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Planting Prosperity: Impact of Afforestation on Livelihoods Diversification in Tribal District Bajaur, Pakistan

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| <p><b>Dr. Ikramullah</b><br/>Planning Officer, ADC(F&amp;P) Office Civil Colony Khar, District Bajaur. <a href="mailto:Ikrambjr@gmail.com">Ikrambjr@gmail.com</a></p> <p><b>Sardar Muzaffar Hussain Zahid</b><br/>PhD Scholar, Center for Disaster Preparedness and Management, University of Peshawar, Pakistan. Email: <a href="mailto:Zahid666@yahoo.com">Zahid666@yahoo.com</a></p> <p><b>Dr. Akhtar Amin</b><br/>Additional Registrar, University of Peshawar email: <a href="mailto:Akhtar.psh@uop.edu.pk">Akhtar.psh@uop.edu.pk</a></p> <p><b>Dr. Shahid Iqbal*</b><br/>Centre for Disaster Preparedness &amp; Management/DAS/IER, University of Peshawar. Corresponding Author Email: <a href="mailto:shahidiqbalkhan@uop.edu.pk">shahidiqbalkhan@uop.edu.pk</a></p> | <p>Afforestation is recognized as a critical strategy for integrated rural development, particularly in semi-arid and tribal regions where communities depend heavily on natural resources. This study investigates the impact of afforestation under the FATA Water Resources Development Project (FWRDP) on livelihood diversification in District Bajaur, Khyber Pakhtunkhwa, Pakistan. Funded by the Asian Development Bank (ADB) and operational since 2015, FWRDP has brought 3,268 hectares under afforestation across 78 sites in Bajaur, including 18 sites in the two sampled tehsils. Primary data were collected from 50 beneficiary households in Khar and Utman Khel through multi-stage sampling and a pre-tested semi-structured questionnaire. The Chi-square test was used to assess associations between dependency on forest income after FWRDP and forest-related livelihood sources. Dependency on forest income increased from 10 percent before FWRDP intervention to 78 percent after intervention, while 72 percent of respondents reported dependency on forest income after FWRDP. Training regarding afforestation was received by 42 percent of respondents, while 24 percent were members of community organizations formed through FWRDP. The majority of respondents (38 percent) reported annual forest income of Rs. 100,001–150,000. Significant associations (<math>p&lt;0.05</math>) were found between forest-income dependency and timber sale, fuelwood, laboring, animal grazing and animal fodder, while associations with house construction material and honey bee keeping were non-significant. The study concludes that FWRDP afforestation has contributed substantially to livelihood diversification through forest resources and recommends continued and expanded interventions with enhanced community training and participation.</p> |
| <b>Keywords</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Afforestation; livelihood diversification; FWRDP; forest income; watershed management; community forestry; Bajaur; Khyber Pakhtunkhwa.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### **INTRODUCTION**

Forests provide a combination of environmental, economic and social services that are particularly important for rural households. In forest-dependent communities, trees and forest resources may provide fuelwood, fodder, timber, construction material, medicinal plants, food products and opportunities for wage labour or small enterprise. Forest resources can therefore complement agriculture and livestock, particularly where households have limited access to non-farm employment. FAO notes that forests support rural livelihoods through both direct products and services and that community participation, fair access and secure resource rights are important dimensions of sustainable forest management (FAO, 2009; FAO, 2026).

Pakistan has historically had a low proportion of land under forest and tree cover. The National Forest Policy identifies expansion, protection and sustainable use of forests, watersheds and natural habitats as important national objectives and recognizes the social and economic functions of forests for local communities (Government of Pakistan, 2015). The policy also emphasizes mass afforestation, community-based management and the sustainable use of wood and non-wood forest products. These priorities are especially relevant in rural and mountainous areas where households depend directly on natural resources and where environmental degradation can affect agriculture, water availability and household welfare.

