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ARTICLE

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How understanding of rural households' diversity can inform agroforestry and community forestry programs in Nepal

E. Cedamon^a, I. Nuberg ^a and K. K. Shrestha^b

^aSchool of Agriculture, Food and Wine, The University of Adelaide, Urrbrae, South Australia; ^bSchool of Social Sciences, University of New South Wales, Sydney, NSW, Australia

ABSTRACT

Socio-economic diversity can help to bring about innovative development in agroforestry practices. The diversity of households in the mid-Nepal hills was analysed using survey data from 521 randomly selected households in six villages. A cluster analysis derived the following household typology based on socio-economic variables—Type 1: resource-poor Brahmin/Chhetri; Type 2: resource-poor Janajati; Type 3: resource-rich mixed-caste households; Type 4: resource-rich Brahmin/Chhetri; Type 5: resource-rich Janajati; Type 6: resource-poor Dalit households. The analysis revealed that social status (caste/ethnicity), household status on foreign employment and land-holding are strong predictors of household segmentation in rural Nepal. This paper suggests revision of existing wellbeing ranking approaches using these socio-economic variables for more inclusive and equitable agroforestry and community forestry outcomes.

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livelihoods

Introduction

Agroforestry and community forestry are important in sustaining livelihoods in rural Nepal. In the last two decades, agroforestry and community forestry programs and policies have given more emphasis to socio-economic diversity of rural Nepali society. With the ongoing social and economic changes in rural economies brought about largely by labour outmigration and remittances (Central Bureau of Statistics 2011a, 2011b; Tamang et al. 2014), it is now imperative to examine whether household classifications being used in agroforestry and community forestry projects are still relevant. If not, is there a novel classification system that might be more appropriate to achieve more inclusive and equitable development outcomes? This paper addresses this question by deriving a household typology in Nepal's mid-hills and then examining key household characteristics.

Many development programs in Nepal continue to classify households based on caste and ethnicity. Bennett et al. (2008) noted that the Shah rulers used the caste hierarchy in the seventeenth century as way of organising and consolidating a diverse population into a nation state. The 2011 Census of Population in Nepal reported 125 caste and ethnic groups (Central Bureau of Statistics 2011a). Pradhan and Shrestha (2005) suggested that one of the most common ways of classifying these groups is to cluster them in three major overlapping divisions: (i) the hierarchical caste structured groups (*jats*) and the egalitarian ethnic groups (*Janjatis*); (ii) the high caste or the ritually 'pure' castes and the low, ritually 'impure untouchable' castes (*Dalits*); and (iii) *Pahadis* and *Madhesis*. Bennett et al. (2008) developed seven major caste/ethnic groups namely: (1) Brahmin/Chhetri, (2) Tarai/Madhesi, (3) Dalits, (4) Newar, (5) Janajati, (6) Muslim and (7) other. Each group has further subdivisions based on geographic location, that is Hill or Tarai.

Natural resource management programs in many developing countries including Nepal have used wealth ranking in

their program design and implementation (Scoones 1995; Department of Forests 2014; Hariyo Ban Program undated). Community forestry programs in particular allocate resources to forest users groups based on self-rated wellbeing ranks—*well-off*, *middle income*, or *poor* (Department of Forests 2014; Hariyo Ban Program undated). With poverty alleviation and inclusion a main goal in community forestry in the last decade (Dressler et al. 2015), wellbeing ranking is central to community forestry planning and natural resource management (Hariyo Ban Program undated). Neupane et al. (2002), Gilmour et al. (2014) and Pandit et al. (2014) reported some use of wellbeing ranking in agroforestry programs.

The caste/ethnicity-based and wealth-rank based household classifications can be simple and straightforward but have raised concerns for projects that aim to be inclusive and equitable. There is some doubt about caste/ethnicity-based household classification as some caste/ethnic groups that are generally known to have been 'poor' may already be otherwise (and vice versa) due to socio-economic diversification. Wealth ranking, particularly participatory wellbeing ranking has also created inequitable distribution of community forest resources because rich households tend to underrate their wellbeing rank so as to benefit from subsidised timber prices for poorer households (Dhaka & Masuda 2009).

Another approach to household classification is to derive a household typology based on a number of household characteristics obtained primarily from household surveys. A household typology is defined as the summation of the characteristics of households wherein the summary is underpinned by the detailed information about these characteristics and the analysis of the relationship between them (Emtage et al. 2007a). Landholder or household typologies have been employed in developing natural resource management programs (Emtage et al. 2007b; Emtage & Herbohn 2012), forestry extension (Vanclay 2005), poverty alleviation programs (Agudelo et al. 2003), livestock development

programs (Maltsoglou & Taniguchi 2004) and agricultural policy (Briggeman et al. 2007; Bidogeza et al. 2009). Emtage et al. (2007b) provide an extensive list of authors who adopted household typologies to improve development programs in agriculture and forestry in the pre and early 2000s.

