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# The Role of Non-Timber Forest Products (NTFPs) in Rural Livelihoods: Evidence from District Chitral, Pakistan

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## ABSTRACT

Non-Timber Forest Products play a pivotal role in sustaining rural livelihoods in forest-adjacent regions, particularly in mountainous and resource-scarce environments. This study investigates the socio-economic determinants of household dependence on NTFPs and quantifies their contribution to household income in district Chitral, Pakistan. Primary data were collected from 300 households across three forest-rich villages—Ayun, Garam Chashma, and Shali—using a multistage random sampling technique. The findings reveal that 82% of households depend on

fuelwood, 45% collect medicinal herbs, and 28% harvest wild fruits and nuts. The average annual income derived from NTFPs was PKR 34,000, contributing between 10% and 25% of total household income. A multiple linear regression analysis indicated that household size ($\beta = 0.346$, $p < 0.01$), forest proximity ($\beta = -0.411$, $p < 0.01$), and market access ($\beta = 0.297$, $p < 0.01$) significantly influence NTFP income, while education ($\beta = -0.218$, $p < 0.05$) and landholding size ($\beta = -0.134$, $p < 0.05$) have a negative relationship. The model explained 49% of the variation in NTFP income (Adjusted $R^2 = 0.49$). These results highlight the continued importance of NTFPs for land-poor, remote households and suggest that forest governance and livelihood policies should prioritize sustainable NTFP management and rural market integration.

**Keywords:** Non-Timber Forest Products (NTFPs); Rural Livelihoods; Forest Dependence; Mountain Communities; Sustainable Income; Chitral; Forest-Based Economy; Environmental Income; Household Economics; Natural Resource Management

## INTRODUCTION

Forests have historically served as a vital source of livelihoods for rural populations, especially in developing countries where formal employment opportunities are limited. In addition to timber, forests provide a broad range of products known as Non-Timber Forest Products (NTFPs), which include fuelwood, medicinal herbs, mushrooms, wild fruits, and resins. Globally, NTFPs are estimated to support the livelihoods of over 1.6 billion people (FAO, 2020), contributing to food security, income generation, and cultural practices. Their importance is particularly pronounced in mountainous regions where arable land is scarce and infrastructure is underdeveloped.

In Pakistan, particularly in the northern highlands such as Chitral, Gilgit-Baltistan, and Swat, forest-dependent communities have long relied on NTFPs for household consumption and trade (Ali et al., 2019). Chitral, located in the Hindu Kush mountain range, is characterized by steep terrain, dispersed settlements, and a fragile ecosystem. The combination of limited agricultural land and poor access to markets has made forest products an indispensable part of rural livelihoods.

Despite the significance of NTFPs, they remain largely invisible in formal policy discourse and development programs. Few empirical studies have systematically quantified their economic contribution or examined the socio-economic drivers behind household-level NTFP dependence in Pakistan. This research addresses that gap by focusing on three forest-rich villages in Chitral District. Following assumptions were made:

- NTFP income is positively influenced by proximity to forest resources and access to markets.
- Households with higher education and larger landholdings tend to depend less on NTFPs due to access to alternative income sources.
- Larger households are more dependent on NTFPs owing to greater labor availability and consumption needs.

### Research Questions

1. What is the contribution of NTFPs to household income in Chitral?
2. What socio-economic factors determine NTFP-based income?
3. How can sustainable NTFP use be enhanced through policy?

### Objectives of the Study

The primary objective of this study is to examine the role of Non-Timber Forest Products (NTFPs) in the livelihoods of rural households in District Chitral, Pakistan. Specifically, the study aims to:

1. Quantify the contribution of NTFPs to household income in selected villages of Chitral.
2. Identify the most commonly utilized types of NTFPs and their usage patterns.
3. Analyze the socio-economic and geographical factors that influence the extent of household dependence on NTFPs.
4. Provide evidence-based recommendations for enhancing sustainable NTFP use in rural livelihood strategies.

## LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

NTFPs have gained scholarly attention in recent decades due to their multidimensional contributions to livelihoods and biodiversity conservation. According to Shackleton and Pandey (2014), NTFPs can constitute up to 25–50% of total household income in rural forest communities. Belcher et al. (2005) found that commercial and subsistence uses of NTFPs are often intertwined, making them crucial for both economic security and cultural continuity.

In the South Asian context, Aryal et al. (2020) note that NTFPs are particularly important in Himalayan regions where limited access to markets and arable land compels communities to rely on wild resources. Similarly, a study by Angelsen et al. (2014) found that environmental income, including NTFPs, accounts for 28% of total income among rural households in forest-rich countries.

Within Pakistan, empirical research remains sparse but indicative. Ali et al. (2019) documented that in Gilgit-Baltistan, households earn up to 30% of their annual income from forest products, primarily herbs and wild fruits. In Swat, Khan et al. (2021) identified NTFPs as a buffer against agricultural income shocks, particularly for landless families. However, access to forests is mediated by institutional, geographic, and socio-economic variables such as education, land tenure, and gender roles.