The relationship between forests and livelihoods is not necessarily straightforward. Forest resources may reduce household vulnerability by providing multiple products and income sources, but excessive dependence can also increase pressure on forest resources. Shahbaz, Ali and Suleri (2007) observed that forest policies in Pakistan have important implications for sustainable livelihoods and that local livelihood needs must be considered in forest management. Hussain et al. (2019), in their study of Naltar Valley, also documented the dependence of rural households on forest resources and highlighted the livelihood significance of timber, fuelwood and other forest products. Thus, afforestation programmes should not be assessed only in terms of the number of trees planted. Their contribution to household welfare, local participation, income opportunities and resource sustainability is equally important.

### **FWRDP AND THE BAJAUR CONTEXT**

The FATA Water Resources Development Project was an integrated rural development intervention supported through the Asian Development Bank framework and implemented in selected areas of the former Federally Administered Tribal Areas. In Bajaur, the intervention combined community organization, irrigation development, on-farm water management, agricultural extension and improved watershed management through afforestation. The integrated design was intended to address interconnected constraints rather than treating forestry, agriculture and rural livelihoods as separate sectors (FWRDP PIU, 2022).

District Bajaur is predominantly rural and has historically depended heavily on agriculture, livestock and natural resources. In such a setting, watershed degradation can affect both forest resources and agricultural production. Afforestation, when accompanied by soil and water conservation measures, can help restore degraded catchments, reduce erosion and create opportunities for local communities. The present study therefore considers afforestation as both an environmental intervention and a livelihood-related intervention.

### **OBJECTIVE OF THE STUDY**

The main objective was to examine the association of FWRDP afforestation with forest-based livelihood diversification among beneficiary households in District Bajaur. Specific attention was given to household characteristics, community organization membership, training, dependence on forest income and selected forest-related livelihood sources.

### **CONCEPTUAL AND EMPIRICAL BACKGROUND**

#### **AFFORESTATION AND LIVELIHOODS DIVERSIFICATION**

Afforestation can contribute to livelihood diversification by creating employment during plantation and maintenance and by providing timber, fuelwood, fodder, medicinal plants, fruits and other forest products. Nursery raising, beekeeping and other forest-based activities can further provide additional sources of income, reducing households' dependence on a single livelihood and increasing their resilience to economic and environmental shocks. In this context, the present study examines livelihood diversification through afforestation, with particular emphasis on the employment, income and forest-based opportunities created for rural households.

Shahbaz et al. (2007) reported that livelihood strategies adopted by households and individuals are influenced by policies, institutions and processes, while these strategies can also affect the sustainability of natural resource use. This perspective is relevant to understanding how afforestation interventions and community participation may influence

both livelihood opportunities and the sustainable use of forest resources. Forests also play an essential environmental role by providing vital ecosystem services and habitats for diverse species that depend on forest goods and services (Owoeye et al., 2019).

The livelihood diversification perspective is relevant because rural households rarely depend on a single activity. Agriculture, livestock, wage labour, forest products, petty trade and other activities may be combined to meet household needs. Diversification can reduce exposure to shocks when one income source performs poorly. However, diversification through forest products should not simply mean increasing extraction. Sustainable livelihood strategies require a balance between household use and the regeneration capacity of forest resources. FAO's work on community forestry emphasizes that improved forest condition and enhanced livelihoods can be pursued together when local stakeholders participate in planning, implementation and benefit sharing (FAO, 2026).

### **COMMUNITY PARTICIPATION AND TRAINING**

Community participation is a central element of sustainable forest management. Local households possess practical knowledge about land, vegetation, water and seasonal conditions, while government departments and development projects can provide technical knowledge, inputs and institutional support. Community organizations can create a platform through which local people participate in plantation planning, protection and monitoring. They may also help connect households with government departments, nurseries and markets.

Training is equally important. Afforestation is not limited to planting seedlings. It involves site selection, species selection, nursery management, planting methods, protection, replacement of dead plants, soil and water conservation and eventual utilization of forest products. FWRDP training in Bajaur focused on private nursery establishment, medicinal plants and linkages among communities, the Forest Department and nursery growers. Such training can convert plantation from a project activity into a locally understood livelihood and resource-management opportunity.

