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Potential of NTFP Based Bioeconomy in Livelihood Security and Income Inequality Mitigation in Kashmir Himalayas

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Abstract: The contribution of non timber forest products (NTFPs) has been acknowledged globally for their role in conservation, income generation, livelihood improvement and rural development. The potential of a NTFP-based bioeconomy has given a new dimension to the forest sector, and NTFPs are now considered favourably by the resource rich developing economies. The actual contribution of NTFPs has never been adequately estimated due to lack of sufficient baseline information on extraction, consumption patterns and traded quantities in Kashmir, India. Complicated management frameworks and fragmented value chains have eclipsed their diverse social life cycle in Kashmir. Therefore the present study investigates the bioeconomic transformation, livelihood contribution, income inequality mitigation and determinant socioeconomic factors of NTFP extraction in the Kashmir Himalayas. A multistage random sampling technique was employed to collect data through participatory household-based surveys from different villages. Data were collected through structured in-depth interviews, non-participant observation and focussed group discussions. Descriptive and analytical statistics were used for data analysis. The Lorenz curve and Gini index were used to evaluate the influence of household NTFP incomes on income inequality mitigation, and econometric models were developed to identify key factors that influence the level of household income from NTFPs to determine their potential for supporting livelihood security and bioeconomy in the region.

Keywords: NTFP; NWFP; Kashmir Himalayas; bioeconomy; livelihood; income inequality; Lorenz curve; Gini coefficient

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1. Introduction

The term non-timber forest products (NTFPs) and allied terms such as "minor", "secondary" and non-wood forest products have emerged as umbrella expressions for a range of plant and animal resources other than timber (or wood, in the case of non-wood forest products) derived from forests or forest species. DeBeer and McDermot in 1989 [1] defined NTFPs as all the biological materials, other than timber, extracted from forests for human use. This definition excludes minerals and includes fuelwood, bamboo and animal products. By contrast, the FAO in 1999 defined non-wood forest products (NWFPs) as "goods of biological origin other than wood that are derived from forests as well as other wooded land that also includes trees outside forests" [2].The FAO's 2015 Forest Resource

Assessment [3] suggests that NWFPs are "Goods derived from forests that are tangible and physical objects of biological origin other than wood", in order to increase consistency in country reportings. In India, researchers have defined the products obtained from plants of forest origin, as well as insects, animals, animal parts and items of mineral origin except timber, as minor forest products (MFPs) or NTFPs or NWFPs [4]. The Indian constitution, the central policy "National Forest Policy 1988" and "The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006" use the term MFPs. However, variations of this term, such as secondary or NTFPs, are now more frequently used by international and national organisations, governments, foresters and academics, depending on the requirements as well as objectives. Hence, for the objective and scope of this study, we have used the term non-timber forest products (NTFPs).

NTFPs have played an essential role in sustaining the livelihoods, income generation, food and nutritional security, fuelwood, fodder and traditional medicine as subsistence support to the rural communities since time immemorial [5–7]. Around 1.6 billion people throughout the world are reported to consume and trade NTFPs [8]. About 80% people across developing countries are reported to use plants for nutritional security [9] and traditional medicine [10]. More than two billion people use biomass-based fuels, mostly fuelwood for cooking and heating purposes [11]. NTFPs comprise a significant component of food security in the developing countries, and communities consume them more for subsistence than trade, as NTFPs are considered a relevant safety net and economic buffer [12] to support them during agricultural shortfalls or lean periods [13].

Research on the role of NTFPs in income generation and rural livelihoods has greatly increased in the last few decades, and has been reported to contribute to 20–60% of the rural household income [9,14] of forest fringe communities globally. In India, the annual contribution of NTFPs to income corresponds to US$2.7 billion, supporting more than 55% of the total employment in the forest sector. One third of India's rural population is reported to derive substantial household incomes from NTFPs [15]. More than 60% population of the Jammu and Kashmir (J&K) UT of India harvests NTFPs for food, nutrition, medicine, income and employment generation purposes [16,17].

The renewed interest in the management of NTFPs has improved extensively due to their significant contribution to addressing income inequality mitigation and supporting sustainable development. Conservative estimates indicate that a large portion of total forest products' value comes from NTFPs, although the magnitude of this value may vary from site to site. In diversified value chains, NTFPs provide medicine, aroma, spices, flavours, phytonutrients and nutritional variety in contemporary diets.

Despite maximum local consumption, trade and poor representation of details in national and international statistics [10,18–20], NTFPs are being increasingly recognized for their significant roles in supporting local and state economies. Comprehensive investigation into the dynamics of NTFPs in rural livelihoods, as well as trends of production, collection, consumption, trade and sustainability, are essential. In order to enhance the local subsistence as well as to support regional bioeconomy with NTFPs, it is important to examine the site-specific potential of different NTFPs. This means that site-specific assessments regarding the consumption patterns and potential of NTFPs with a greater focus on forest-based livelihoods are crucial and relevant. Moreover, the collection, consumption and trade of freely available forest-based NTFPs are influenced by the context and site-specific household characteristics. Among household characteristics, gender and age are more important than numbers. Therefore, this study was conceived to understand the synergy of local community households' dependency on these resources, as well as to understand the links with adaptation to various stresses and the potential contribution to bioeconomy.

1.1. NTFPs in Income Inequality Mitigation

Poverty has been described as an evident deprivation in well-being or living below a defined threshold of income [21]. However, forest fringe communities living in poverty

are particularly vulnerable to adverse events beyond their control. They are often treated badly by the state, system and society, and are excluded from voice as well as power [21,22]. Poverty is a complex material scarcity, lack of access to basic needs (education, health, nutrition and food security), absence of political autonomy, lack of freedom of choice and effect of social inequality, among others. In addition, the occurrence of poverty and the intensity and extent of inequality—i.e., the distribution of income between the poor and rich—also helps in differentiation [22].

The livelihoods of forest-dependent communities are intrinsically delicate and exposed to an array of jolts and seasonal instability; hence, rural households maintain diversified livelihood approaches, such as the harvesting and trade of NTFPs, for both subsistence and cash income. The significance of NTFPs to the livelihood of marginalized communities can help offset inequalities [23]. Forest fringe communities do not have sufficient productive lands or access to formal employment opportunities, which forces them to extract NTFPs for subsistence consumption and income generation. Incomes from NTFPs are most important to poor and less educated people compared to rich and educated people [23], having substantial use within the households. The contribution of NTFPs to rural households and local economies is ignored by poverty estimation surveys, due to insufficient information on their income-balancing impact of reducing inequalities among rural households. Hence, NTFPs are not adequately considered in the poverty reduction strategies of most developing and underdeveloped countries, as poverty analysis based on income or material use discounts the role of forests [9].

With the onset of gloomy economic circumstances due to increasing population, demand for food, water and healthcare requirements, resource exhaustion and climate-induced disasters, bioeconomy is expected to provide opportunities for environment-friendly raw material sourcing, mainly based on renewable and recycled resources. The forest vis-à-vis NTFP sector is an efficient renewable bioresource base for meeting the growing demands, if managed sustainably. The increasing consumer demand for diversified bioactive compounds extracted from various NTFPs for pharmaceutical, nutraceutical, cosmeceutical, food and beverage industries can transform local economies into a bioeconomy. In bioresource-rich countries, NTFPs are more relevant to forest fringe communities for income generation, livelihood improvement and modelling the rural development by promoting new bio-products through the NTFP-based bioeconomy. Despite the huge dependence of rural people on NTFPs in India, there is little emphasis in its national policies and research priorities on the forest bioeconomy. However, a bioeconomy created through biotechnological transformations of the energy and pharmaceutical sectors has been envisioned by the Ministry of Science and Technology of the Government of India [16].

