The horizontal Basic Need line is household income required to provide the minimum calorific intake and other non-food items essential for survival. This survival income figure is estimated to be NRs 6725 (US$ 93) for a person in 2003 and was calculated from the National Planning Commission Survey 2001 (NPC 2003) and 5% inflation. The minimum income needed in each forest user and household income group varies due to differences in the number of consumer units in households (family members under 15 years old were considered equivalent to half an adult). Under the current policy, the incomes of all poor households are below the minimum required for survival. For medium-income households incomes are reasonably sufficient. In all user groups the incomes of rich households are more than enough for minimum needs.

Figure 1B shows household incomes for households under the unconstrained community use policy. Compared to the current policy case, all incomes generally increase, with the greatest increase for poor households. The income of poor households increased by 72% in the Banshkharka group, and nearly 50% in the Khorthali, Chapanigadi and Bidur groups. The income level of poor households in the Chapanigadi, Banshkharka and Suryamati groups were now above the minimum level required for survival. The medium households in all user groups also gained income to some extent. Even for the rich households, income increased in 4 out of 6 user groups. This indicates that the incomes of many poor households could be increased above the minimum needed for survival under a policy of unconstrained community management.

Figure 1C shows household income under the lease policy. The income increase under the unconstrained lease policy alternative was greater than that under the unconstrained community use policy. Again, the greatest income increase was for poor households, ranging from 44% in the Suryamati group to 110% in the Banshkharka group. Medium-income households also increased their incomes almost in the same proportion. The greatest income increase for rich households was about 47% in the Banshkharka group but was almost zero in other groups.

FIGURES 1A–1C 1A: household incomes under current policy (NRs 72 = US$ 1.00). The Basic Need line is household income required to provide the minimum calorific intake and other non-food items essential for survival, estimated to be NRs 6725 (US$ 93) per person in 2003. 1B: household incomes under the unconstrained community use policy (NRs 72 = US$ 1.00). 1C: household incomes under the lease policy (NRs 72 = US$



In general, the results indicate that poor households could meet their survival income from a combination of farm and community forest resources if all policy constraints on land use were fully relaxed and user groups were allowed to maximize income. Except for the Khorthali and Bidur user groups, the incomes of poor households were above the minimum survival level. In the Khorthali user group, low productivity due to location in a high-altitude region and relatively less community forest area are the main reasons why incomes for poor households are still below survival levels. In the Bidur user group, relatively larger family sizes for poor households is one of the main reasons why incomes are insufficient for survival level. For both of these user groups, local resources are not sufficient to support these communities.

Employment

For each policy alternative, unemployment was calculated for rich, medium, and poor households. The community forest (Common) was also treated as a household that must employ labor to carry out community forest activities on the land it manages. Common practice is that members of Community Forest User Groups (CFUGs) are required to contribute some labor towards management of the community forest, and this is incorporated in the model. Labor demand for community forest management is the net demand after allowing for household contributions as part of their membership in the CFUG. Since each household type may have a labor surplus or deficit and thus either be employed by or employ labor from other households, there will also be a net unemployment level for the community as a whole (Net Community).

Figure 2A shows unemployment levels under current policy. There is a large variation in unemployment across user groups and across household income groups. However, in all user groups there was net unemployment in the community. In all cases, poor households faced the greatest unemployment, but even medium-income households are affected in most user groups. In the high-altitude Khorthali and Banshkharka user groups, even rich households face unemployment. A key factor for most user groups is that the direct employment contributions of the community forest are small.

The unemployment status under the unconstrained community use policy is shown in Figure 2B and under the unconstrained lease policy in Figure 2C. Under these policies there is no unemployment in any group except for the poor and medium-income households of the high-altitude Khorthali user group. Other than the Khorthali user group, communities now experience labor shortages. In most cases labor is employed for community forest work. The main difference between the unconstrained community use and unconstrained lease policies is that there is generally no labor shortage problem with the unconstrained lease policy.

In summary, under the current policy there is about 30% community unemployment. The unemployment of almost all user groups is reduced to zero under the unconstrained lease and unconstrained community use policy alternatives. The key difference

is that a labor deficit appears under the unconstrained community use policy but not under the unconstrained lease policy. The difference is determined by production costs in terms of labor requirements. More labor days are required for buying fodder, timber, and firewood from the community forest under the unconstrained community use policy than for individually producing and collecting it under the unconstrained lease policy.

Land use change

Land uses under the different policy scenarios are shown in Table 3. The area in all cases is a combination of private and community forest areas. In each case the area used totals less than 100%, with the residual being areas allocated to homestead use. Under current policy, land is generally allocated equally to either food or timber production. This reflects the focus on timber production in community forests under the current policy.

Under the unconstrained community use and unconstrained lease policies, there is a major shift in the use of community forest land from timber to fodder production. The main cause of this is that timber is the least profitable use and fodder production the most profitable. Log production on only a small proportion of the community forest is sufficient for all of the required household timber needs in the 5–8% of total area. Where there is still significant production of timber in some communities under the unconstrained lease policy, this is associated with a scarcity of labor that makes it infeasible to allocate more area to fodder production. The results also show substantial shifts in land use to firewood production in some user groups. This is generally related to the needs of poor households who have limited access to land and to the availability of fuels produced as a by-product of other activities.

Conclusions

This study examined the potential of community forestlands to increase income and employment in rural communities while ensuring sustainable use of the forests. This was done using a welfare maximization model that maintained conservation outcomes through explicit constraints on use of community forests which reflected particular production and environmental outcomes (eg agroforestry systems) while maximizing income. The essence of the problem is that the private landholdings of most rural households are insufficient to provide bare subsistence income and inadequate to utilize family labor. The results show that under current forest policy, community forestland has been over-allocated towards timber production relative to how user groups would allocate land to maximize income. To make communities better off, policies need to be changed so that communities can make decisions about the best mix of land use.

