# Socioeconomic Determinants of Livelihood Dependence on Forestry Resources in Leh Himalaya, India


## Abstract

A comprehensive understanding of the underlying socioeconomic determinants is crucial for the implementation of forestry interventions in the Indian arid region, particularly in cold deserts. This study investigated the socioeconomic determinants of livelihood dependence on forestry resources in Leh Himalaya, India. Using a multi-stage random sampling technique, the data were gathered from 185 sample families selected from five blocks and nine chosen villages. Descriptive and analytical statistics were used to analyze the data. The findings showed that out of the twelve socioeconomic determinants, ten factors, including education (0.536), social participation (0.604), family composition (0.592), size of land holding (0.554), housing status (0.688), possession of livestock (0.711), main occupation (0.521), wealth status (0.427), and annual income (0.570), exhibited a significant positive correlation with livelihoods based on forestry resources, while urban closeness (-0.678) demonstrated a significant negative correlation. The coefficient of determination ($R^2$) of multiple regression analysis is 0.865, implying that all the socioeconomic variables jointly explained 86.50% of the variation in the forestry resource-based livelihood. The F value (92.12) indicated that the $R^2$ is statistically significant ($p < 0.05$). Prioritizing socioeconomic upliftment and livelihood diversification through strengthening forestry interventions is an effective strategy for poverty alleviation for downtrodden people. The characterization of the socioeconomic determinants of forestry-based livelihoods for farmers will be the basis for the planning and implementation of forestry programmes for forestry resource production and livelihood diversification in the Leh district of Ladakh.



**Keywords:** Socioeconomic determinants, livelihoods, forestry resources, Leh, Himalaya, India.


## 1. Introduction

The local communities of Leh district in Ladakh Union territory depend on forestry resources substantially as a common thread in all aspects of life, including birth, marriage, livelihood, and death [1]. Forestry resources are a are a vital component of the district's residents' survival and progress. Forestry resources have a significant role in alleviating poverty in marginalized rural communities by supporting a variety of livelihoods, including sustainable human development, food security, income, and health [2]. The district's forestry resources are used for a wide range of purposes and provide a significant source of livelihoods for the locals, in addition to playing a vital role in environmental amelioration. They also serve as a vital source of employment, income, shelter, materials for housing, cloth, decoration, fuel, fodder, grazing, timber, food, vegetables, medicines, fertilizer, fibre, floss, oilseed, cottage industries, handicrafts, etc. [3]. The Leh district still possesses traditional and ancient expertise regarding the use of forestry resources. The district's rural inhabitants face numerous

challenges, including exploitation, ignorance, superstitions, addictions, poverty, malnourishment, and illiteracy, in addition to socially, educationally, economically, and politically backwardness [4,5]. Their customs, traditions, cultural identities, and methods of living are intricately linked to the nature. The district has excessive unemployment and underemployment, which results in poor household income and a wretched existence. The district's local communities rely heavily on the forestry resources for their livelihoods [1]. In Ladakh's Leh district, the traditional way of life is heavily reliant on the forestry resources. The integration of forestry resource development with agricultural and industrial advancement holds significant potential to improve food security, livelihood security, and reduce poverty for marginalized groups in society, such as the illiterate, unskilled, resource-poor, jobless, landless, and labourers [3].