1.2. Closing the Data Gaps: On NTFP-Based Livelihood for Bioeconomy

Feeding a growing world population sustainably is a key challenge for the 21st century and is well acknowledged and highlighted by the United Nations Sustainable Development Goals of 2015. Bioeconomy has gained urgency due to financial crisis, inflation and loss of livelihoods caused by pandemics, resource exhaustion and fossil-fuel-induced climate change. Bio-based products are innovative elements of a bioeconomy, and can materialize only if the flow of resources in the economy is well understood. Given the fact that most forest products are consumed by local households, and do not enter the formal markets, very little is known about the value of these products contributing to the bioeconomy. Only wood and its supply chain are accounted for and considered as essential pillars of a forest-based bioeconomy. Globally, NTFPs have played a vital role in ensuring human well-being, by efficiently supporting local livelihoods, businesses, culture and indigenous practices through the diversification of income from formal as well as informal forest sectors, such as trees outside forests. However, NTFP-based production systems, management as well as value chains fall within a very diverse set of socio-ecological and socio-economic complexities. This results in crucial challenges as well as opportunities that require attention, to explore and understand the importance of NTFPs to bioeconomies and human wellbeing,

and to harness their potential—from the local level to supporting international sustainable development goals. Moreover, most of the NTFPs and wild edibles consumed and traded by local communities are never formally reported or accounted for. The actual contribution of forest products to livelihoods is difficult to understand without better data [24]. The potential role of NTFPs in income diversification and uplifting rural economies has been hindered by the lack of clear baseline data, analytical frameworks and inclusive value chains in India. Despite their significance to trade, NTFP markets are mostly informal and scattered, with no formal records maintained, leading to an inadequate information flow on the contribution of NTFP trade at the local as well as national level. Hence, NTFP are poorly acknowledged, despite their significant contribution to local income and livelihood generation [25]. Data on the valuation of NTFPs, as well as their entry in government records for production and exports, are also limited and inconsistent in India [26].

Proper NTFP management offers a sustainable basis for livelihoods once diversified and developed as tradable products. Various studies have proved that NTFP production has contributed to higher-than-average income compared to the national income [27] if managed sustainably. The development of NTFPs or NTFP-based value-added products could improve the living standards of several local communities if promoted and facilitated through transformations of local economies into bioeconomies. However, the literature on bioeconomy has focussed more on the technological aspects of developing new biobased products and the policy process that supports transition to bioeconomy [16,27]. There is insufficient information to demonstrate the impact of biobased products vis-à-vis NTFPs on local livelihood upliftment and economic benefits. Therefore, there is a significant data gap to investigate and understand the impact of NTFPs on local livelihoods and the potential impacts of local economies largely on bioeconomies.

The contemporary biobased industry offers tremendous opportunities for indigenous people and local communities by endorsing products that are consistent with, and acceptable to, traditional ways of life, values and cultures. This can help with the creation of sustainable and culturally meaningful employment in local communities. Moreover, indigenous people and local communities are familiar with, and skilled at, identifying, harvesting and using NTFPs; hence, they are well-suited to this type of work [28]. Once all of these varied forms of income generation are considered, the value of NTFPs could increase significantly [29]. Therefore, accurate baseline data on the potential value and contribution of NTFPs to local communities at the household level may significantly help with designing appropriate policy interventions. Collecting such information is also critical to understand the importance of NTFPs to protecting indigenous and traditional cultural values and practices.

1.3. Research Aim

The Kashmir part of the Indian Himalayan Region (IHR) is a unique mountain ecosystem which harbours rich floral, faunal and cultural diversity, in addition to the largest source of freshwater resources harnessed by both India and Pakistan. The forests of the region have diverse NTFPs, with a substantial contribution to its rural livelihood and local economy. Hence, the present study attempted to analyse the determinant factors that influence the extent of households' dependence on NTFPs for their livelihoods and income generation. We also attempted to categorise the potential of NTFPs to mitigate income inequality. The study aimed to address the following questions:

- What is the role of NTFPs in household subsistence and income generation in supporting a bioeconomy?
- How do different sources of income and socio-economic factors influence the contribution of NTFPs to the livelihood strategies of households?
- What is the potential impact of the local economy on the bioeconomy?

2. Materials and Methods

2.1. Study Site Description

This study was conducted in the Langate Forest Division in the frontier district of the Kupwara, Jammu and Kashmir (J&K) Union Territory (UT) of India (Figure 1). The Langate Forest Division is situated between the northern latitude at 34°13′ to 34°30′ and eastern longitude at 73°56′ to 74°26′, with an altitudinal range of 1590 to 4308 m asl (meters above sea level). However, the principal forest cover extends up to 3500 m asl only in the dominant eastern aspect. This area faces severe cold during winter and pleasant weather during summer months. The temperature ranges between −5 °C minimum in winter and up to 22 °C maximum during summers; while the mean annual rainfall is 1270 mm. This area has temperate, sub-alpine and alpine climatic conditions with rich biodiversity, including many rare species of NTFP, such as *Morchella esculenta, Aconitum heterophyllum, Saussurea lappa, Taxus wallichiana* and *Trillium govanianum*, among others. Out of the total geographical area (2744 km^2), district Kupwara has about 1534.52 km^2 (55.92%) of forest, of which 760.06 km^2 is very dense, 423.61 km^2 is moderately dense and 350.85 km^2 is open forest [30]. According to the 2011 census, district Kupwara has a population of around 875,564, of which 776,322 people live in rural areas and 99,242 people live in urban settings.

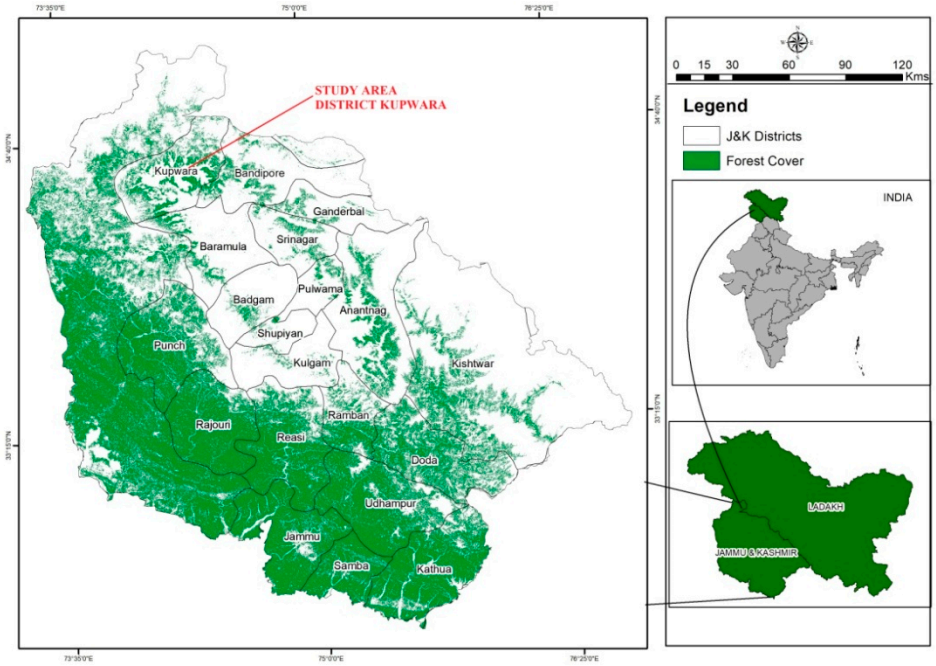

Figure 1. Location map of the study area. Raw image source: APA format, Landsat-8 (USGS Earth Explorer). Time period: January–February 2021 [31].

2.2. Methodology

The purpose of the household survey was to map the availability of NTFPs, livelihood dependency of people on NTFPs, economic valuation, current extraction, consumption patterns, prioritization and usage patterns.

2.2.1. Sampling Procedure

A multistage sampling technique [32] was used to select the ranges and villages from Langate Forest Division. In the first stage, out of the four forest ranges in the division, two prominent forest ranges (i.e., Mawar and Rajwar), having the maximum forest cover and forest fringe villages, were selected for this study after a proper reconnaissance survey. As the target groups selected for the household interviews were people living in closer proximity to the forests; therefore, at the second stage, ten sample villages, five villages from each range, were selected on the basis of livelihood (forest/agriculture), dependency on

NTFPs, density of forest, ratio of forest-dependent population and proximity of household to forests. At the third stage, a total of one hundred households extracting, consuming and selling NTFPs were selected randomly, which was 8% of the total households in each village (Table 1). Household heads or eldest members of the families were considered for focussed and in-depth interviews, as they are generally the main earners, decision makers and future planners of the households' transactions.