### **FORESTS, NON-TIMBER FOREST PRODUCTS AND RURAL ECONOMIES**

Non-timber forest products are particularly relevant for poor rural households because they can provide food, medicine, fodder, fuel and small cash income without requiring the sale of standing timber. FAO has identified non-farm income from non-wood forest products as an important livelihood opportunity for small farmers and local communities when appropriate technical, business and institutional support is available (Marshall & Chandrasekharan, 2009). In Pakistan, studies have similarly shown the importance of forests to rural livelihood systems. Hussain et al. (2019) documented household dependence on forest resources in Naltar Valley, while Essa et al. (2011) examined the contribution of agroforestry to farmers' livelihoods in northern Pakistan.

The evidence suggests that livelihood outcomes depend on the interaction of natural resources, household characteristics, institutions and market access. Consequently, the effects observed in Bajaur should be interpreted within the broader socio-economic setting of the beneficiary communities rather than attributing every livelihood change directly to plantation activity.

### **MATERIALS AND METHODS**

#### **STUDY AREA**

The study was conducted in District Bajaur, Khyber Pakhtunkhwa, Pakistan, within the area covered by the afforestation component of FWRDP. Bajaur is predominantly rural and households depend substantially on agriculture, livestock and natural resources. The wider district context includes mountainous and hilly terrain where watershed degradation, soil erosion and water scarcity can influence agricultural and livelihood conditions. The FWRDP approach therefore linked afforestation with watershed management rather than treating plantation as an isolated activity.

#### **RESEARCH DESIGN AND SAMPLING**

The afforestation component reported in this paper is based on a focused sample of 50 beneficiary households. The respondents were selected from communities benefiting from the FWRDP afforestation intervention. The wider doctoral study used a multi-stage sampling approach, while the present analysis concentrates on the forest-related component and the corresponding beneficiary households. Primary information was collected through a semi-structured questionnaire during 2023.



### DATA COLLECTION

The questionnaire covered socio-demographic characteristics, household size and working members, community organization membership, training related to afforestation, dependence on forest income and selected forest-based livelihood activities. Information was also collected regarding the livelihood activities reported before and after the FWRDP intervention. Project-level information on plantation area and training was obtained from FWRDP records and project documentation.

### VARIABLES AND MEASUREMENT

The principal livelihood-related variable was dependence on forest income. Forest-based activities considered in the analysis included timber sale, fuelwood, labouring, medicinal plants, honey-bee keeping, house construction material, animal fodder and animal grazing. Explanatory characteristics included age, education, family size, community organization membership and receipt of afforestation-related training. The analysis also considered the institutional dimension of the intervention, particularly the role of community organizations and training.

### STATISTICAL ANALYSIS

Descriptive statistics were used to summarize the distribution of respondents. Frequencies and percentages were calculated for categorical variables. Chi-square tests were used to examine the association between dependence on forest income and selected forest-related livelihood sources after the intervention. A probability value below 0.05 was treated as statistically significant. The analysis is therefore concerned with association rather than proof of causal impact.

### ETHICAL AND INTERPRETIVE CONSIDERATIONS

The analysis uses household-level information collected for the doctoral research. Results are presented in aggregate form and are interpreted within the selected beneficiary communities. Because the sample is relatively small and the study is cross-sectional, the findings should not be generalized to all households of Bajaur without qualification. The statistical results indicate patterns of association, while the qualitative interpretation draws on the institutional and environmental context of the FWRDP intervention.

### RESULTS

#### SCALE AND NATURE OF THE AFFORESTATION INTERVENTION

FWRDP carried out afforestation over approximately 3,268 hectares in the study area. The plantation component was implemented as part of a broader watershed-management approach. Check dams were constructed in plantation areas to reduce the impact of flash floods and soil erosion, while small ponds were developed for water harvesting and storage. This combination is important because tree survival and watershed rehabilitation are affected by soil moisture, erosion and the availability of water during dry periods. The intervention therefore linked environmental rehabilitation with local resource management.