The combined social and economic standing of an individual or group with respect to other members of society is known as their socioeconomic status [6]. They are crucial in influencing a person's ability to access shared resources, options for a living, sources of income, food security, etc. [7]. They also influence human psychological behaviours, such as knowledge, attitudes, perceptions, adoption, change-proneness, aspirational level, risk-taking capacity, and economic motivation, etc. [8]. A multitude of social and economic factors interact to shape families' forestry adoption and dependence on forestry interventions [9]. Although the majority of the local population depends on agriculture to provide food and a living for their families, forestry activities significantly help their safety nets, income, and subsistence. Agroforestry, homestead plantations, woodlots, roadside plantations, bund plantations, village forestry, community forestry, green manuring, etc. are a few forestry practices that offer increased yield, return, appropriate use of natural resources, sustainable livelihood security, and enrichment of food and nutrition [10]. The adoption of forestry techniques is not reliant on an accurate assessment of their potential to improve livelihoods. People's adoption of forestry interventions and livelihood dependence is significantly influenced by a few key socioeconomic factors. Given that forestry farmers live in a complex, varied, and risky environment, research on their socioeconomic determinants is crucial. The potential value of socioeconomic determinants guiding the adoption of forestry programmes and livelihood dependence, either for household production or their marketing, is often underestimated or unknown. In light of these facts, the current study aims to characterize the socioeconomic conditions for forestry farmers in the Leh district of Ladakh, as well as to explore the socioeconomic determinants of livelihood dependency on forestry resources.

## 2. Materials and Methods

### 2.1 Description of study locale

Leh district (Fig. 1) is one of the coldest and highest inhabited regions in the world, with 112 inhabited villages and one uninhibited village at an altitude ranging from 2900 to 5900 metres [11]. With an area of

45110 sq. km, it is likely the largest district in the nation. The district is located at an elevation of between 2300 and 500 metres above sea level, approximately between 32- and 36-degrees north latitude and 75- and 80-degrees east longitude. The district is bordered to the west by Pakistan-occupied Kashmir, to the east and north by China, and to the south by the Laquan Spite of Himachal Pradesh. The district is located 474 km from Manali (HP) and 434 miles from Srinagar. Geographically, the district is entirely mountainous, featuring three parallel Himalayan mountains. The district is divided into nine (9) blocks: Leh, Chuchot, Panamic, Saspol, Khru, Nyoma, Durbok, and Nubra. The Leh district is cut off from the rest of the nation for half of the year due to excessive early precipitation (snow) caused by its high altitude and geographic location. Since the Zojila and Rotang passes are closed due to severe winter snowfall, the area continues to be inaccessible from both Srinagar and Himachal Pradesh. The human population of Leh district is 117232 [12]. The density of population is 3 people per sq. km. One of the areas on Earth with the lowest population density is the Leh district. The population is divided into 76.70% rural areas and roughly 23.30% semi-urban areas. The working population is mostly employed in domestic industry, employment in agriculture, and other occupations. The district's principal development organization was established in September 1995 and is known as the Ladakh Autonomous Hill Development Council.