Table 1. Sampling framework and sample size distribution in the study area.

S. No.	Range	Village	Sampling Frame	Sample Size	Sampling Intensity
1.	Rajwar	Dardahaji	100	8	8%
2.	Rajwar	Satkhoji	389	31	8%
3.	Rajwar	Briniyal	100	8	8%
4.	Rajwar	Uthroosa	90	7	8%
5.	Rajwar	Shilthara	68	6	8%
6.	Mawar	Reshwari	60	5	8%
7.	Mawar	Puthwari	75	6	8%
8.	Mawar	Monabal	90	7	8%
9.	Mawar	Lahikot	126	10	8%
10.	Mawar	Bandi	146	12	8%
Total	2	10	1244	100	8%

2.2.2. Data Collection

The data were collected from the sample households through interviews using a structured interview schedule and focussed group discussions guided by a checklist of questions [33]. The questions asked through the interview schedule included socioeconomic characteristics of households; the collection, consumption and trade of NTFPs; the quantity of NTFPs marketed, various sources of household income; and the economic contribution of NTFPs. The socioeconomic variables of the households included age, education level, social membership, household size, household labour, farm size, livestock ownership, main occupation, wealth status, gross annual income, proximity to forest and forest visits. The variables were measured using a socioeconomic status scale [34] after modification. The focussed group discussions were held with 10–12 participants, including village elders with good knowledge of the identification and use of NTFPs. The observations extracted from the focussed group discussions were used to triangulate and validate the data collected through the household surveys, and also to interpret the results and draw inferences.

2.2.3. Data Analysis

Descriptive statistics including the percentage, average, standard deviation and range [35] were applied to summarize the socioeconomic characteristics; NTFP collection; and the consumption, trade, income generation and contribution of NTFPs to household incomes. The Lorenz curve [36] and Gini coefficient [37] were applied to evaluate the distribution of household NTFP incomes and their impact on income inequality mitigation [38]. The Lorenz curve was generated in MS Excel by drawing a line chart with cumulative share of population on the horizontal axis and cumulative share of income on the vertical axis. The Gini coefficient was calculated using the following formula:

$$G = A/A + B = 2A = 1 - 2B \quad (1)$$

where

G is Gini coefficient

A is an area between the line of perfect equality and the Lorenz curve

B is the area under the Lorenz curve

The data collected in terms of local units were converted into International System Units (ISU) and analysed using statistical analytical package SPSS Ver. 21.0. The results are displayed through various tables and graphs.

2.2.4. Analytical Framework

Multiple regression analysis [39] determined the socioeconomic variables that influenced the household NTFP incomes. It was hypothesized that household NTFP income is inextricably influenced by the socioeconomic characteristics of the household. Here, the household NTFP income was the regress and socioeconomic characteristics were the regressors. The b-values in the analysis were the impact multipliers, which explain the magnitude of the effect of the unit change on the quantity of a household NTFP income. The conceptual model based on the multivariate function is given below:

$$Y = a + b_1x_1 + b_2x_2 + \ldots + b_{10}x_{10} + e \quad (2)$$

where Y is the household NTFP income (INR/year, also indicated in USD);

x_1–x_{10} are socioeconomic characteristics; a is the constant or intercept; b_1–b_{10} are regression coefficients and e is an error term.

3. Results

3.1. Diversity and Use Pattern of NTFPs

The use pattern of NTFPs was characterised by a range of factors, including the access to resources, diversity of species available in the nearby forest areas and availability of markets. However, the use pattern varied from area to area and even between households within a village or community. Therefore, the NTFPs extracted by local community households were classified into different categories based on the use pattern (Table 2) of each species (for example, medicine, fuelwood, fodder, vegetable, spice or wild fruit), and part harvested (leaves, fruits, fruiting body, roots or stem). The investigation further revealed that around 50 species of NTFPs distributed across 36 families (Figure 2) were used by the households of the study area for different purposes. Among these, 65% were herbs, 17% were trees, 12% were shrubs, 4% were fungi and 2% were climbers (Figure 3). Apparently, the tubers, roots, rhizomes (28%), and leaves (28%) were the highest-exploited parts, followed by fruits and seeds (8%), bark (8%) and the whole plants and branches (6% each); other parts, such as flowers, nuts, wickers and fruiting bodies, were the least-exploited parts (Figure 4). As the use categories of the species were concerned, about 23 species were used for medicines; 11 for vegetables; 5 for fuelwood; 4 species each for fodder, wild fruit and spice; and 3 species for wicker (Figure 5).

Table 2. Diversity and use pattern of NTFPs in the study area.

S.No.	Species/Habit	Family	Local Name	English/Common Name	Part Used	Uses
1.	*Abies pindrow* Royle (tree)	Pinaceae	Budul	Himalayan fir	Branch/bark	Fuel wood
2.	*Achillea millefolium* Linn(herb)	Compositae	Berguer	Yarrow	Leaf	Medicine
3.	*Aconitum heterophyllum* Wall (herb)	Ranunculaceae	Atis	Aconite	Tuber	Medicine
4.	*Acorus calamus* Linn (herb)	Araceae	Vai	Sweetflag	Rhizome	Medicine
5.	*Allium humile* Kunth (herb)	Amaryllidaceae	Jangli-piaz	Allium	Whole plant	Vegetable/spice
6.	*Angelica glauca* Edgew. (herb)	Apiaceae	Chohore	Angelica	Root	Medicine/spice
7.	*Arnebia benthamii* Wall ex G. Don (herb)	Boraginaceae	Kahzaban	Arnebia	inflorescence/root	Medicine
8.	*Artemisia absinthium* Linn (herb)	Asteraceae	Tethwan	Artimisia	Leaf, flower	Medicine

Table 2. *Cont.*

S.No.	Species/Habit	Family	Local Name	English/Common Name	Part Used	Uses
9.	*Atropa accuminata* Royle ex Lindl (herb)	Solanaceae	Jal-kafal	Atropa	Root, leaf	Medicine
10.	*Berberis lycium* Royle (shrub)	Berberidaceae	Kawdach	Berberis	Root/fruit	Medicine
11.	*Bergenia ciliata* (Haw.) Sternb (herb)	Saxifragaceae	Zakhmi-hayat	Berginia	Root/whole plant	Medicine
12.	*Betula utilis* D.Don (tree)	Betulaceae	Burza	Birch	Leaf, bark	Medicine
13.	*Bunium persicum* (Boiss). Fedts (herb)	Apiaceae	Kala zeera	Cumin	Seed	Spice
14.	*Capsella bursa-pastoris* (L.) Medic (herb)	Brassicaceae	Kralmond	Shepherds purse	Leaf	Vegetable
15.	*Castanea sativa* Mill (tree)	Fagaceae	Gour	Sweet chestnut	Nut	Wild fruits
16.	*Cedrus deodara* G.Don. (tree)	Pinaceae	Deodar	Himalayan cedar	Branch/bark	Fuel wood
17.	*Cichorium intybus* Linn. (herb)	Asteraceae	Kasini	Chicory	Whole plant	Vegetable
18.	*Corylus jacquemontii* Decne (shrub)	Betulaceae	Hazel nut	Indian tree hazel	Nut/leaf	Wild fruits
19.	*Dactylis glomerata* Linn. (herb)	Poaceae	Ghass	Orchard grass	Leaf	Fodder
20.	*Dioscorea deltoidea* Wall. ex Griseb (climber)	Dioscoreaceae	Krish	Dioscoria	Tuber	Medicine
21.	*Diplazium esculentum* (Retz.) Sw. (herb)	Athyriaceae	Kasrod/Dade	Vegetable fern	Leaf	Vegetable
22.	*Dipsacus inermis* Wall. (herb)	Caprifoliaceae	Wopalhakh	Himalayan teasel	Leaf	Vegetable
23.	*Fritillaria roylei* Hook. (herb)	Lilaceae	Sheedkhar	Himalayan fritillary	Bulb	Medicine
24.	*Helvella crispa* (Scop.) Fr. (fungi)	Helvellaceae	Shajkan	Common helvel	Fruiting body	Vegetable
25.	*Indigofera heterantha* Wall ex. Brandis (shrub)	Fabaceae	Krats	Himalayan indigo	Wicker/leaf	Wicker/kangri making
26.	*Inula racemosa* Hook. f. (herb)	Compositae	Poshkarmool	Inula	Root	Medicine
27.	*Juglans regia* Linn. (tree)	Juglandaceae	Doon	Walnut	Nut/branch/bark	Wild fruits
28.	*Jurinea dolomiaea* Boiss. (herb)	Asteraceae	Guggal	Jurinea	Root	Medicine
29.	*Mentha longifolia* Linn. (herb)	Lamiaceae	Pudina	Wild mint	Leaf	Spice/medicine
30.	*Morchella esculenta* (Linn.) Pers. (fungi)	Morchellaceae	Guchi	Wild Morel	Fruiting body	Vegetable
31.	*Origanum vulgare* Linn. (herb)	Lamiaceae	Wanbaber	Oregano	Leaf	Medicine
32.	*Parrotiopsis jacquemontiana* (Decne) Rehd (shrub)	Hamamelidaceae	Pohu	Parrotia	Wicker/leaf	Wicker for kangri making/fodder
33.	*Picrorhiza kurrooa* Royle ex Benth (herb)	Scrophulariaceae	Kutki	Picrorhiza	Rhizome	Medicine
34.	*Pinus wallichiana* A.B. Jacks (tree)	Pinaceae	Kail	Blue pine	Branch/bark	Fuel wood
35.	*Plantago lanceolata* Linn (herb)	Plantaginaceae	Gul	Plantago	Leaf	Vegetable