The project also worked through community structures and the Forest Department. According to FWRDP project records, 70 training sessions were conducted through community organizations formed by the Forest Department, with 1,540 community members trained (FWRDP PIU, 2022). The training included basic concepts of private nursery establishment, nursery management techniques, the benefits of medicinal plants for livelihood generation and improved linkages between communities, the Forest Department and nursery growers.

#### AGE DISTRIBUTION OF RESPONDENTS

Farmers' age may influence forest management through differences in knowledge, experience, and openness to new practices. Younger farmers may be more receptive to modern technologies, while older farmers may possess valuable traditional knowledge and practical experience in forest management.

**Table 1:** *Age Distribution Of Respondents*

| Age group   | Frequency | Percent |
|-------------|-----------|---------|
| 18–28       | 16        | 32      |
| 29–38       | 11        | 22      |
| 39–48       | 5         | 10      |
| 49–60       | 9         | 18      |
| 61 or above | 9         | 18      |
| Total       | 50        | 100     |

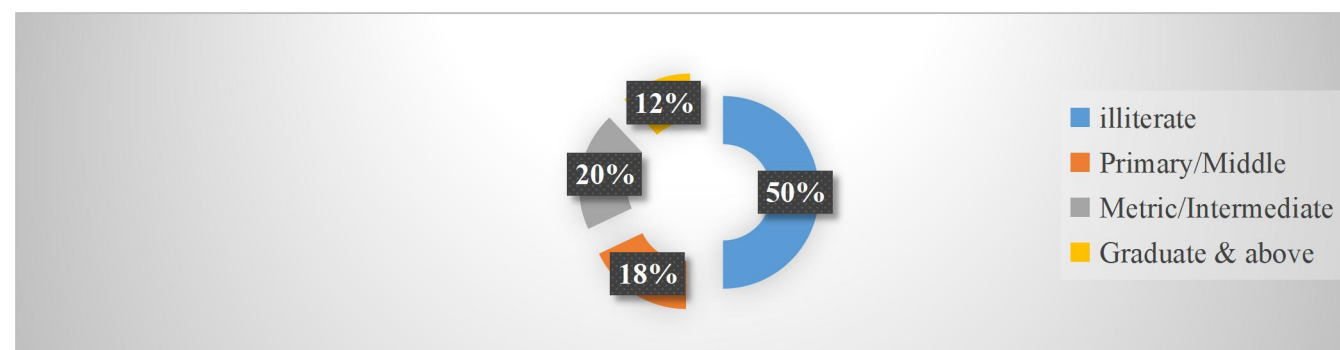
Source: Field Survey, 2023.

The age distribution indicates that the largest group was 18–28 years, accounting for 32 percent of respondents. The 29–38 group represented 22 percent, while the 49–60 and 61-or-above groups each represented 18 percent. Respondents aged 39–48 accounted for 10 percent. The presence of both younger and older respondents is relevant to forest management because age may influence physical participation, accumulated local knowledge and willingness to adopt new practices. Older household members may possess experience regarding traditional forest use, while younger members may be more able to participate in labour-intensive activities or seek new livelihood opportunities.

### EDUCATION LEVEL OF THE RESPONDENTS

Agro forestry adoption can be positively influenced by factors such as age, education, and the presence of functional community-based organizations. Conversely, political conflicts and tenure insecurity can have a negative impact on smallholder farmers' ability to adopt agro forestry practices in a timely manner (Ullah et al., 2023).

**Figure 1. Distribution of the respondents on the basis of education level**



Source: Field Survey, 2023

Figure 1 shows that 50 percent of the respondents were illiterate, while 18 percent had primary/middle education, 20 percent had middle-level education, 14 percent had secondary education (Matric/Intermediate), and 12 percent were graduates or held higher degrees. The education level of respondents is relevant to their knowledge and understanding of forest management and conservation. While educated respondents may better understand the ecological and economic aspects of forest management, illiterate community members may possess valuable traditional knowledge. The high proportion of illiterate respondents therefore highlights the need for awareness and training programmes using simple, community-based and visual approaches.