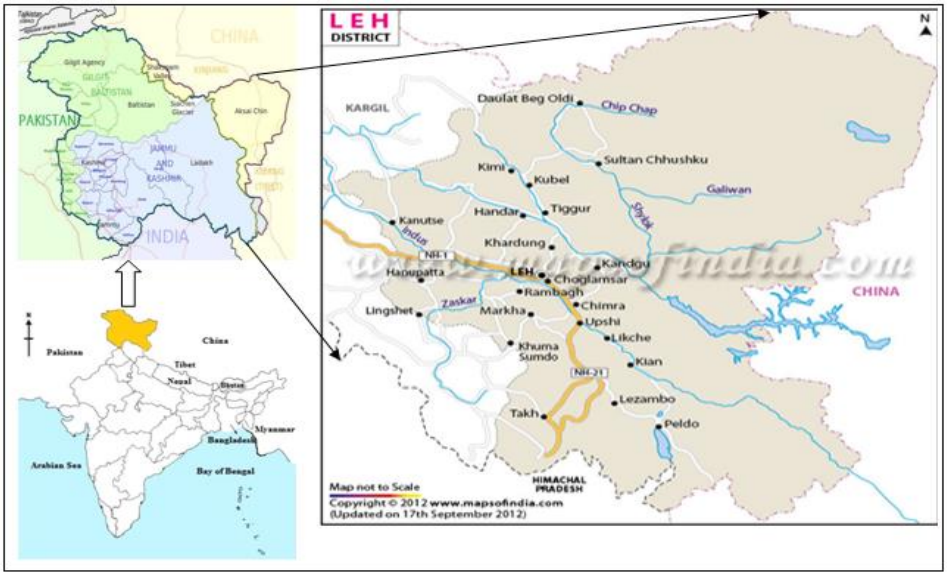


**Fig. 1.** Location map of the study area

### 2.2 Sampling technique and Sample

The current investigation was carried out in the Ladakh Union Territory's Leh area. The villages and the respondents were chosen using a multi-stage random sampling technique [13]. The first phase was the random selection of five (5) blocks from the Leh district: Leh, Nyoma Chochot, Panamic, and Khaltsi. The second phase involved random sampling of ten (10) villages, viz., Saboo from Leh Block,

Chumathang and Mud from Nyoma Block, Stakna and Nang from Chochot Block, Lakjung and Panamic from Panamic Block, and Dha, Lamayuru, and Nurla from Khaltsi Block. In the third phase, 185 households in total were selected using a simple random selection technique for the field study, with a sampling intensity of 15% from the sample villages. The interviewees were either the head of the household or the oldest family members. The flow chart, shown in Fig. 2 below, summarizes the procedure used to choose the samples.

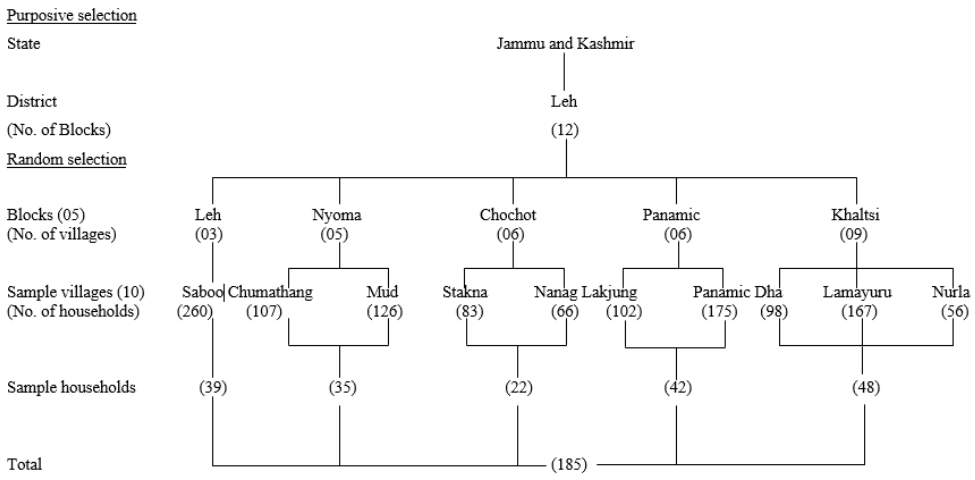


**Fig. 2.** Sampling procedure

### 2.3 Data collection

The current study used both qualitative and quantitative methodologies to accomplish its research goals. Primary field surveys as well as secondary sources were used to gather data. Structured interviews with specific respondents and non-participant observations were utilized as primary sources [14]. Secondary sources included documentation from several governmental and non-governmental organizations, literature from journals, records from the forest department, records from the village, the internet, earlier studies, annual reports, and other relevant materials. The primary data were collected at the household level, whereas the secondary data were collected at the block, village, and household/individual level.

#### 2.3.1 Structured interview

Primary data were collected by means of in-person interviews with respondents using a pre-tested, well-structured interview schedule conducted at the household level. A reconnaissance assessment of the research region, conversations with locals, expert consultation, and the literature cited were all used to establish the interview schedule for the household survey. The structured interview schedule was used to gather data regarding the socioeconomic determinants of the populace that impact the adoption of forestry practices and livelihoods reliance on forestry resources in the area. Thus, the data produced by these methods were utilized to investigate the relationship between socioeconomic determinants and livelihoods

reliance on forestry resources in order to provide measures to stay up with the area's current development and upcoming issues.

### 2.3.2 Non-participant observation

The basis for the qualitative analysis was firsthand observation and conversation with the respondents. The use of this technique made it possible to interact with the respondents directly, observe their behaviour in a realistic setting, and research the situation-based characteristics of behaviour.