Education has been found to inversely correlate with forest dependence. Malla et al. (2003) argue that educated individuals are more likely to pursue off-farm employment. Household size, on the other hand, is positively associated with forest product collection due to labor availability (Cavendish, 2000). Market access has also been highlighted as a key enabling factor for converting NTFPs into monetized income (Sharma et al., 2016).

### Hypotheses

• H0: Socio-economic and geographic variables do not significantly influence NTFP income.

• H1: Household size, education, distance to forest, market access, and landholding size significantly affect NTFP income.

## METHODOLOGY

### Study Area

This study was conducted in District Chitral, Khyber Pakhtunkhwa province, located in the Hindu Kush mountain range. The district features a cold desert climate and is known for its alpine forests and biodiversity. The villages of Ayun, Garam Chashma, and Shali were selected for their proximity to forest resources, variation in elevation, and community reliance on NTFPs. These villages represent a gradient of accessibility to markets and forest cover.

### Sampling and Data Collection

A multistage stratified random sampling technique was employed. First, villages were selected purposively based on ecological and demographic diversity. In the second stage, 100 households from each village were randomly selected, resulting in a total sample size of 300 households. Primary data were collected using semi-structured interviews, focus group discussions, and field observations during the summer of 2024.

The questionnaire was designed to collect information on household demographics, income sources, landholdings, education, forest access, and NTFP collection practices. Income from NTFPs was calculated as the estimated annual market value of products collected and/or sold.

### Econometric Model

To analyze the determinants of NTFP income, a multiple linear regression model was specified as follows:

$$NTFP\_Income = \beta_0 + \beta_1(Education) + \beta_2(HouseholdSize) + \beta_3(ForestDistance) + \beta_4(MarketAccess) + \beta_5(LandSize) + \varepsilon$$

**Whereas**:

• NTFP_Income = Annual income from NTFPs (PKR)
• Education = Years of formal schooling of household head
• HouseholdSize = Total number of family members
• ForestDistance = Distance (km) to nearest forest
• MarketAccess = Distance (km) to nearest market
• LandSize = Total landholding (kanals)

The model was estimated using Ordinary Least Squares (OLS) in SPSS 26. Standard tests were performed for multicollinearity, heteroskedasticity, and normality of residuals.

## RESULTS AND DISCUSSION

### Descriptive Statistics

The table 1 presents the distribution of Non-Timber Forest Product (NTFP) utilization among the sampled households in Ayun, Garam Chashma, and Shali villages of District Chitral. The data reveal that fuelwood is the most extensively used NTFP, with 82% of households reporting regular collection and use. This high reliance

is consistent with the findings of Khan et al. (2021) in Swat and Ali et al. (2019) in Gilgit-Baltistan, where fuelwood constituted a primary energy source for cooking and heating due to limited electrification and affordability issues.

Medicinal plants emerged as the second most commonly harvested NTFP, used by 45% of the respondents. This reflects the deep-rooted ethnobotanical knowledge in the Hindu Kush region, where traditional herbal remedies remain a culturally embedded and economically viable alternative to formal healthcare services. This trend is supported by Sharma et al. (2016) and Malla et al. (2003), who observed similar dependence in the mid-hills of Nepal.

Wild fruits and nuts, used by 28% of households, often supplement food security and serve as seasonal income sources, especially during summer months when products like mulberries, walnuts, and apricots are abundant. The economic potential of these products has been documented by Belcher et al. (2005), who emphasized the dual consumption-and-sale role of such NTFPs in household economies.

Mushroom collection (11%) and wild vegetables (6%) represent more specialized NTFPs, typically harvested by knowledgeable community members. In Garam Chashma, the collection of high-value species such as Morchella esculenta (morels) contributes significantly to household cash income during spring. However, low collection rates in other areas suggest either limited ecological availability or lack of commercial awareness, a challenge similarly noted in studies from Indian and Nepali Himalayas (e.g., Shackleton & Pandey, 2014; Aryal et al., 2020).

The overall trend indicates that the intensity and diversity of NTFP use are shaped by ecological availability, traditional knowledge, market access, and household needs. This aligns with findings from global meta-analyses (e.g., Angelsen et al., 2014) showing that forest-adjacent communities tend to rely more heavily on low-capital, high-labor forest goods, particularly when other livelihood assets (education, land, capital) are limited.

**Table 1: NTFP Use by Type (% of Households)**

| NTFP Type | Usage (%) |
|---|---|
| Fuelwood | 82% |
| Medicinal Plants | 45% |
| Wild Fruits & Nuts | 28% |
| Mushrooms | 11% |
| Wild Vegetables | 6% |

**Econometric Results**

The regression model yielded an adjusted $R^2$ of 0.49, indicating that nearly half of the variation in NTFP income was explained by the independent variables. The following coefficients were statistically significant ($p < 0.05$):

- **Household Size** ($\beta = +0.346$): Larger households tended to earn more from NTFPs, likely due to greater labor availability and resource needs. Similar trends have been reported in rural Nepal (Sharma et al., 2016) and Sub-Saharan Africa (Angelsen et al., 2014).