As nearly 83% of Nepal's population is rural (Central Bureau of Statistics 2011a), land and other farming assets are strong determinants for households' socio-economic wellbeing. In addition, remittances from family members working abroad and the non-farm economic sector have a strong influence on the economy of most households (Tamang et al. 2014). This paper addresses the following questions:

- Is it possible to generate a meaningful household typology based on farming and non-farming livelihood characteristics, and how does the household typology differ from household classification based on caste/ethnicity or wellbeing ranking?
- What are the key defining criteria for a household typology?
- What insights can researchers and policy-makers learn from a typology to advance the role of agroforestry and community forestry in rural development and sustainable natural resource management?

Method

This work was undertaken in the context of a five-year research project to enhance livelihoods and food security through agroforestry and community forestry in Nepal (EnLiFT Project, <http://enlift.forestation.org/>) funded by the Australian Centre of International Agricultural Research

(ACIAR). It draws on data from a quantitative baseline survey (EnLiFT Project 2014) conducted in 2013–2014 in six sites in the mid-hills districts of Kavre and Lamjung (Fig. 1). The survey sought household-level information on the themes household demographics, farming system, agroforestry, community forestry and under-utilised land. Table 1 summarises the questions covered in the baseline survey. Six hundred and sixty-eight households randomly selected from the listings of households of the village development committees of the six sites participated in the survey. The survey sample represents 0.54% of the population of the two districts. The survey data were collated and analysed in SPSS (SPSS 21 2012).

The household typology was derived using cluster analysis—a multivariate technique that classifies a sample of subjects using sets of measured variables into a number of different groups such that similar subjects are placed in the group (Everitt et al. 2010). The variables used for classifying the sample households were determined from consultation with agroforestry and community forestry experts in Nepal. This includes caste/ethnicity, whether or not the household has a member working abroad, annual household income, landholding, under-utilised land holding (land abandoned from cultivation for more than one year), livestock holding, labour force (≥ 15 years old) and relative tree density (trees per hectare). The number of livestock by type in each household was standardised to livestock units. The livestock unit was derived using the following conversion: Buffalo = 1 (Oli et al. 2015), adult cow or ox = 0.7, adult goat = 0.10, adult pig = 0.2 (Otte & Chilonda 2002), calf = 0.12 (assuming a weight of 15 kg, FAO 1999). The caste/ethnicity grouping of the baseline survey respondents was derived following the major caste/ethnic groups proposed by Bennett et al. (2008) based on the reported ethnicity or caste. The hill Brahmin/

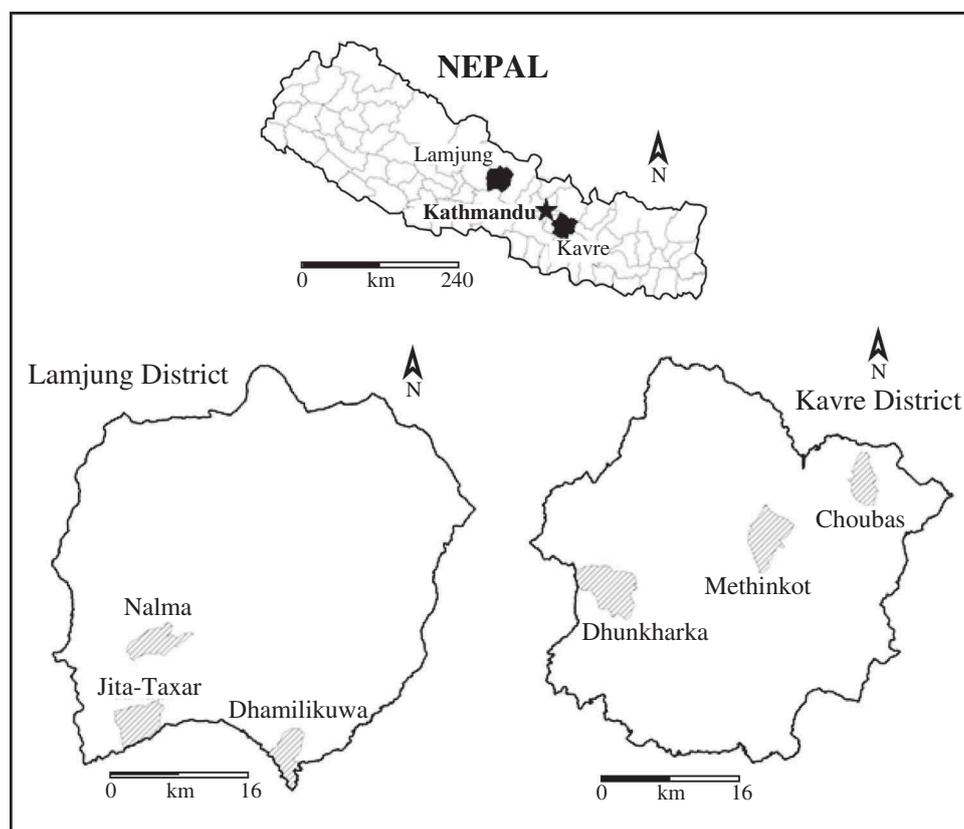


Figure 1. Composite maps of research sites.