### 2.4 Data analysis

To summarize the socioeconomic determinants of the forestry farmers and assess their impacts on forestry resource-based livelihoods, descriptive and analytical statistics were employed, such as frequency (f), percentage (%), average (x), standard error, range, correlation, and regression analysis [15].

## 3. Results and Discussion

### 3.1 Factors influencing the livelihood dependency on forestry resources

Factors influencing the forestry resource exploitation averaged for the sample population (Table 2) indicated the preponderance of middle-aged heads (45.57), schedule caste (1.47), primary literate people (3.05), having nuclear large-sized families (3.02), marginal-sized landholding (1.48), mixed house type with three rooms (6.36), owning 5–10 livestock (2.09), engaged mainly in agriculture and petty business (3.20), moderate wealth status (21.35), earning a gross annual income of 61521.08 and having an urban closeness of 11.75 km. The study's results indicated that the local communities, despite living in resource-rich areas, are underprivileged in every way, as evidenced by their low socioeconomic characteristics. Leh district has greater possibility and ability to succeed in the field of forestry farming, according to the overall assessment of the socioeconomic conditions of forestry farmers.

**Table 1:** Descriptive statistics of factors influencing the forestry resources exploitation in the locality (N=185)

| Factors (Code) | Mean | Std. Dev. | Minimum | Maximum | 95% Confidence Interval for Mean | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Age ($X_1$) | 45.57 | 15.31 | 21 | 81 | 43.35 | 47.80 |
| Education ($X_2$) | 3.05 | 1.49 | 0 | 6 | 2.83 | 3.27 |
| Caste ($X_3$) | 1.47 | 0.84 | 1 | 4 | 1.34 | 1.59 |
| Social participation ($X_4$) | 1.74 | 1.17 | 0 | 4 | 1.56 | 1.91 |
| Family composition ($X_5$) | 3.02 | 0.76 | 2 | 4 | 2.91 | 3.13 |
| Size of land holding ($X_6$) | 1.48 | 0.72 | 1 | 4 | 1.37 | 1.58 |
| Housing status ($X_7$) | 6.36 | 1.43 | 2 | 8 | 6.15 | 6.57 |
| Livestock possession ($X_8$) | 2.09 | 0.82 | 0 | 3 | 1.97 | 2.21 |
| Main occupation ($X_9$) | 3.20 | 1.58 | 1 | 6 | 2.97 | 3.43 |
| Wealth status ($X_{10}$) | 21.35 | 7.86 | 10 | 38 | 20.21 | 22.49 |
| Annual income ($X_{11}$) | 61521.08 | 23904.06 | 20000 | 140000 | 58053.71 | 64988.44 |
| Urban closeness ($X_{12}$) | 11.75 | 6.25 | 1 | 32 | 10.84 | 12.65 |

### 3.2 Correlation Analysis

The coefficients of correlation (r) were worked out to ascertain the relationship between the various socio-economic variables and forestry resource-based livelihoods. The results (Table 2) depicted that out of twelve socio-economic variables, ten attributes, viz., education (0.536), social participation (0.604), family composition (0.592), size of land holding (0.554), housing status (0.688), livestock possession (0.711), main occupation (0.521), wealth status (0.427), and annual income (0.570), exhibited a positive and significant correlation with forestry resource-based livelihoods, whereas urban closeness (-0.678) has shown a negatively significant correlation. The variables, namely, age (0.119) and caste (0.157), have shown a non-significant relationship with forestry resource-based livelihoods.