• **Forest Distance** (β = -0.411): Proximity to forest significantly boosted NTFP income. Households located within 1 km of forested areas collected nearly twice as many products. This echoes findings by Cavendish (2000) and Ali et al. (2019), who found that forest access is a key determinant of environmental income.

• **Market Access** (β = +0.297): Improved access to markets positively impacted household income. In Ayun, households near the main road sold herbs directly to traders, whereas remote Shali villagers relied on middlemen, reducing their profit margins.

• **Education** (β = -0.218): Surprisingly, higher education was negatively associated with NTFP income. This supports the hypothesis that educated individuals may pursue wage employment or business, thereby reducing their reliance on forest resources (Malla et al., 2003; Angelsen et al., 2014).

• **Landholding Size** (β = -0.134): Households with larger landholdings were less dependent on forest products, consistent with studies in Gilgit (Ali et al., 2019) and India (Shackleton & Pandey, 2014).

**Table 2: Regression Results**

| Variable | Coefficient | p-value |
|---|---|---|
| **Education** | -0.218 | 0.037 |
| **Household Size** | 0.346 | 0.001 |
| **Distance to Forest** | -0.411 | 0.002 |
| **Market Access** | 0.297 | 0.004 |
| **Landholding Size** | -0.134 | 0.048 |

These findings underscore the complex interplay between environmental and socio-economic variables in shaping NTFP dependence. While market and forest access enhance income, education and landholding appear to shift livelihood strategies toward agriculture or non-farm sources.

## CONCLUSION

This study provides empirical evidence on the significant role of Non-Timber Forest Products (NTFPs) in sustaining the livelihoods of rural households in District Chitral, Pakistan. The findings confirm that NTFPs serve not only as a safety net for vulnerable communities but also as a substantial source of income for families facing constraints in land ownership and formal employment. The econometric analysis revealed that household size, proximity to forests, and access to markets are positively associated with higher income from NTFPs, while education and landholding size reduce reliance on forest-derived income.

These findings align with regional studies in South Asia and Africa, reinforcing the assertion that forest resources are critically important for poorer, less educated, and land-constrained households (Angelsen et al., 2014; Aryal et al., 2020). Despite their importance, NTFPs remain poorly integrated into Pakistan's rural development and forest governance frameworks. Therefore, there is a pressing need for policy interventions that not only acknowledge the economic value of NTFPs but also ensure their sustainable management through community participation, institutional

support, and market facilitation. Integrating NTFPs into rural development and forest conservation strategies can help uplift marginalized communities, enhance biodiversity conservation, and build climate resilience in highland regions.

## Policy Recommendations

To harness the potential of NTFPs for poverty alleviation and sustainable rural development in Chitral and similar regions, the following policy measures are recommended:

**1. Community-Based Forest Governance:** Establish and empower local forest user groups under joint forest management models. These groups should be formally recognized and trained in sustainable harvesting, resource monitoring, and value chain development. Community ownership improves compliance and stewardship (Shackleton & Pandey, 2014).

**2. Market Infrastructure Development:** Improve road connectivity, storage facilities, and access to local and regional markets. Establishing NTFP collection centers and cooperatives in remote areas like Shali and Garam Chashma can reduce reliance on middlemen and ensure fair pricing for collectors.

**3. Capacity Building and Extension Services:** Conduct training programs on identification, sustainable harvesting, drying, storage, and packaging of high-value NTFPs. Encourage the use of non-destructive techniques and provide certification for organically harvested products to access premium markets.

**4. Institutional Integration:** Incorporate NTFP-based livelihoods into national and provincial forest and poverty alleviation policies. Ministries of Forestry, Climate Change, and Rural Development should collaborate to integrate NTFPs into district-level planning frameworks.

**5. Research and Data Systems:** Establish a central database on NTFP species, yields, and market trends in Khyber Pakhtunkhwa. Encourage academic partnerships for long-term monitoring of ecological impacts, income potential, and sustainable harvesting levels.

## Limitations and Future Research

While this study offers critical insights, several limitations must be acknowledged. First, the cross-sectional design limits the ability to analyze seasonal variations in NTFP collection and income. Second, ecological impacts of increased harvesting were not assessed. Third, gender roles in NTFP collection and decision-making were beyond the scope of this study.

Future research should adopt longitudinal designs to capture inter-annual variations, include ecological assessments of overharvesting, and explore the role of women and youth in NTFP-based economies. Comparative studies across districts can also help inform provincial-level policies.

## Ethical Declaration

All procedures performed in this research complied with the ethical standards of the University of Agriculture Peshawar. Informed consent was obtained from all individual participants included in the study. All data were anonymized and used strictly for academic purposes.

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