Table 1. Summary of parameters covered in the household survey

<i>Household demographics</i>	
A.1. Location and key respondent information (village name, ward number, forestry office area, respondents name, caste, language spoken, family structure)	
A.2. Household information (for all household members the following information was obtained: name, sex, relationship to household head, marital status, educational attainment, main occupation in Nepal, is the household member overseas and if so for what purpose, has the household member been in Nepal for the last 3 months)	
<i>Farming and farming system</i>	
B.1. Land use and farming system (land area cultivated by land type—Khet, Bari, Pakho bari, Khar bari; who has legal ownership of the land; crops grown in the last 3–5 years)	
B.2. Food purchases (amount and type of food purchase)	
B.3. Farm inputs (amount of farm yard manure, livestock manure, chemical fertiliser, and others)	
B.4. Agroforestry crops (type of trees, grasses, agronomic crops grown)	
B.5. Livestock, products and revenue (number of animals by livestock type grown, products and revenue derived)	
B.6. Off-farm income (amount of income from various off-farm sources)	
B.7. Credit and finance (how much and from whom money was borrowed, attitudes to loans and investment)	
B.8. Organisation membership (roles and membership in community organisations)	
B.9. Self-assessed household wellbeing (respondents are asked to choose which of the wellbeing ranks best suit their socio-economic situation: well-off, non-poor, poor.)	
<i>Agroforestry</i>	
C.1. Agroforestry system (trees and non-timber forest products grown, location of these trees and NTFPs on the farm, production costs and revenues)	
C.2. Forage grasses and understorey crops (types and forage grasses and understorey crops grown, area planted and location of these crops)	
C.3. Agroforestry decision-making (household member who makes agroforestry decision)	
C.4. Agroforestry aspiration and problems (problems encountered in agroforestry and future plans)	
C.5. Agroforestry product collection (amount of agroforestry products collected by product type)	
C.6. Benefits and disincentives of agroforestry (perceptions in benefits and disincentives of agroforestry)	
<i>Community forestry</i>	
D.1. Community forestry (income derived from community forestry, products collected from community forests)	
D.2. Perception on well-being ranking as part of community forest management	
D.3. Benefits from participation in community forest management	
D.4. Perceptions and opinions on community forest issues	
<i>Under-utilised land</i>	
E. 1. Area, land type, products from under-utilised land	

Chhetri are the upper castes, Janajatis are the hill tribes including Newar, while Dalits are the lower caste.

In the first iteration of cluster analysis, missing data for the above variables were replaced with zeros except for total household income. In the second iteration all the above variables were used in clustering, but analysis of means reveals that there is little variation in highest educational level attained by households. Additionally, the economic wellbeing classes, derived from total household income, had a weaker effect on clustering than total household income. Therefore, the variable 'wellbeing classes' was deleted to improve the clustering result. The third and final iteration of cluster used all variables in Table 1 as inputs for clustering. The clustering technique standardised input data to the Z-scores of scale variables (see previous paragraph). The authors interviewed key informants and villagers to ground-truth the common sense of the household typology.

To test the common sense of the household typology, the authors examined the report created for cluster analysis by SPSS to determine the relative importance of the each variable used in the cluster analysis. Average values of the variables used in the cluster were derived for the household typology and household grouping by caste/ethnicity and wellbeing rank to examine whether there was an advantage of the typology over contemporary household classification. The livelihood activities, agroforestry practices, community forestry engagement and state of land under-utilisation by household types were then analysed. The survey sought ratings for the ease of access to wood products, fuelwood and grasses and litter. The rating was 1–5, a rating of 1 being strongly disagree, 3 moderately agree and 5 strongly agree; averages were calculated for each household type. Measures of central tendency (mean, median), frequencies and relative frequencies of respondents were calculated for key socio-economics variables, agroforestry practice, community forestry engagement, and status of land under-utilisation of household types.

Results

Criteria of the household typology

The cluster analysis determined the importance levels of the predictor variables in deriving the household typology. It was found that caste/ethnicity class was the strongest predictor with a predictor importance of 1 (Fig. 2). The second strongest predictor was status of the household of having a family member working overseas (foreign employment [yes, no]) with a predictor importance of 0.43 while land holding has predictor importance of 0.21. Other input variables, including under-utilised land holding, household income, livestock holdings, tree density and labour force showed low predictor rating in the cluster analysis, but these are important in refining differentiation of household types.

A typology was derived using only the top three predictors—caste/ethnicity, status of foreign employment, and landholdings—to test whether a realistic typology could be derived. This achieved the same number of clusters but inspection of the socio-economic profile of each cluster revealed that the clusters were less homogenous than those from the typology derived from broader socio-economic variables. This suggested that only when household characteristics like income, number of labour force, tree and livestock holdings were included in the cluster analysis that meaningful typology is achieved.