### DEPENDENCE ON FOREST INCOME

Rural households in Pakistan rely heavily on forest resources for their livelihoods. However, deforestation, illegal logging, and poor forest management threaten the sustainability of this dependence. Forest resources support local economic well-being, but excessive extraction can adversely affect biodiversity and ecosystem sustainability (Ali et al., 2020).

**Table 2: Dependency of respondents on forest income**

| Dependency on forest income | Frequency | Percent |
|-----------------------------|-----------|---------|
| Yes                         | 36        | 72      |
| No                          | 14        | 28      |
| Total                       | 50        | 100     |

Source: Field Survey, 2023.

A substantial 72 percent of respondents reported dependence on forest income, compared with 28 percent who reported no dependence. This finding demonstrates the economic importance of forests within the beneficiary communities. It also means that forest management decisions have direct livelihood implications. Where households depend on fuelwood, fodder, labour, medicinal plants or other forest resources, changes in access can influence household expenditure and income. The result is consistent with the wider literature on forest-dependent rural communities in Pakistan, where forest products form an important part of household livelihood strategies (Hussain et al., 2019).

### COMMUNITY ORGANIZATION AND AFFORESTATION TRAINING

Training can improve farmers' forestry skills, productivity, and livelihood opportunities by promoting the practical application of scientific knowledge (Zhao et al., 2021). Under FWRDP, 70 training sessions were conducted through the concerned Forest Division, training 1,540 community members. These trainings aimed to promote sustainable resource



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management, community participation, and local economic development (FWRDP PIU, 2022). The active involvement of local communities further strengthened these efforts by encouraging their participation in forest management and conservation, thereby contributing to improved socio-economic conditions (Sheikh et al., 2019).



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**Table 3:** *Community Organization Membership and Training*

| Indicator                                              | Yes (%) | No (%) |
|--------------------------------------------------------|---------|--------|
| Membership of Forest Department community organization | 24      | 76     |
| Received afforestation-related training                | 42      | 58     |

*Source: Field Survey, 2023.*

Only 24 percent of respondents reported membership in a community organization formed by the Forest Department, while 76 percent were not members. Community organizations are important because they can provide a mechanism for collective action, plantation protection and communication with government agencies. The relatively limited membership suggests that the institutional benefits of community forestry may not have reached all beneficiary households equally.

Training coverage was higher than community organization membership but remained incomplete. Forty-two percent of respondents had received training related to afforestation, whereas 58 percent had not. Among the full sample, 28 percent reported FWRDP as a source of afforestation training and 14 percent reported other forest-related sources. This pattern indicates that project-supported training reached a meaningful proportion of households but that more than half of the respondents remained outside formal training coverage.

The training content was livelihood-oriented. It included the establishment and management of private nurseries, the benefits of medicinal plants and the development of linkages between local communities, the Forest Department and nursery growers. Such content is relevant because it creates the possibility of moving from plantation as a public programme toward household-level economic activity. Nursery raising can provide income before trees reach maturity, while medicinal plants and other non-timber products can provide periodic or seasonal returns.

### HOUSEHOLD SIZE AND LABOUR AVAILABILITY

Family size and the availability of working members are important determinants of forest-dependent livelihoods. Larger households may provide more labour for forest-related activities but may also increase dependence on forest resources and household needs. Similarly, a higher number of working members can improve household earning capacity and savings, whereas larger household size may increase financial pressure (Bunyasiri, 2017). Therefore, both family size and labour availability should be considered when designing interventions for sustainable forest management and livelihood improvement.

**Table 4:** *Family Size of Respondents*

| Family size | Frequency | Percent |
|-------------|-----------|---------|
| 1–5         | 2         | 4       |
| 6–10        | 18        | 36      |
| 11–15       | 20        | 40      |
| 16–20       | 7         | 14      |
| 21 or above | 3         | 6       |
| Total       | 50        | 100     |

*Source: Field Survey, 2023.*

Forty percent of respondents belonged to households with 11–15 members, followed by 36 percent with 6–10 members. Fourteen percent had 16–20 members, 6 percent had 21 or more members and only 4 percent had 1–5 members. Large household size can provide labour for plantation maintenance, collection of forest products and agricultural activities. At the same time, large households may have greater consumption requirements and therefore greater dependence on natural resources.