The results here show that user groups would shift to fodder production in community forests. An increase in fodder supplies from community forests increases livestock farming, which in turn increases household income, manure supply, and food production. This land use model is particularly beneficial in high-altitude and isolated communities where the incidence of food deficits and poverty is highest. In addi-

FIGURES 2A–2C 2A: household group unemployment rates under the current policy. 2B: unemployment rates under the unconstrained community use policy. 2C: household group unemployment rates under the lease policy.

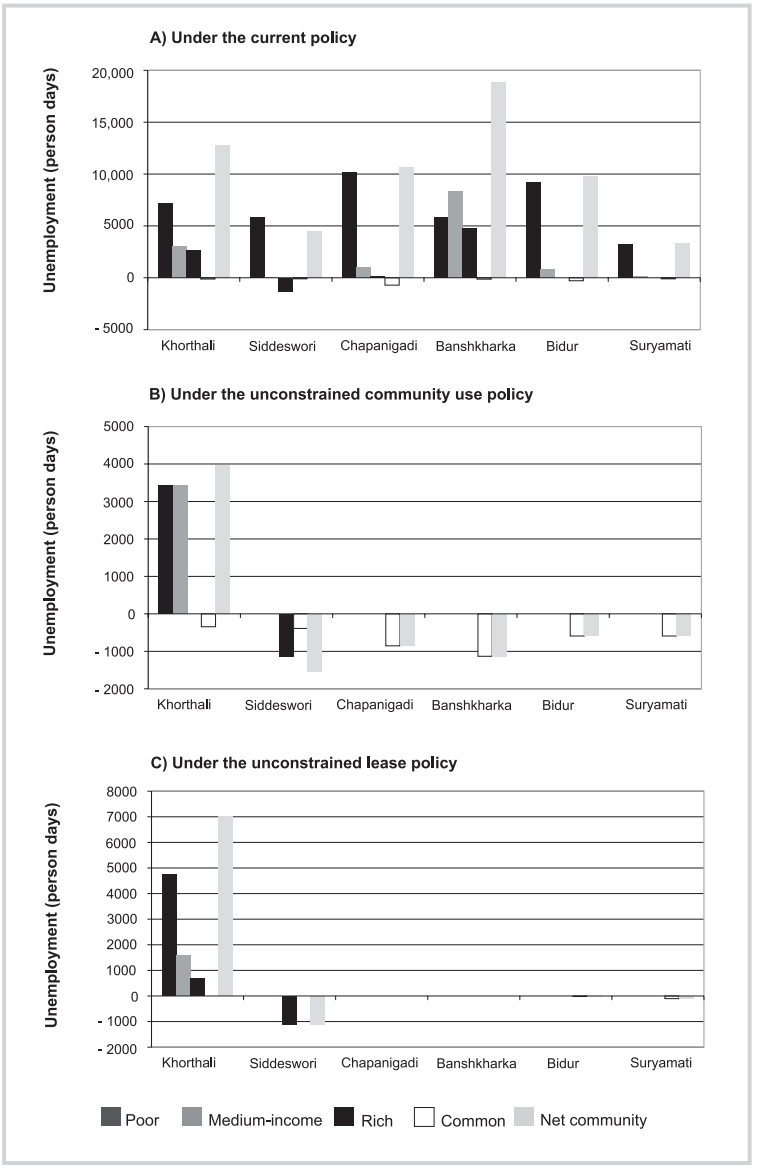


TABLE 3 Land use by product from the survey results, in percent (rounded to the nearest whole number).

User group	Uses	Policy			User group	Uses	Policy		
		Current	Unconstrained community	Lease			Current	Unconstrained community	Lease
Khorthali	Food	67	66	67	Banshkharka	Food	40	40	40
	Fodder	1	24	24		Fodder	6	53	46
	Firewood	0	0	0		Firewood	0	0	5
	Timber	31	8	8		Timber	52	6	7
	Total	**98**	**98**	98		**Total**	**99**	**98**	**98**
Siddeswori	Food	60	59	59	Bidur	Food	42	43	42
	Fodder	2	27	26		Fodder	1	44	35
	Firewood	4	5	6		Firewood	7	1	8
	Timber	32	7	7		Timber	48	11	13
	Total	**98**	**98**	**98**		**Total**	**98**	**99**	**98**
Chapanigadi	Food	47	47	47	Suryamati	Food	44	44	43
	Fodder	4	47	31		Fodder	4	43	28
	Firewood	0	0	4		Firewood	4	4	8
	Timber	48	5	17		Timber	47	8	19
	Total	**99**	**99**	**99**		**Total**	**98**	**98**	**98**

tion, fodder and firewood are collected daily—generally by women—and adequate supplies of these products could reduce women's workloads. Since fodder production is based on an agroforestry land use model, this change should have little effect on environmental services while increasing income and employment.

The implication of this study is that the restrictions on use of community forestland limit the potential to significantly meet local income and employment requirements, and in particular address the plight of the poorest households. To make socially disadvantaged people (women, high-altitude communities, and poor households) better off, the Nepalese government should consider at a minimum allowing communities unconstrained use of their community forests for agroforestry as well as timber uses. To have a much greater impact on rural unemployment, the government should consider a policy change that allows user groups to lease community forestlands to individual households based on their needs and ability to use land.

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AUTHORS

Bhubaneswor Dhakal, Hugh R. Bigsby, Ross Cullen
Lincoln University, Commerce Division, PO Box 84, 7647 Lincoln, Canterbury, New Zealand.
bhubaneswordhakal@gmail.com (B.D.); bigsbyh@lincoln.ac.nz (H.B.), cullenr@lincoln.ac.nz (R.C.)

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