Table 2. *Cont.*

S.No.	Species/Habit	Family	Local Name	English/Common Name	Part Used	Uses
36.	*Poa pratensis* Linn (herb)	Poaceae	Ghass	Meadow grass	Leaf	Fodder
37.	*Podophyllum hexandrum* Royle (herb)	Podophyllaceae	Wanwangun	Podophyllum	Root/fruit	Medicine
38.	*Polygonatum verticillatum* Linn (herb)	Liliaceae	Salam-mishri	Polygonatum	Root	Medicine
39.	*Punica granatum* Linn (tree)	Lythraceae	Anar	Pomegranate	Fruit	Wild Fruit
40.	*Rosa webbiana* Wallich ex Royle (shrub)	Rosaceae	Jangli-gulab	Wild rose	Flower	Medicine
41.	*Rheum webbianum* Royle (herb)	Polygonaceae	Pambhaakh	Himalayan rhubarb	Leaf/root	Vegetable/ Medicine
42.	*Rumex nepalensis* Spreng (herb)	Polygonaceae	Obej	Dock	Leaf	Vegetable
43.	*Salix alba* Linn (tree)	Salicaceae	Vir	Salix	Wicker/leaf	Wicker/Kangri making/Fodder/Fuelwood
44.	*Saussurea costus* C.B. Clarke (herb)	Asteraceae	Kuth	Costus	Root	Medicine
45.	*Taraxacum officinale* Weber (herb)	Compositae	Handh	Taraxacum	Whole plant	Vegetable
46.	*Thymus serpyllum* Linn (shrub)	Lamiaceae	Javend	Thyme	Leaf	Spice
47.	*Trillium govanianum* Wall. ex. D. Don (herb)	Melanthiaceae	Tripatri	Himalayan trillium	Root	Medicine
48.	*Valeriana jatamansi* Jones (herb)	Valerianaceae	Mushkbala	Valeriana	Root	Medicine
49.	*Viola odorata* Linn (herb)	Violaceae	Bunafsha	Viola	Flower	Medicine
50.	*Ziziphus jujube* (L.) Mill (tree)	Rhamnaceae	Breyi	Common jujube	Fruit	Medicine

3.2. Household Socioeconomic Variables

The results of this study revealed that the NTFP collectors were between the age group of 20 to 84 years, with mean age of 48.84 years. The middle-aged people were generally economically active, hard-working and the main earner group of the society. The mean score of the education level of the NTFP collectors was 1.55, which is equivalent to the primary school level. To understand the literacy rate in the area, six categories were defined, which ranged from illiterate, below primary, primary school, middle school, high school and graduation and above. The literacy levels in terms of formal education were observed to be quite low. The prevalence of low literacy among NTFP collectors was due to the remoteness of the area, lack of higher educational facilities, low socio-economic conditions and higher involvement of young people in livelihood earnings. The proportion of uneducated persons was found to be higher than that of other categories. The mean social membership of the NTFP collectors was only 1.33, which indicates that they had membership of at least one organization; the majority of the NTFP collectors had no social memberships. Low social participation shows a grousing magnitude of interest and willingness of the NTFP collectors towards membership in various formal and informal organisations. The mean value (1.68) of the household family size indicates that the NTFP collectors had a household composition or number of family members above five. Considering children as added assets, a need for family labour and a lack of knowledge of family planning are the key reasons for large families. The majority of the sampled households contributed as workers, with a mean of 3.13 workers per household.

This proved that a considerable number of workers in the surveyed households accounted for the large quantity of extraction, consumption and marketing of NTFPs. The larger section of NTFP collectors were marginal and small landholders, with a mean landholding size of only 1.68 ha. Almost all the sampled households possessed livestock. The mean value of the livestock unit (2.29) shows that they owned livestock ranging from 5 to 10 per household. The mean score of the main occupation was 3.27, indicating that agriculture was the prevalent main occupation among the sampled households. The main occupations to compensate the household income were both wage labour and non-farm labour (NTFP collection). Agriculture and allied activities, such as the cultivation of vegetables and fruits, constitute a considerable proportion of the livelihood portfolio of the households. The NTFP collectors were mostly poor, with a very low wealth status with a mean of only 1.40. This clearly indicates widespread poverty in the forest fringe villages around the study area. The gross annual income of the NTFP collectors ranged from INR 5400.00 (USD 71.93) to INR 309,523.00 (USD 4122.99) with a mean of INR 67,122.44 (USD 894.09). The majority of the NTFP collectors had a significantly low income status. The NTFP collectors lived very close to forests and had to walk around only 0.30 to 1.90 km. The sampled households would frequently visit forests, with a mean of 1.52 visits (Table 3). People living closer to the forest had a higher dependency on NTFPs to meet their daily livelihood needs, which implies frequent forest visits.