**Table 5:** *Working members in respondent households*

| Working members | Frequency | Percent |
|-----------------|-----------|---------|
| 1–3             | 39        | 78      |
| 4–7             | 9         | 18      |
| 8 or above      | 2         | 4       |



|       |    |     |
|-------|----|-----|
| Total | 50 | 100 |
|-------|----|-----|

Source: Field Survey, 2023.

Most households, 78 percent, had 1–3 working members. Eighteen percent had 4–7 working members and 4 percent had 8 or more. This indicates that although household size was generally large, the number of economically active members available for forest-related work was comparatively limited. Project planning should therefore consider both household size and actual labour availability when designing community forestry activities.

**FOREST-BASED LIVELIHOOD SOURCES**

Forest resources provide rural households with diverse livelihood opportunities, including timber, fuelwood, construction materials, animal fodder, grazing, medicinal plants, and honey. These resources generate income and reduce household expenditures, particularly where alternative livelihood opportunities are limited. However, excessive dependence may lead to resource degradation; therefore, sustainable forest management is essential (Hussain et al., 2019).

**Table 6:**      *Reported forest-related livelihood sources before and after FWRDP*

| Livelihood source           | Before FWRDP (%) | After FWRDP (%) | Change (percentage points) |
|-----------------------------|------------------|-----------------|----------------------------|
| Timber sale                 | 6                | 27              | +21                        |
| Fuelwood                    | 11               | 41              | +30                        |
| Labouring                   | 14               | 38              | +24                        |
| Medicinal plants            | 8                | 25              | +17                        |
| Honey-bee keeping           | 2                | 22              | +20                        |
| House construction material | 8                | 31              | +23                        |
| Animal fodder               | 27               | 44              | +17                        |
| Animal grazing              | 41               | 40              | -1                         |

Source: Field Survey, 2023.

The descriptive comparison indicates increased reporting of several forest-related livelihood activities after the intervention. Timber sale increased from 6 to 27 percent, fuelwood from 11 to 41 percent and labouring from 14 to 38 percent. Medicinal plants increased from 8 to 25 percent, honey-bee keeping from 2 to 22 percent and house construction material from 8 to 31 percent. Animal fodder increased from 27 to 44 percent. Animal grazing showed a small decline from 41 to 40 percent.

The increase in reported forest-related activities should not automatically be interpreted as proof that the plantation itself caused all changes. The intervention occurred within a broader rural economy in which households simultaneously experience changes in agriculture, labour markets, household demand and access to forest resources. Nevertheless, the pattern indicates that forest resources became more prominent within reported livelihood strategies of the surveyed households. This is important for policy because greater economic use of forests can generate benefits but can also create pressure if extraction exceeds sustainable levels. The slight decline in animal grazing is consistent with the project context in which some plantation areas were fenced to protect young trees and watchmen were engaged for protection. While fencing may improve plantation survival, restrictions on grazing can reduce an existing livelihood activity. This illustrates why environmental and livelihood objectives need to be planned together. Where grazing access is reduced, alternative fodder arrangements can help prevent the intervention from shifting pressure to other forest areas.

**ANNUAL INCOME OF RESPONDENTS FROM FOREST**

Forest resources provide rural households with both direct income from timber and non-timber forest products and indirect savings through fuelwood, construction materials, and animal fodder. Income depends on forest type, product value, market demand, and accessibility (Zenteno et al., 2013). However, poor roads, storage and market facilities, limited price information, and middlemen can constrain NTFP earnings. Improved market access, infrastructure, sustainable management, and training can enhance forest-based income (Ahmed et al., 2023).