Typology of mid-hills households

The cluster analysis derived six household types from 521 sample households. These types are:

- Type 1: resource-poor Brahmin/Chhetri
- Type 2: resource-poor Janajati
- Type 3: resource-rich mixed-caste households
- Type 4: resource-rich Brahmin/Chhetri
- Type 5: resource-rich Janajati
- Type 6: resource-poor Dalit household

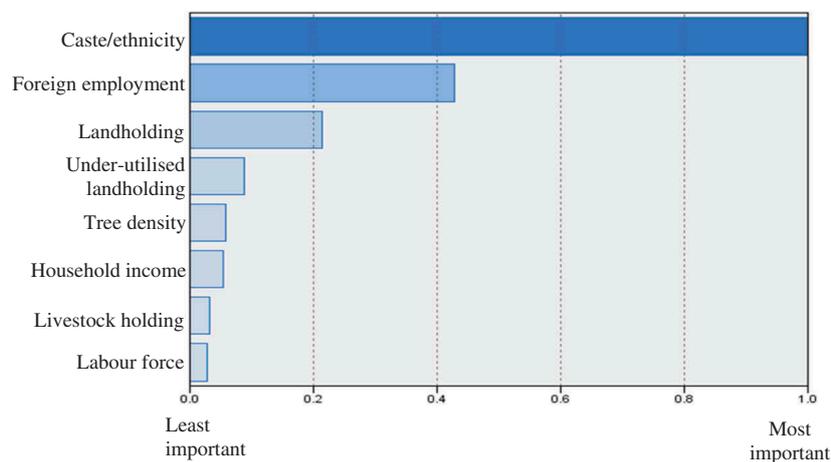


Figure 2. SPSS cluster analysis output showing variables' predictor importance.

An important feature of the typology is the dichotomy of castes in rural Nepal, that is resource-rich and resource-poor households across caste groups. This is expressed clearly in terms of the annual household income where households in the poor groups (Types 1 and 2) have only half the annual income of their richer counterparts (Type 3 and 4) (Table 3). Most of the Dalit households formed a distinct group (Type 6) although a small number which have higher income and landholdings had been classified as Type 3.

The distribution of households varied across household types with the resource-rich Brahmin/Chhetri being the largest group (Type 4, 24%) followed by resource rich Janajati (Type 5, 23%), then resource-poor Janajati (Type 2, 18%), followed by resource-poor Brahmin/Chhetri (Type 1, 17%), Dalit (Type 6, 14%) and the smallest group was the resource-rich mixed-caste group (Type 3, 3%). Type 3 has extremely high landholding and livestock holding but their annual income is around the average. This group can be easily construed as outliers but further discussion with key informants and villagers reveals that this particular group are generally the 'elite' who play crucial roles in development and natural resource management programs.

All household types except Type 3 exist in all research sites although the distribution varies, indicating intrinsic social differentiation or ethnic diversity (or homogeneity) of a particular site. In addition, some sites exhibit dominance of a particular caste/ethnicity group. For example, Site 6 has a high frequency of Types 2 and 5 indicating the relative dominance of Janajati households. Other household types are also present at Site 6 although at low numbers. Another example is Site 5 where there is a high frequency of Types 1, 4 and 6 indicating that this is a Brahmin/Chhetri-dominated community. All other sites have more or less balanced distribution of at least four household types.

Advantage of the household typology over contemporary household classification

Comparison of key livelihood characteristics of household typology found that it is superior to caste/ethnicity-based and wellbeing rank-based household classifications. The key advantage of the typology is it is better for deriving homogenous household groupings. Type 1 (resource-poor Brahmin/Chhetri) and Type 2 (resource-poor Janajati) are

groups distinct from their resource-rich counterparts due to their lack of foreign employment, low annual income, lower landholdings, and lower under-utilised land holdings (Table 1). These household types could otherwise be generalised as middle income and well-off households had caste/ethnicity been the basis for household classification. The self-rated wellbeing ranking and caste/ethnicity classifications underestimated the proportion of the poor in a community. The survey estimated that about 25% and 26% identified as poor households for wellbeing ranking and caste/ethnicity respectively whereas the typology estimated that about half of households are poor (Table 2) for each. Table 2 shows the power of including 'household foreign employment status' in household grouping where the difference between resource-poor and resource-rich Brahmin/Chhetri and Janajati is largely brought about by foreign employment. Additionally, Table 2 shows that typology without foreign workers have generally lower income than other groups. Conversely, the caste/ethnicity and self-rated hardly show the relationship of foreign employment to household economic because the proportions of households with foreign employment are around the median.