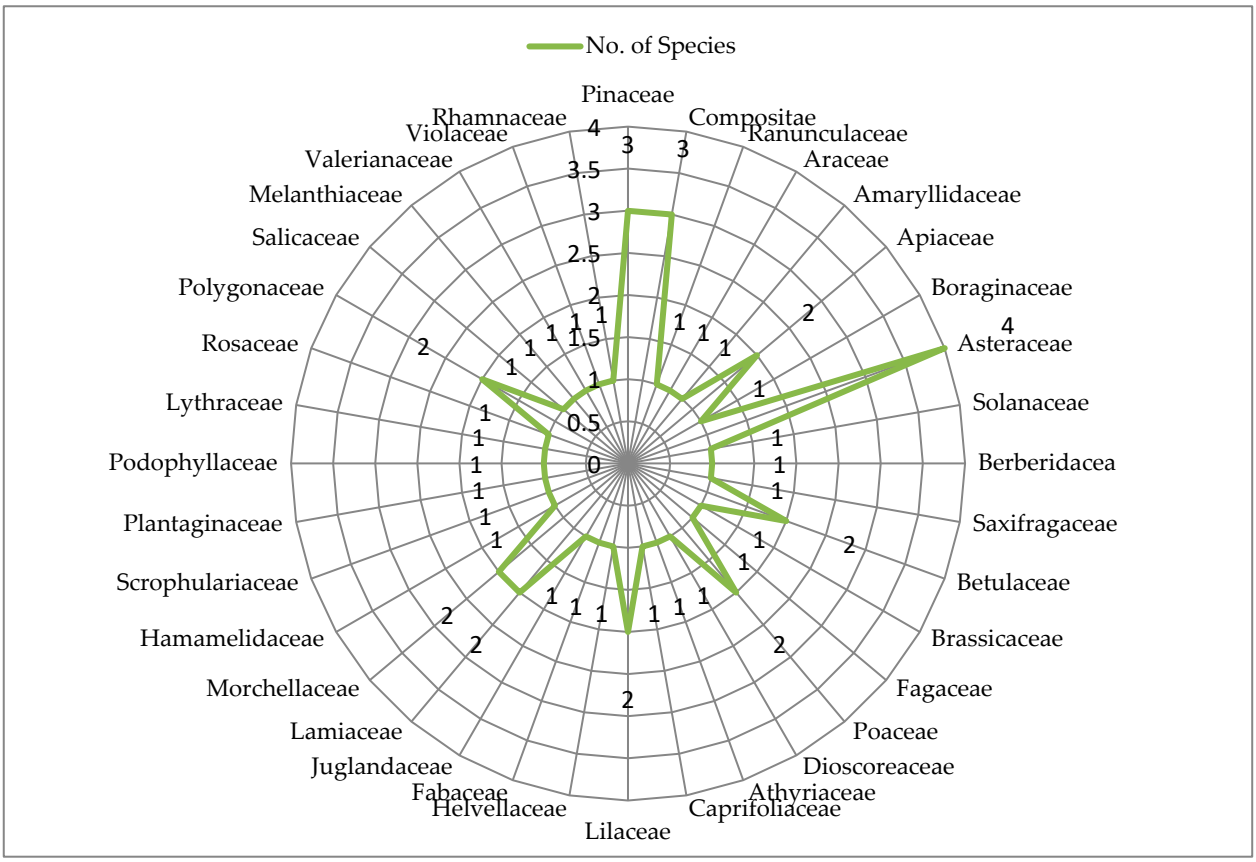

Figure 2. Proportion of NTFP species by family (N = 100).

3.3. Extraction and Consumption of NTFPs

The NTFP collectors extracted a total of 506.43 tons of fuel wood, 90.52 tons of fodder, 2.62 tons of wild fruits, 4.42 tons of wild vegetables, 1.99 tons of mushrooms and 4.88 tons of medicinal plants annually from the forests of the study area. In each household, per year of extraction there were around 5.06 tons of fuel wood, 0.90 tons of fodder, 0.02 tons of wild fruits, 0.04 tons of wild vegetables, 0.01 tons of mushrooms and 0.04 tons of medicinal

plants annually from the forests in the study area. Out of the total harvests, the NTFP collectors consumed a total of 100.77 tons of fuel wood, 78.85 tons of fodder, 2.44 tons of wild fruits, 4.23 tons of wild vegetables, 1.81 tons of mushrooms and 4.22 tons of medicinal plants annually. The average annual consumption rates in the sampled households were about 1.00 tons of fuel wood, 0.78 tons of fodder, 0.02 tons of wild fruits, 0.04 tons of wild vegetables, 0.01 tons of mushrooms and 0.04 tons of medicinal plants. The percentage involvement of households in NTFP collection ranged from 37% for mushrooms to 100% for fuel wood (Table 4).

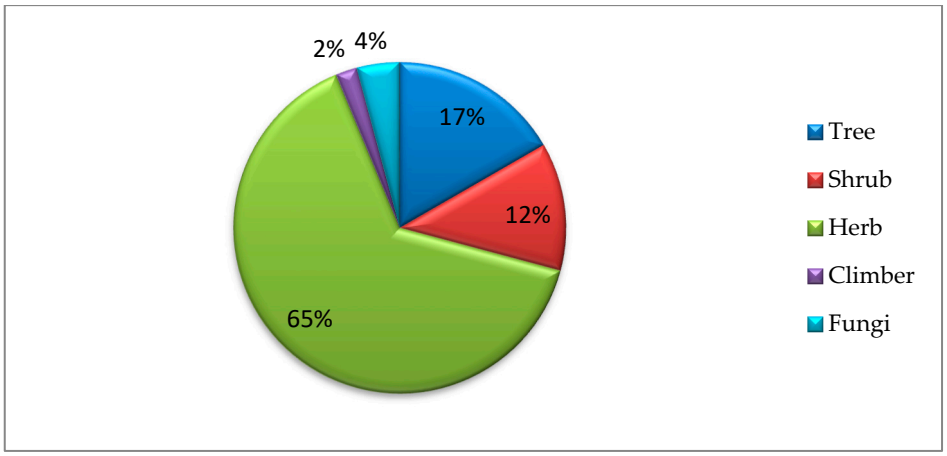

Figure 3. Proportion of NTFPs used by habit (N = 100).

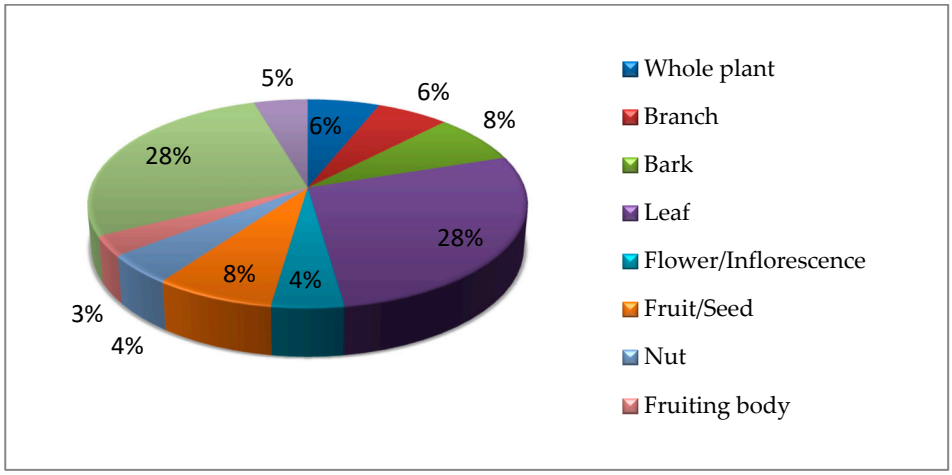

Figure 4. Proportion of NTFPs by percent parts used (N = 100).

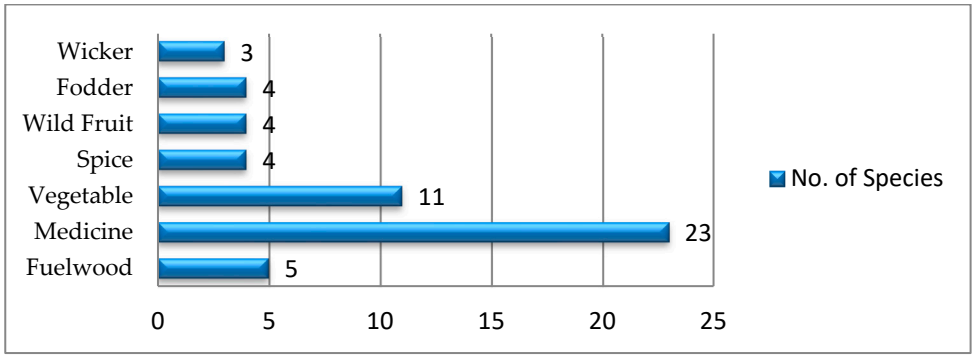

Figure 5. Proportion of NTFP Species by use category.

Table 3. Household descriptive variables determining NTFP-based bioeconomy (N = 100).