Table 7: Respondent’s annual from forest

| Annual Income from Forest (PKR in Thousands) | Frequency | Percent |
|----------------------------------------------|-----------|---------|
| 10000-50000                                  | 7         | 14      |
| 51000-100000                                 | 12        | 24      |
| 100001-150000                                | 19        | 38      |
| 151000-200000                                | 8         | 16      |
| 200001 or above                              | 4         | 8       |
| Total                                        | 50        | 100     |

Source: Field Survey, 2023

Table 7 confirms that the majority of the respondents fall within the income range of Rs 100,001 to 150,000, which represents the highest percentage of 38 percent among all income ranges. The second most common income range is Rs. 51,000 to 100,000, accounting for 24 percent of the total respondents. The income ranges of Rs. 10,000 to 50,000 has the lowest number making up 14 percent of the total respondents. The income ranges of Rs. 151,000 to 200,000 representing 16 percent of the total respondents, while the income ranges of Rs. 200,001 or above has the smallest number with 4 respondents, accounting for 8 percent of the total respondents. The results suggest that the majority of respondents from the forest in study area have an annual income falling within the range of Rs. 100,001 to 150,000, while fewer respondents fall into the higher income ranges.

CHI-SQUARE ANALYSIS OF FOREST-INCOME DEPENDENCE

Table 8: Chi-square tests of forest-income dependence and selected livelihood sources

| Livelihood source           | $\chi^2$ | p-value | Interpretation  |
|-----------------------------|----------|---------|-----------------|
| Fuelwood sources            | 19.797   | <0.001  | Significant     |
| Labouring                   | 34.613   | <0.001  | Significant     |
| Animal grazing              | 8.705    | 0.008   | Significant     |
| House construction material | 0.160    | 1.000   | Not significant |
| Honey-bee keeping           | 0.334    | 0.734   | Not significant |
| Animal fodder               | 44.558   | <0.001  | Significant     |

Source: Field Survey, 2023.

The chi-square results show that forest-income dependence was significantly associated with fuelwood use, labouring, animal grazing and animal fodder. The strongest statistical association in the reported results was observed for animal fodder ( $\chi^2=44.558$ ,  $p<0.001$ ), followed by labouring ( $\chi^2=34.613$ ,  $p<0.001$ ), fuelwood ( $\chi^2=19.797$ ,  $p<0.001$ ) and animal grazing ( $\chi^2=8.705$ ,  $p=0.008$ ). These results suggest that forest resources are connected with both direct and indirect components of household livelihoods.

The association with fuelwood is understandable because fuelwood can serve as an essential household energy source where modern energy alternatives are limited. Dependence on animal fodder and grazing reflects the close relationship between forests and livestock systems. In rural households, livestock may provide food, cash income and social security, while forest vegetation and tree resources provide fodder. Labouring may represent a different pathway, whereby households obtain employment from forest-related activities or from project implementation and associated services.

In contrast, house construction material was not significantly associated with forest-income dependence ( $\chi^2=0.160$ ,  $p=1.000$ ), and honey-bee keeping was also not significant ( $\chi^2=0.334$ ,  $p=0.734$ ). The absence of statistical significance does not mean that these activities have no livelihood value. Rather, within this sample, the distribution of these activities did not differ sufficiently by forest-income dependence to establish a statistically significant association. The findings also illustrate why forest-based livelihood diversification should be understood as a portfolio rather than a single outcome. Some households may use forests mainly for household consumption, others for wage labour, and others for market-oriented products. A programme that supports only tree planting may therefore have limited livelihood impact unless it also supports skills, market access, nursery development and sustainable utilization.



### **DISCUSSION**

#### **AFFORESTATION AS AN INTEGRATED RURAL DEVELOPMENT INTERVENTION**

The Bajaur case demonstrates the relevance of treating afforestation as part of integrated rural development. The FWRDP intervention did not restrict itself to plantation. It combined tree establishment with watershed measures, community organizations and training. Such integration is consistent with the broader understanding of sustainable forest management, in which environmental, social and economic objectives need to be considered together (FAO, 2026).

The plantation area of approximately 3,268 hectares represents a substantial physical intervention within the beneficiary area. However, the long-term value of this investment depends on plantation survival, protection, maintenance and community ownership. Tree planting creates an initial asset, but the livelihood and environmental benefits emerge over time. For this reason, post-project management is as important as the initial plantation campaign.