Livelihood activities

Pluriactivity

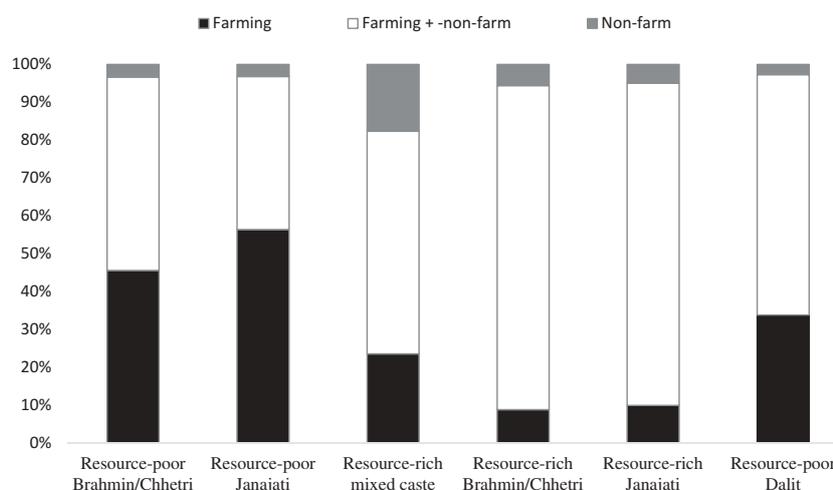
While many know that Nepal is an agricultural country, farming is never the sole occupation of rural people. As far as understanding the diversity of farming households in Nepal, it is also important to know the extent of pluriactivity in rural households. In simplest terms, pluriactivity is defined as combining agricultural activity with other economic activities (Fuller 1990) including farm-related enterprises and off-farm related activities. Figure 3 shows that most (67%) households have other livelihood activities in addition to farming while a small proportion of households (5%) are not engaged in farming. Notably, nearly half the poorer households (Types 1 and 2) and a third of the Dalits (Type 6) are engaged in farming as their sole occupation while less than 10% of the richer households (Type 4 and Type 5) are engaged solely in farming. Based on multiple response ($n = 351$) data, the other occupations of pluriactive farmers include government and non-government jobs (69%), national/foreign employment (33%), running own business (22%) and 3% in service or skilled jobs. From field observations

Table 2. Socio-economic characteristics of household types based on the typology and contemporary household classifications

Household groups	Proportion of respondents (%)	Proportion of respondents with foreign worker (%)	Average annual household income (NRs)	Average livestock holding (Livestock unit)	Average landholding (ha)	Average under-utilised landholding (ha)	Average tree holdings (trees)
Household type							
Resource-poor Brahmin/Chhetri	17	0	125 037	2.99	0.79	0.25	81
Resource-poor Janajati	18	0	115 783	2.55	0.66	0.27	85
Resource-rich mixed caste	3	53	171 152	13.89	4.11	1	665
Resource-rich Brahmin/Chhetri	24	100	274 279	2.76	0.83	0.29	157
Resource-rich Janajati	23	100	225 816	2.67	0.78	0.35	61
Resource-poor Dalit	14	57	135 039	2.48	0.37	0.21	26
Caste/ethnicity							
Brahmin/Chhetri	41	52	210 315	2.89	0.93	0.29	170
Janjati	33	54	167 513	3.24	0.94	0.36	77
Dalit	26	52	134 225	2.43	0.42	0.21	30
Self-rated wellbeing rank							
Well off	15	71	289 571	2.77	1.63	0.39	126
Non-poor	59	53	183 544	3.18	0.77	0.34	114
Poor	25	40	97 515	2.51	0.56	0.21	96
Not reported	1	50	260 715	2.58	0.98	0.3	25

Table 3. Frequency of households by location of trees by household type

Tree location	Resource-poor Brahmin/Chhetri	Resource-poor Janajati	Resource-rich mixed caste	Resource-rich Brahmin/Chhetri	Resource-rich Janajati	Resource-poor Dalit	All types
Terrace risers	40	33	5	47	59	43	227
Terrace risers and woodlots	27	31	10	37	37	10	152
Woodlots only	6	6	1	15	7	7	42
Other locations	5	9	1	11	9	4	39
No tree intercroppings	12	15	0	15	9	10	61
All tree locations	90	94	17	125	121	74	521


Figure 3. Frequency of households by household member occupation and by household type.

by the authors, pluriactive farmers are more advanced in farming practices compared with non-pluriactive.

The average and median annual household income of all respondents is NRs 178 986¹ and NRs 120 000 respectively, which is lower than the average national income for 2010–2011 of NRs 202 274 however; the median income is comparable to the national median of NRs 127 281 (Central Bureau of Statistics 2011b). This income comes from wages (agriculture and non-agriculture), net income from businesses including net income from agroforestry, wines sales, hotel/tourism income and remittances. Four household types (Type 1, Type 2, Type 3 and Type 6) comprising nearly half (52%) of the respondents have income below the national average.

Agroforestry practices

While the mid-Nepal hills area is composed of a mosaic of agroforestry, the scale of tree-crop integration and the agroforestry system practices are quite diverse among households in a given village. Type 3 households have the highest tree holdings (665) while Dalit ones have the lowest tree holdings (21) and the rest of the households have tree holdings ranging from 61 to 157 (Table 2). Most of the households surveyed have trees located on terrace risers. Type 6 (Dalit households) have the highest proportion of trees (58%) on terrace risers while most (59%) Type 3 households have a combination of terrace riser trees and woodlots (Table 3). Analysis of respondents' perception of the benefits of agroforestry revealed no differentiation between

¹ 1 US\$ = 104 NRs.

household types. Provision of fodder was reported by most (56%), followed by supply of timber and firewood (25%), convenience of not going to forest to collect fodder/litter (14%), general increase of income (13%) and soil protection (12%). All households raise livestock, with about 97% having an average livestock holding of between 2.48–2.99 livestock units but Type 3 having 13.89 livestock units.