**Table 2:** Correlation of household variables with the forestry resources-based livelihood (N=185)

| **Household variables (Code)** | **Co-efficient of correlation (r)** | **p-value** |
|---|---|---|
| Age ($X_1$) | 0.119 | 0.107* |
| Education ($X_2$) | 0.536 | 0.000** |
| Caste ($X_3$) | 0.157 | 0.033* |
| Social participation ($X_4$) | 0.604 | 0.000** |
| Family composition ($X_5$) | 0.592 | 0.000** |
| Size of land holding ($X_6$) | 0.554 | 0.000** |
| Housing status ($X_7$) | 0.688 | 0.000** |
| Livestock possession ($X_8$) | 0.711 | 0.000** |
| Main occupation ($X_9$) | 0.521 | 0.000** |
| Wealth status ($X_{10}$) | 0.427 | 0.000** |
| Annual income ($X_{11}$) | 0.570 | 0.000** |
| Urban closeness ($X_{12}$) | -0.678 | 0.000** |

*Note:- *= non-significant; **= significant ($p<0.05$)*

The positively significant correlation between education and forestry resources-based livelihood is well uttered by the facts that education results in bringing desirable changes in human behaviour and helps the individual to move in the right direction [16], knowledge is built up through education, which makes the person aware of new innovations [8], and the change in attitude is partly a function of education [17]. The social participation of the local people paves the way for sharing their views and experiences with other members of the organization [18], clarifying their doubts and getting opinions from different people, and enriching their knowledge [7]. The positive and significant relationship of family composition with the livelihood dependency on forestry resources could be attributed to the fact that the local people, being an important member of their nuclear family, might have taken up independent decisions regarding any matter concerning the livelihood generation for their family [19], and the larger-sized families had more livelihood diversification and opportunities, resulting in a higher livelihood dependency on forestry resources [6].

The economic attributes, viz., size of land holding, livestock possession, main occupation, and annual income of the local people, exhibited a direct bearing on the household economy [20], facilitating the possession of livelihood assets. That's why the higher the magnitudes of these characteristics, the higher

will be forestry resources-based livelihood. Housing status and wealth status are the major indicators of physical capital possessed by the local people [21], and physical capital is a core contributor, a major part, and the representative of the livelihood dependency on forestry resources [22]. Hence, these characteristics have contributed positively and significantly to the livelihood dependency on forestry resources. The significant negative correlation of urban closeness with forestry resource-based livelihood can be explained by the fact that the higher the urban closeness, the higher the non-farm livelihood opportunities available to households and vice versa [23]. Thus, the people with lower urban closeness have more dependency on forestry resources for income and employment opportunities than the people living in the areas closer to the urban settlements. The involvement of local people of different age groups in livelihood earnings was more or less similar, indicating that the variations in age have no influence at all on the livelihood dependency on forestry resources [24]. The heterogeneity of caste has no differential impact on the livelihood dependency on forestry resources in the local households because the people belonged to unstratified, undifferentiated, and unhierarchic societies with similar patterns of life style, livelihood options, socioeconomic, biophysical, religio-cultural, and political backgrounds.

**3.3 Multiple regression analysis**

The multiple regression analysis was computed to delineate the impact of household variables on forestry resource-based livelihoods. The values of regression coefficients for the explanatory variables (Table 3) were, age (7.867), education (93.156), caste (912.727), social participation (1234.933), family composition (-1524.973), size of land holding (1570.535), housing status (512.271), livestock possession (2026.842), main occupation (-65.967), wealth status (-163.454), annual income (0.095), and urban closeness (-328.815). When the calculated 't' values were compared with the table 't' values, it was found that the variables viz., education (3.285), social participation (6.496), family composition (2.780), size of land holding (3.489), livestock possession (5.797), annual income (8.008), and urban closeness (-7.657) were statistically significant in influencing the forestry resource-based livelihoods. The coefficient of determination ($R^2$) of 0.865 implies that all the socio-economic variables jointly explained 86.50% of the variation in the forestry resource-based livelihood. The F value (92.12) indicated that the $R^2$ is statistically significant ($p < 0.05$). The fitted multiple regression equation for forestry resource-based livelihood should be written as:

$$Y = 3490.78 + 7.867X_1 + 93.156X_2 + 912.727X_3 + 1234.933X_4 - 1524.973X_5 + 1570.535X_6 + 512.271X_7 + 2026.842X_8 - 65.967X_9 - 163.454X_{10} + 0.095X_{11} - 328.815X_{12}$$