Variables (Code)	Explanation	Measurement Description	Minimum	Maximum	Mean	SD
Age (X_1)	Age of household head in years	Number of years lived by the respondent	20	84	48.84	14.57
Education level (X_2)	Household head undergone in education	0 = illiterate, 1 = < primary, 2 = primary, 3 = middle, 4 = high school, 5 = intermediate, 6 = graduate and over	0	6	1.55	1.74
Social membership (X_3)	Membership of household head in organisations	0 = no membership, 1 = membership of 1 organization, 2 = membership of >1 organization, 3 = office bearer, 4 = public leader	0	4	1.33	0.73
Household size (X_4)	No. of family members in a household	1 = $\leq$ 5 members, 2 = > 5 members	1	2	1.68	0.46
Household labour (X_5)	No. of workers in a household	1 = 1 worker, 2 = 2 workers, 3 = 3 workers, 4 = >3 workers	1	4	3.13	0.89
Farm size (X_6)	Land area under household management	0 = landless, 1 = marginal (up to 1.0 ha), 2 = small (1.1 to 2.0 ha), 3 = medium (2.1 to 4.0 ha), 4 = large (>4.0 ha)	1	2	1.68	0.46
Livestock ownership (X_7)	No. of livestock units owned by the household	0 = no livestock, 1 = $\leq$ 5 livestock, 2 = 6 to 10 livestock, 3 = > 10 livestock	0	3	2.29	1.14
Main occupation (X_8)	Occupation in which an individual was engaged for six months or more in a year	1 = wage labour, 2 = non-farm labour, 3 = cultivation, 4 = business, 5 = service, 6 = any other	1	6	3.27	1.29
Wealth status (X_9)	Relative position of households in the community in respect of wealth/physical assets	0 = poor, 1 = medium, 2 = rich	0	2	1.40	0.72
Gross annual income (X_{10})	Household income earned by all the on-farm and off-farm sources	INR/household/annum	5400.00	309,523.00	67,122.44	56,622.46
Proximity to forest (X_{11})	Distance between forests and house (km)	Distance of home to forests (km)	0.30	1.90	0.74	0.38
Forest visits (X_{12})	Frequency of forest visits in a year	0 = never, 1 = occasionally, 2 = frequently, 3 = very frequently	0	3	1.52	0.83

Table 4. Household extraction and consumption of NTFPs (N = 100).

NTFP	Involvement in Collection (%)	Total Extraction (ton/Year)	Average Extraction (ton/hh/Year)	Total Consumption (ton/Year)	Average Consumption (ton/hh/Year)
Fuel wood	100.00	506.43	5.06	100.77	1.00
Fodder	91.00	90.52	0.90	78.85	0.78
Fruits	34.00	2.62	0.02	2.44	0.02
Vegetables	64.00	4.42	0.04	4.23	0.04
Mushroom	37.00	1.99	0.01	1.81	0.01
Herbal medicine	88.00	4.88	0.04	4.22	0.04

3.4. Economic Valuation of NTFP Use

The diversity of NTFPs plays a crucial role in diversifying the household income; hence, significant proportions of the products extracted were marketed for income gener-

ation in the study area. The highest number of NTFPs marketed were medicinal plants (63%), followed by fuel wood (42%), vegetables (34%), mushrooms (32%), fruits (24%) and fodder (18%). Around 405.65 tons of fuel wood, 11.65 tons of fodder, 0.66 tons of medicinal plants, 0.18 tons of vegetables, 0.17 tons of mushrooms and 0.17 tons of fruits were sold in the market in a year. Fuel wood was the highest source of household income, at INR 3,124,839.00 (USD 41,623.73), with 69.88% income share to households; followed by medicinal plants, at INR 5,667,749.00 (USD 75,497.02), with 21.45% income share; and mushrooms, at INR 2,423,277.00 (USD 32,279.16), with 5.96% income share. Fodder, fruits and vegetables made comparatively low contributions to the household income, at 1.87%, 0.80% and 0.04%, respectively. NTFPs also contributed to the subsistence income of households, which is not usually accounted for. The monetary value of NTFPs used for subsistence consumption was estimated to be INR 8,611,614.31/year (USD 114,709.11) and INR 86,116.14/household/year (USD 1146.99). The economic valuation of NTFP extraction confirms that NTFPs generated a total income of INR 12,193,404.00/year (USD 162,421.75), which accounted for 29.38% of cash income and 70.62% of subsistence income in the study area (Table 5).

Table 5. Economic valuation of household NTFP use (N = 100).

NTFP	Involvement in Marketing (%)	Sale Price (INR/kg) USD *	Sale (Ton/Year)	Subsistence Income (INR/Year) USD *	Cash Income (INR/Year) USD *	Total Income (INR/Year) USD *	Income Share (%)
Fuel wood	42.00	6.80 (0.091) *	405.65	621,839.10 (8283.07) *	2,503,000.00 (33,340.66) *	3,124,839.00 (41,623.73) *	69.88
Fodder	18.00	6.32 (0.83) *	11.65	452,157.90 (6022.87) *	66,940.00 (891.66) *	519,097.90 (6914.62) *	1.87
Fruits	24.00	180.37 (2.39) *	0.17	400,082.30 (5329.21) *	28,500.00 (379.63) *	428,582.30 (5708.91) *	0.80
Vegetables	34.00	7.44 (0.099) *	0.18	28,608.63 (381.07) *	1250.00 (16.65) *	29,858.63 (397.73) *	0.04
Mushroom	32.00	1344.02 (17.90) *	0.17	2,209,577.00 (29,432.18) *	213,700.00 (2846.54) *	2,423,277.00 (32,279.16) *	5.96
Herbal medicine	63.00	1278.53 (17.03) *	0.66	4,899,349.00 (65,260.70) *	768,400.00 (10,235.30) *	5,667,749.00 (75,497.02) *	21.45
Total	-		-	8,611,614.31 (114,709.11) *	3,581,790.00 (47,710.45) *	12,193,404.00 (162,421.75) *	100.00
Average	-		-	86,116.14 (1147.09) *	35,817.90 (477.10) *	121,934.00 (1624.22) *	-

* USD 1 = INR 75.08 as on 30 January 2022.

3.5. Contribution of NTFPs to Local Household Economy

The involvement of households in various economic activities is presented in Table 6. It was observed that NTFPs were the largest source of income across all the categories, with 53.33% contribution to the household income, followed by labour (15.27%), goat/sheep husbandry (11.46%), dairy (9.85%), and agricultural crops (6.80%) respectively. The art and crafts (1.49%), horticulture (1.46%) and service (0.34%) had significantly low contribution in the local economy.

Table 6. Contribution of NTFPs in household economy (N = 100).

Sources	Total Income (INR/Year) USD *	Average Income (INR/Year) USD *	Std. Dev.	Percentage
Agricultural crops	456,600.34 (6082.41) *	4566.00 (60.82) *	10,703.07	6.80
Horticulture	98,100.45 (1306.80) *	981.01 (13.07) *	2506.63	1.46
Dairy	661,200.28 (8807.90) *	6612.00 (88.08) *	13,315.71	9.85
Goat/sheep husbandry	770,000.42 (10,257.24) *	7700.00 (102.57) *	16,505.58	11.46
Labour	1,025,500.56 (13,660.77) *	10,255.01 (136.61) *	15,509.11	15.27
Art and craft	100,000.78 (1332.12) *	1000.01 (13.32) *	6590.47	1.49
NTFPs	3,581,790.56 (47,713.31) *	35,817.91 (477.10) *	37,310.56	53.33
Service	23,054.72 (307.11) *	230.55 (3.07) *	2019.32	0.34
Total	6,716,298.00 (89,468.34) *	67,122.44 (894.02) *	56,622.46	100.00

* USD 1 = INR 75.08 as on 30 January 2022.

The coefficient of correlation (r) was worked out to ascertain the relationship between the livelihood dependency on NTFPs and the socioeconomic characteristics of the sample households (Figure 6). Out of twelve socioeconomic characteristics of the people, eight characteristics—viz., education, social membership, household size, household labour, farm size, livestock ownership, age, proximity to forest and forest visits—exhibited positive and significant correlations with the livelihood dependency on NTFPs. By contrast, the characteristics of main occupation, wealth status and gross annual income had significant negative correlations with the livelihood dependency on NTFPs.

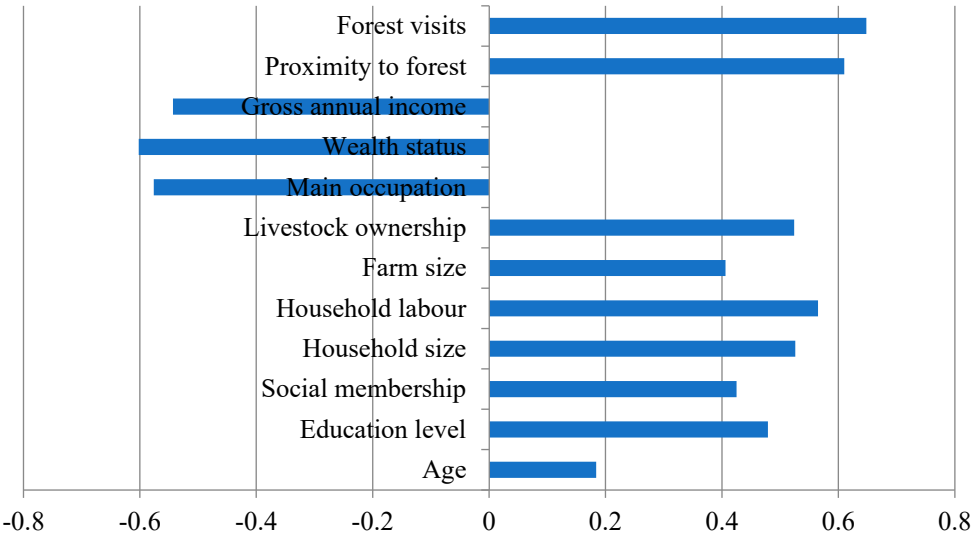

Figure 6. Correlation between household variables and NTFP income dependence (N = 100).