Community forestry benefits, collective engagement and perception on community forestry leadership

The survey data revealed that generally respondents moderately to strongly agree that access to forest products is easy. The resource-rich mixed-caste group gave higher ratings for easy access to wood products, fuelwood and grass/leaf litter (Table 4). The Dalit group provided the lowest rating for easy access to these resources indicating that the existing governance system does not provide equitable access to these resources. Table 4 shows that the Janajati household groups have the lowest proportion of respondents who are familiar with community forestry policy (33–34%) whereas the resource-rich Brahmin/Chhetri have the highest proportion of respondents who are familiar with community forestry policy. Lastly, contrary to the knowledge earlier noted about Type 3 being the elite group, this group has the lowest (53%) participation in formulating local community forestry policies (Table 4).

Status of land under-utilisation

Abandonment or under-utilisation of agricultural land is now a common agrarian phenomenon in Nepal due to changing socio-economic conditions in rural areas. Analysis of the

survey data showed that 38% of survey respondents have under-utilised land where the median proportion of areas of under-utilised land to total landholdings ranges from 16 to 34% (Table 5). More than three quarters of the resource-rich mixed caste households have under-utilised land while Dalit households have the lowest proportion of respondents with under-utilised land. In terms of proportion of under-utilisation of land, Dalit households were found to have the highest proportion yet they have the lowest area of total landholdings. Conversely, the resource-rich mixed caste has shown the lowest proportion of 16% yet this group has the largest area of under-utilised land, the maximum area reported being 3.41 ha. The average area of under-utilised land was calculated for three land types, Khet, Bari and Kharbari (Fig. 4). It is to be noted the average values in Figure 4 are higher than the average under-utilised land reported in Table 1 because missing values for respondents who had not reported under-utilised lands were not included in the calculations of average under-utilised lands by land type as shown in Figure 4. It was found that among land types, Khet or irrigated land was the largest area of under-utilised for all households except resource-rich Brahmin/Chhetri (Fig. 4) and that the average under-utilised khet land was 0.29 ha to 0.61 hectares. The resource-rich mixed caste has the largest under-utilised khet while Dalit the lowest. The resource-rich mix caste had the largest under-utilised bari land with an average of 0.41 ha while the resource-rich Brahmin/Chhetri had the largest under-utilised Kharbari land. The main reasons for land being under-utilised are lack of labour for farming, wage costs,

Table 4. Respondents' rating on easy access to wood products, fuel wood and grass and leaf litter, relative frequency (%) of respondents who are aware of community forestry (CF) policy and relative frequency (%) of respondents who participated in policy making

Household type	Average rating on ease of access to wood products (1-strongly disagree, 5-strongly agree)	Average rating on ease of access to fuelwood (1-strongly disagree, 5-strongly agree)	Average rating on ease of access to grass and litter (1-strongly disagree, 5-strongly agree)	Relative frequency of respondent's awareness of community forestry policy (%)	Relative frequency of respondents who participated on policy-making (%)
Resource-poor Brahmin/Chhetri	3.4	3.7	3.9	44.4	65.6
Resource-poor Janajati	3.6	4.2	4.3	33.0	66.0
Resource-rich mixed caste	4.1	4.3	4.2	41.2	52.9
Resource-rich Brahmin/Chhetri	3.1	3.7	3.7	63.2	69.6
Resource-rich Janajati	3.4	4.0	4.0	34.7	56.2
Resource-poor Dalit	3.1	3.5	3.5	50.0	58.1

Table 5. Relative frequency and median rate of under-utilised land by household type

Household type	Relative frequency of respondents with under-utilised land (%)	Median proportion of under-utilised land (%)
Resource-poor Brahmin/Chhetri	39	27
Resource-poor Janajati	31	28
Resource-rich mixed caste	76	16
Resource-rich Brahmin/Chhetri	42	25
Resource-rich Janajati	41	32
Resource-poor Dalit	27	34

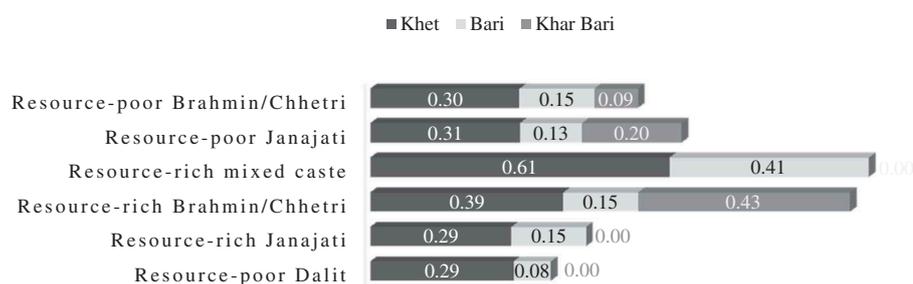


Figure 4. Average area (hectares) of under-utilised land by types and household type. Khet is irrigated land of generally flat to moderate slope, Bari is rainfed on rolling slopes, Khar bari is grassland and bushland on steep slopes).

unsuitability of land for cultivation and low land productivity. These reasons are common to all household types with more households from Type 3, Type 4 and Type 5 experience these problems.