Where, Y = Forestry resources-based livelihood (₹/household/annum)

$X_1 - X_{12}$ = Household characteristics

**Table 3:** Multiple regression analysis of household variables with the forestry resources-based livelihood (N=185)

| Household variables (Code) | Regression co-efficient (b) | Standard error of 'b' | B | 't' value |
|---|---|---|---|---|
| Age ($X_1$) | 7.867 | 17.990 | 0.022 | 0.437 |
| Education ($X_2$) | 93.156 | 203.075 | 0.025 | 3.285* |
| Caste ($X_3$) | 912.727 | 277.888 | 0.138 | 0.459 |
| Social participation ($X_4$) | 1234.933 | 190.093 | 0.262 | 6.496* |
| Family composition ($X_5$) | -1524.973 | 562.371 | -0.211 | 2.780* |
| Size of land holding ($X_6$) | 1570.535 | 450.079 | 0.205 | 3.489* |
| Housing status ($X_7$) | 512.271 | 184.261 | 0.133 | -2.712 |
| Livestock possession ($X_8$) | 2026.842 | 349.612 | 0.300 | 5.797* |
| Main occupation ($X_9$) | -65.967 | 158.142 | -0.019 | -0.417 |
| Wealth status ($X_{10}$) | -163.454 | 56.156 | -0.232 | -2.911 |
| Annual income ($X_{11}$) | 0.095 | 0.012 | 0.410 | 8.008* |
| Urban closeness ($X_{12}$) | -328.815 | 42.944 | -0.371 | -7.657* |

$_a$ = 3490.78 F = 92.12* $R^2$ = 0.865 Multiple R = 0.930 Adjusted $R^2$ = 0.856

* = *Significant at 5% level of probability*

The analysis of 't' values of the regression coefficient indicated that among the twelve socioeconomic characteristics of the local people, seven variables, viz., education, social participation, family composition, size of land holding, livestock possession, annual income, and urban closeness, had a significant contribution to the forestry-based livelihoods and were the potential predictors in explaining the variation in the level of livelihood dependency on forestry resources. Education plays a key role in awareness enrichment, improvement in technical know-how, decision-making, motivation, and livelihood promotion. Social participation is the prime input for forestry resource production, collection, protection, management, processing, consumption, and marketing [17]. The family composition of the local people has direct influences on their present necessities and future expectations, possible achievement, socioeconomic soundness, household food, and livelihood security. Land holding, livestock possession, and gross annual income are the prominent economic resources that have direct linkages with forestry-based livelihoods. Urban closeness is the crucial variable having a direct negative impact on forestry resource-based livelihoods; hence, families with higher custodianship of this variable could arrange a considerable size of non-farm-based livelihoods, whereas families devoid of these variables were least involved in the non-farm-based livelihoods. Several studies [6, 7, 8, 17, 18, 22, 23, 24] emphasize that household drivers are important actors in forestry resource dependence for livelihood security.

## 4. Conclusion

The analysis of the socioeconomic characteristics of the local people indicated that they are in a deprived position in all respects. Hence, there is an urgent need to improve their quality of life through forestry interventions through judicious use of existing resources. The livelihood security from forestry resources depends on a multitude of household socioeconomic factors like education, social participation, family composition, size of land holding, housing status, livestock possession, main occupation, wealth status, annual income, and urban closeness, which are the major predictors of forestry-based livelihoods. The socioeconomic characteristics having a significant impact on forestry resource-based livelihoods should

be given due consideration during the planning, implementation, and execution of specific strategies for improving and strengthening forestry resource-based livelihoods. This study will help identify the best target local population to boost the efficient adoption and implementation of forestry interventions. Further, the household socioeconomic conditions of forestry farmers specified in the study are important to understand the extent of the benefits that local communities accrue from forestry interventions.

**Conflict of Interest Statement**

The authors declare that they have no potential conflicts of interest, whether financial or non-financial.

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