3.6. OLS Regression Model

The OLS regression analysis was carried out to determine the household dependence from NTFP income against household variables (Table 7). The coefficient values were determined for household variables including age (170.31), education level (3020.36), social membership (287.32), household size (2410.22), household labour (−195.03), farm size (10,287.28), livestock ownership (3057.57), main occupation (−4193.87), wealth status (−5895.07), gross annual income (0.00), proximity to forests (35,967.92) and forest visits (8835.33). The "*t*" values of the regression coefficients indicate that, out of twelve household variables, proximity to forests (5.25), forest visits (2.17), education level (0.14) and farm size (0.12) had significant influences on NTFP income levels. The coefficient of determination (R^2) 0.70 indicates that the explanatory variables contributed to 70.40% of the variation in household NTFP income. The degree of the F value (17.22) indicates that R^2 is statistically significant ($p < 0.05$), which establishes that the model is reliable and well prognostic. The OLS regression equation appropriated for the household NTFP income may be written as:

$$Y = 23{,}575.17 - 170.31\,X_1 + 3020.36\,X_2 + 287.32\,X_3 + 2410.22\,X_4 - 2410.22\,X_5 + 10{,}287.28\,X_6 + 3057.57\,X_7 - 4193.87\,X_8 - 5895.07\,X_9 + 0.000\,X_{10} + 35{,}967.92\,X_{11} + 8835.33\,X_{12}$$

where Y is household NTFP income (INR/year) and X_1–X_{12} are socioeconomic variables.

Table 7. OLS regression model of household NTFP income dependence against household variables.

Variables (Code)	Coefficient (b)	Standard Error of b	B	*t* Value	*p*
Age (X_1)	170.31	162.20	0.067	1.05	0.29
Education level (X_2)	3020.36	1695.03	0.14	1.78	0.07
Social membership (X_3)	287.32	3799.70	0.00	0.07	0.94

Table 7. *Cont.*

Variables (Code)	Coefficient (b)	Standard Error of b	B	*t* Value	*p*
Household size (X_4)	2410.22	16,275.12	0.03	0.14	0.88
Household labour (X_5)	−195.03	5124.99	0.00	−0.03	0.97
Farm size (X_6)	10,287.28	11,438.93	0.12	0.89	0.37
Livestock ownership (X_7)	3057.57	4195.01	0.09	0.72	0.46
Main occupation (X_8)	−4193.87	2502.01	−0.14	−1.67	0.09
Wealth status (X_9)	−5895.07	4744.92	−0.11	−1.24	0.21
Gross annual income (X_{10})	0.00	0.08	0.00	0.00	0.99
Proximity to forest (X_{11})	35,967.92	6841.32	0.36	5.25	0.00
Forest visits (X_{12})	8835.33	4064.83	0.19	2.17	0.03

A = −23,575.17; F = 17.22 *; R^2 =0.70; multiple R = 0.83; adjusted R^2 =0.66; * = significant at 5% level of probability.

The regression coefficient indicates that the proximity to forests, forest visits, education level and farm size of the NTFP collectors made a significant economic contribution to the households.

3.7. Income Inequality Mitigation by NTFPs

The income inequality mitigation potential of NTFPs was determined by the Lorenz curve. The study revealed that the household income without NTFPs deviated more from the line of equality than the Lorenz curve of the total household income (Figure 7). Similarly, the Ginicoefficient for the household income with NTFPs was 0.28, and 0.57 without the NTFP income. This means that NTFP income contributed to mitigating income inequalities among the households by 29.27%. Therefore, the values of Ginicoefficient and departure of the Lorenz curve from the line of equality clearly indicate that the NTFPs mitigated the income inequality significantly among the sampled households and had a substantial equalising effect on the total income distribution.

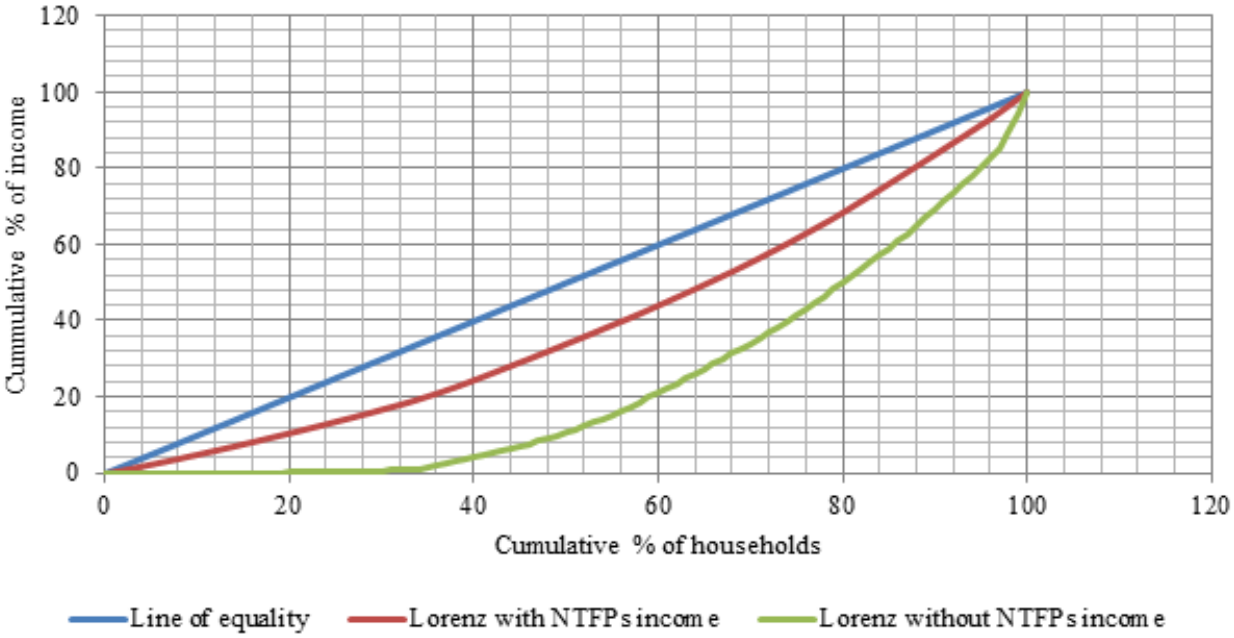

Figure 7. Lorenz curve of household income including and excluding NTFP income (N = 100).

4. Discussion

NTFP collection significantly contributed to the cash and subsistence income and the economic inequality mitigation among rural households. The entire sample of households derived substantial parts of their household annual income from NTFP-based activities. The absolute NTFP income was estimated to be INR 35,817.91 (USD 477.10), contributing

53.33% of the total annual household income and equalising economic inequalities by 29.27%. NTFP income constituted the first most viable income source because the alternative options were either scarce or even absent. The earnings from NTFPs enabled the people to purchase daily necessities, secure livelihood perspectives, create stock capital for income diversification and preserve that as savings to cope with adversity. Nonetheless, different NTFPs accrued different levels of income; the collectors reported fuel wood, medicinal plants, mushrooms, fodder, fruits and vegetables as the most important NTFPs for both subsistence and cash income. These NTFPs had more market demand and income generating opportunity than the others. The higher quantity of fuel wood collection and trade was only due to a lack of low-priced substitute energy sources. The higher collection of medicinal plants was due to its immense demand in traditional health-care systems and handsome sale return. The sale of fodder grasses was a forest-based self-employment of local people because livestock production was a major subsidiary occupation, and fodder security is a challenge due to a short growing season. Wild fruits and vegetables were prominent NTFPs consumed for food and nutritional security and sold by the primary collectors for revenue. The involvement of households in collection and marketing varied by NTFP type and availability, consumption requirement, market value and socioeconomic conditions of people. The cash incomes from NTFPs were variable across households and directly related to the degree of time and labour expended.