Discussion

Understanding of the socio-economic diversity of farmers is important to bring about innovations and practices that are relevant to their needs. This paper identified six household types based on socio-economic variables, namely: Type 1—resource poor Brahmin/Chhetri; Type 2—resource poor Janajati; Type 3—resource rich mixed-caste households; Type 4—resource rich Brahmin/Chhetri; Type 5—resource rich Janajati; and Type 6—resource poor Dalit households. The strongest determinants of household type were caste/ethnicity class, the status of the household of having a family member working overseas, and land holdings.

The analysis showed that the household typology is potentially more useful than the typically-used caste/ethnicity and wellbeing ranking used in many rural development projects in Nepal. The typology has estimated that over half of rural households are poor, based on annual income. From the sample sample of households, the caste/ethnicity based classification and wellbeing ranking estimated the proportion of poor households to be about about a quarter, which is a gross underestimate. This implies that a household classification based on a number of household characteristics—as in this typology—should be used to ensure that a robust household grouping is achieved so that projects for poverty alleviation and inclusion can be carefully targeted.

The analysis of agroforestry systems by household type revealed that some household types practice a particular agroforestry system. Resource-rich households Types 3, 4 and 5 generally have terrace-based agroforestry and woodlots while majority of resource poor household types (Types 1, 2 and 6) are practising terraced-based systems only. Considering that trees are the main source of fodder for livestock, improving fodder productivity of the terrace-based system of the poorer households is an important agroforestry development opportunity. Conversely, given the high tree-holdings in richer households (Type 3 and Type 4) and the favourable market condition for privately-grown trees, these groups are highly likely to invest in expanding high density timber-based agroforestry. However, silviculture research is needed to provide landholder sound timber management advice. As more male household members go overseas for employment, agriculture in Nepal rural areas is becoming increasingly feminised. There is therefore a need to develop silviculture technologies that are responsive and sensitive to women's needs and capacity.

Community forestry has a strong emphasis on helping out the poor members of a forest user group by providing subsidies on timber purchased from community forests and generous allocation of community forestry resources such as timber, fuelwood, grass and forest litter, and cash. The typology has revealed that the wellbeing ranking being promulgated in the preparation of community forestry operation plans (Department of Forests 2014; Hariyo Ban Program undated) potentially underestimates the number of poor households, and therefore a considerable number of them are missing the benefits from community forestry. The majority of households with easy access to community

forestry resources in Hariyo Ban indicated that many households are not satisfied with the material provisions from community forests. This could be a result of poor household ranking. The Hariyo Ban Project (undated) advocated the use of the following criteria for participatory wellbeing ranking: *land holdings and other property, availability of food grains, education level of family members, family size, income from employment and remittance, social status within the community (caste system), and vulnerability to climate hazards*. This study suggests that the three household attributes—social status, household status through remittance and landholding can make wellbeing ranking easier yet more powerful in revealing homogenous household groups.

Land is an important resource to a rural household in Nepal and an important economic and social status symbol, but the agrarian sector is changing with increasing under-utilisation of agricultural land in recent years so that about two-fifths of households in villages have under-utilised land. This study found a high frequency of richer households having under-utilised land. Conversely, the study found that the Dalit group, who had the lowest landholding area, also had the highest proportion of under-utilised land. The high proportion of under-utilised land among Dalits is probably due to overseas employment. The fact that Dalits are the major supplier of agriculture labour in many rural villages has repercussions on land under-utilisation among other groups. The exodus of agriculture workers from villages causes labour scarcity and wage rises. Moreover, maintaining or improving the productivity of agricultural land has a greater role to play in achieving food security than it has in the past. Given that labour scarcity is the major driver for land under-utilisation, establishing high density and diversified timber-based agroforestry could be a solution, for example, intercropping of high-value crops under fast-growing and commercially-valuable timber could be a solution.

Conclusion

Socio-economic diversity can help to bring about innovative development in agroforestry practice. Using a household survey data, a typology of households in the mid-Nepal hills based on farming and non-farming characteristics was derived. Caste/ethnicity or social status, household status with respect to foreign employment and landholding are key predictors for household segmentation. This study suggests that households' wellbeing ranking currently used in community forestry and other related programs could be improved by rigorously using these three indicators in participatory wellbeing ranking exercises.

This paper argues that the typology is more powerful than the existing household classification system by being able to derive household groupings with more homogenous household characteristics. The typology has revealed important insights for agroforestry and community forestry programs particularly in achieving inclusive and equitable projects. While agroforestry and community forestry has been attentive to the dichotomous segmentation of rural household into rich and poor, this study suggests revisions of the existing wellbeing ranking approaches using these socio-economic variables has the potential to allow better targeting of agroforestry and community forestry programs to improve food security and poverty alleviation and allow for a more inclusive and equitable agroforestry and community forestry outcomes.