The correlation and OLS regression results indicate that household NTFP income was influenced by all explanatory variables, except the household head's age. The positive effect of education on household NTFP income is well articulated by the facts that, as low literacy prevailed among the NTFP collectors, ranging from illiterate to primary level, the more educated households had better awareness, skill bases and access to markets which accrued more NTFP return. Social participation facilitates information flow, sharing views and experiences, clarifying doubts, getting opinions and enriching knowledge among members in a social group; hence, this factor had a significant positive influence on household NTFP income. The findings also indicated that household size and labour significantly influenced the collection of NTFPs by the households. This is because the larger families had a greater labour force to support more NTFP extraction from the forests. The positive effect of farm size on NTFPs could be attributed to the fact that the households had limited farmland and were unable to produce sufficient food for their families; hence, they relied heavily on NTFPs for their food security, safety net and cash income. Similarly, livestock ownership had a positive effect on NTFP income. This is due to limited size of land holding, low fodder production, lack of grazing lands and heavy demand for fodder as safety nets. The economic attributes—viz., main occupation, wealth status and gross annual income—exhibited negative effects on the NTFP income. These factors were the major indicators of, and core contributors to, the household economic conditions that helped them to facilitate the other types of capital to be owned and traded. Thus, the households with higher occupation, wealth status and gross annual income had more financial opportunities, more earnings and less dependency on NTFP income. The involvement of household heads of different age groups in NTFP collection was more or less similar, indicating that the variation in age had no influence at all on the household NTFP income.

The descriptive analysis shows that the dependence of households on NTFPs was significant relative to other sources of livelihood such as agricultural crops, horticulture, dairy, goat/sheep husbandry, wage labour, arts, crafts and service. The households in the study area collected mostly medicinal plants, food and fuelwood. These results are consistent with other studies in the area [40], which highlighted the traditional use of plants for various purposes. However, the extent of NTFP collection and use differed widely across households. The possibility of household participation and intensity of involvement in NTFP collection was higher among households living near the forests. As the distance to the forest increased, the NTFP collection decreased. This is apparent due to the accessibility of the NTFP resource rich areas in the forests where households have to travel shorter distances. The proximity to forests, education level and farm size had positive effects on the

household income compared to other activities, such as service, possibly due to multiple sources of income, such as forests, as well as farms, and higher levels of education gave them more power to negotiate NTFPs' prices in markets. Nearness to forests meant easy access to a number of NTFPs in a short span of time, and, hence, lower labour costs in the collection and transportation of the produce, and higher income. The results indicate that NTFP collectors lived in inaccessible areas, had poor socioeconomic conditions; and were mostly without access to services, provisions and government developmental schemes. Hence, they had inadequate access to employment, health and other welfare schemes of the government, resulting in low economic wellbeing. Therefore, the diversification of NTFP-based livelihoods has a great scope in these areas for improving the quality of life and human wellbeing from nature's contributions. This was also confirmed by the findings of other studies in other geographies [5,24,40–42].

The collection of NTFPs is a viable source of a subsistence livelihood, income and safety net option across the forest fringe communities of mountain areas, especially in Kashmir, due to a lack of any other sustainable income generation alternative. The income generated from NTFPs may not be the primary source of livelihood; however, domestic consumption in the form of fuel wood, fruits, vegetables and medicinal plants make a significant contribution to the subsistence of almost all households. Moreover, the income derived from NTFPs is a significant source of other domestic necessities, such as educating children, health, paying debt or providing a safety net against hardships during the severe winter months prominent in Kashmir. Our results are supported by other studies [5,11,43–46] as well, which show how people living in rural settings are dependent on NTFPs more for subsistence use than trade.

As indicated by the Lorenz curve, NTFPs play a significant role in income inequality mitigation and a safety net for underprivileged forest fringe communities. Therefore, transition to a NTFP-based bioeconomy has the potential to improve the local socioeconomic status, if recognised and managed properly. NTFPs consumed by households in forest fringe communities have not been fully accounted for. They have much greater worth than NTFPs traded in the local markets. Despite such an enormous contribution to local economy, the contributions of NTFPs in Kashmir have never been considered enough to be accounted for by the authorities. This has obstructed support for the potential NTFP-based bioeconomy in the region. Proper valuation of resources being extracted, consumed and traded at the local level must be included in the regional and national statistics for realising the actual potential of a NTFP-based bioeconomy. The results of this study are substantiated by the literature on the sustainable bioeconomy potential of NTFPs accumulated to date [47,48].

Indefinite harvesting of NTFPs from wild, without proper harvesting and management practices will negatively impact the sustainability and yield of the species. Therefore, the production of NTFPs through both *in-situ* and *ex-situ* mechanism is the only way forward. The management of NTFPs should be included in the forest working plans with amplified investments in the sector. The sustainable use of NTFPs has proven to be economical for local communities [49], and has the potential to enhance socio-ecological security in these multifunctional landscapes. On the other hand, the increasing industrial demand for NTFP-based diversified bio-products in emerging global markets can provide significant opportunities for NTFP-driven bioeconomies. The diversified bioactive compounds and genes of interest extracted from NTFPs have brought revolutions in pharmaceutical, nutraceutical, cosmeceutical, food and beverage industries [50]. Therefore, it is necessary to recognise the contribution of NTFPs in both the local as well as state economy. The diversification of raw materials, with an emphasis on production, processing and the establishment of an inclusive value chain, will significantly augment the livelihoods of, and mitigate income inequality for, forest fringe communities. It is equally important to have a shift from local to global value chains, in order to promote the economic value of NTFPs, from raw materials to end products, by adopting contemporary visions of bioeconomy [16]. The processing of NTFPs can positively influence the sustainable economic development

of local-forest-dependent communities in J&K. However, despite local interest and the potential contributions of NTFPs as key sources of livelihood diversification and sustainable development, NTFP processing enterprises are still in the informal sector, and there is a tremendous lack of understanding of the underlying factors. Hence, transitioning from local NTFP commercialisation efforts to developing NTFP-based value chains that can help locals approach the export markets, and enhancing cooperation for a supportive institutional framework, are very much required. A largely successful NTFP-based bioeconomy can be supported by local socio-economics and ecological conditions that require more holistic approaches, which can address and support the local context and NTFP value chains. Hence, this can support the UT government to facilitate and accomplish its sustainable and equitable development goals by promoting an NTFP-based bioeconomy in J&K [16].

5. Conclusions

The findings of this study indicate that NTFPs make a significant contribution to supporting the subsistence use and income generation of households. People dwelling in remote and inaccessible areas of Kashmir, where market supplies are not organised, still extract fuelwood, fodder, vegetables, fruits, mushrooms and medicinal plants from the nearby forests for their consumption and income generation. The results presented in the study stress that NTFPs make a significant contribution to income inequality mitigation for the forest fringe communities. However, to realise the full potential of NTFPs, it is important that they are commercialised as a diversified product through a bioeconomy that ensures the sustainable use of wild species, following sustainable livelihoods, income generation and inclusive development. It is very important that NTFPs are managed properly and included in the forest working plans for commercial production of high value species. The contribution of NTFPs to local and regional economy must be considered in the state and national GDP and GNI calculations. The government can play an important support role in this context, where markets do not work inclusively. An inclusive economy includes resources which lack enough markets to manage supply and demand, and addresses the issues of under-delivery, non-reporting and overexploitation. Basically, these NTFPs have historically been an integral part of the day-to-day needs and traditional lifestyle of indigenous people and local communities. Progressive policies on forest resource management and trade must be interactive in nature and should acknowledge the local rights, knowledge and practices to ensure access and concessions for sustainable harvesting of NTFPs for socio-ecological and economic well-being. Livelihood promotion and income diversification for local communities may need sufficient support from the government to encourage a shift to an NTFP-based bioeconomy to keep pace with current and future development challenges in the region.

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