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ORCID

I. Nuberg  <http://orcid.org/0000-0003-1942-1190>

References

- Agudelo C, Rivera B, Tapasco J, Estrada R. 2003. Designing policies to reduce rural poverty and environmental degradation in a hillside zone of the Colombian Andes. *World Development*. 31:1921–1931.
- Bennett L, Dahal DR, Govindasamy P. 2008. Caste, ethnic and regional identity in Nepal: further analysis of the 2006 Nepal Demographic and Health Survey. Calverto777713333n. Maryland (USA): Macro International.
- Bidogeza J, Berentsen P, De Graaff J, Oude Lansink A. 2009. A typology of farm households for the Umutara Province in Rwanda. *Food Security*. 1:321–335.
- Briggeman B, Gray A, Morehart M, Baker T, Wilson C. 2007. A new US farm household typology: implications for agricultural policy. *Review of Agricultural Economics*. 29:765–782.
- Central Bureau of Statistics. 2011a. National population and housing census 2011 (national report) volume 1. Kathmandu: Central Bureau of Statistics.
- Central Bureau of Statistics. 2011b. Nepal living standards survey 2010–2011, statistical report volume 2. Kathmandu: Central Bureau of Statistics.
- Department of Forests. 2014. Guidelines of community forestry 22 July 2014. Kathmandu: Community Forestry Division, Department of Forests.
- Dhakal M, Masuda M. 2009. Local pricing system of forest products and its relations to equitable benefit sharing and livelihood improvement in the lowland community forestry program in Nepal. *Forest Policy and Economics*. 11:221–229.
- Dressler W, McDermott M, Schusser C. 2015. The politics of community forestry in a global age—a critical analysis. *Forest Policy and Economics*. 58:1–4.
- Emtage N, Herbohn H, Harrison S. 2007b. Landholder typologies in the development of natural resource management programs in Australia: a review. *Australasian Journal of Environmental Management*. 13:79–94.
- Emtage N, Herbohn J. 2012. Assessing rural landholders diversity in the Wet Tropics region of Queensland, Australia in relation to natural resource management programs: a market segmentation approach. *Agricultural Systems*. 110:107–118.
- Emtage N, Herbohn J, Harrison S. 2007a. Landholder profiling and typologies for natural resource-management policy and program support: potential and constraints. *Environmental Management*. 40:481–492.
- EnLiFT Project. 2014. Baseline quantitative survey research. Final report. SEARCH Nepal unpublished.
- Everitt B, Landau S, Leese M, Stahl D. 2010. *Cluster analysis*. 5th ed. New York (NY): John Wiley & Sons.
- FAO. 1999. Tropical livestock unit: livestock and environment tool box [Internet]. [cited 2015 Jun 1]. Available from: <http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/Mixed1/TLU.htm>.
- Fuller A. 1990. From part-time farming to pluriactivity: a decade of change in rural Europe. *Journal of Rural Studies*. 6:361–373.
- Gilmour D, Pradhan U, Malla Y, Bartlett T, Finlayson R, Shah R. 2014. Enhancing livelihoods and food security from agroforestry and community forestry systems in Nepal: current status, trends and future directions. Johari R, ed. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program; Kathmandu: International Union for Conservation of Nature—Nepal; Canberra: Australian Centre for International Agricultural Research (ACIAR).
- Hariyo Ban Program. undated. Internal governance tool 2, participatory wellbeing ranking (PWBR) [Internet]. [cited 2017 Apr 10]. Available from: http://d2ouvy59p0dg6k.cloudfront.net/downloads/toolkit_2_pwbr.pdf.
- Maltsoglou I, Taniguchi K. 2004. Poverty, livestock and household typologies in Nepal, ESA [Internet]. Working Paper No. 04-15 June 2004. Rome: Food and Agriculture Organization. [cited 2014 Oct 30]. Available from: <http://ageconsearch.umn.edu/bitstream/23808/1/wp040015.pdf>.
- Neupane R, Sharma K, Thapa G. 2002. Adoption of agroforestry in the hills of Nepal: a logistic regression analysis. *Agricultural Systems*. 72:177–196.
- Oli B, Treue T, Larsen H. 2015. Socio-economic determinants of growing trees on farms in the middle-hills of Nepal. *Agroforestry Systems*. 89:765–777.
- Otte M, Chilonda P. 2002. Cattle and ruminant production systems in sub-Saharan Africa: a systematic review. Rome: Food and Agriculture Organisation. [cited 2015 Jun 25]. Available from: <ftp://ftp.fao.org/docrep/fao/005/y4176E/y4176E00.pdf>.
- Pandit B, Shrestha K, Bhattarai S. 2014. Sustainable local livelihood through enhancing agroforestry systems in Nepal. *Journal of Forest and Livelihood*. 12:47–63.
- Pradhan R, Shrestha A. 2005. Ethnic and caste diversity: implications for development. Working paper series No. 4. Kathmandu: Nepal Resident Mission, Asian Development Bank.
- Scoones I. 1995. Investigating difference: applications of wealth ranking and household survey approaches among farming households in Southern Zimbabwe. *Development and Change*. 26:67–88.
- SPSS 21. 2012. IBM SPSS statistics V21.0.0 documentation [Internet]. Accessed 21 June 2017. Available from: https://www.ibm.com/support/knowledgecenter/SSLVMB_21.0.0/com.ibm.spss.statistics_21.kc.doc/pv_welcome.html.
- Tamang S, Paudel K, Shrestha K. 2014. Feminization of agriculture and its implications for food security in rural Nepal. *Journal of Forest and Livelihood*. 12:20–32.
- Vanclay J. 2005. Using typology of tree growers to guide forestry extension. *Annals of Tropical Research*. 27:97–103.