#### **FOREST DEPENDENCE AND LIVELIHOOD SECURITY**

The 72 percent level of reported dependence on forest income indicates that forest resources are already embedded in household livelihood systems. The finding is consistent with evidence from other parts of Pakistan showing that rural households depend on forests for fuel, fodder, construction materials, timber and other products (Hussain et al., 2019; Sheikh et al., 2019). Such dependence has two implications. First, forests can function as livelihood safety nets. Second, poorly managed extraction can undermine the same resource base on which households depend.

The National Forest Policy recognizes the importance of sustainable use of forest products and community-based management. Its emphasis on mass afforestation and community participation is particularly relevant where forest degradation and household dependence occur together (Government of Pakistan, 2015). The policy direction supports an approach in which local people are treated not only as users of forest resources but also as participants in restoration and management.

#### **COMMUNITY ORGANIZATION AND INSTITUTIONAL CAPACITY**

Only 24 percent of respondents reported membership in a Forest Department community organization. This relatively low participation is important because community organizations are the institutional bridge between households and the forestry system. Without broad participation, project benefits may remain concentrated among a limited group, and local monitoring of plantations may be weaker. Community forestry literature emphasizes that local participation is most meaningful when communities have defined roles in planning, management and benefit sharing rather than being involved only during plantation campaigns (FAO, 2026).

The results therefore support a shift from short-term project mobilization toward continuing local institutions. Community organizations should have clear responsibilities for plantation protection, reporting of damage, maintenance of water structures, nursery management and transparent sharing of benefits. The institutional arrangement should also provide a practical mechanism for resolving conflicts related to grazing restrictions, access to forest products and the use of communal land.

#### **TRAINING, SKILLS AND LIVELIHOOD DIVERSIFICATION**

The finding that only 42 percent of respondents had received afforestation-related training shows that knowledge transfer remained incomplete. This is important because plantation success depends on technical practices that are not necessarily familiar to all households. Training can improve knowledge of nursery raising, seedling selection, planting techniques, protection, medicinal plants and sustainable utilization. FWRDP's 70 training sessions reaching 1,540 community members demonstrate a substantial institutional effort, but the household survey shows that coverage was not universal.

Evidence from agricultural development also indicates that training can improve knowledge and support adoption of improved practices. Schreinemachers et al. (2016), for example, found that farmer training can influence knowledge and livelihood-related outcomes in vegetable production. While their context differs from forestry in Bajaur, the underlying lesson about practical, context-specific training is relevant. Forestry training should therefore be designed around the actual opportunities available to households rather than only general awareness messages.

#### **NON-TIMBER FOREST PRODUCTS AND COMPLEMENTARY INCOME**

The increase in reported medicinal plant activity and honey-bee keeping suggests potential for forest-compatible livelihood diversification. Non-timber forest products can complement agricultural income, particularly where households have limited land or limited access to formal employment. FAO has highlighted the potential of non-wood forest products to contribute to subsistence and trade when supported by appropriate technical and business services (Marshall & Chandrasekharan, 2009).

However, the development of non-timber forest products requires attention to sustainability and markets. Collection without regeneration can reduce the resource base, while production without market linkages may not generate meaningful income. Nursery raising, medicinal plant cultivation, beekeeping and small forest enterprises should therefore be linked with technical guidance, local market assessment and appropriate resource management rules.

### **SPECIES SELECTION AND ENVIRONMENTAL CONSIDERATIONS**

The Forest Department records indicate that several species were planted in the study area, with eucalyptus reported as having relatively greater quantity and coverage. Eucalyptus is fast growing and can perform under a range of conditions, but species selection requires site-specific assessment. Plantation programmes should consider water requirements, compatibility with local soils, biodiversity, household uses and potential effects on adjacent agricultural land. The objective should not simply be rapid biomass accumulation, but a plantation system that is ecologically suitable and economically useful to local communities.

The wider evidence on community forestry also emphasizes that restoration should maintain a balance between environmental rehabilitation and local livelihood needs. Where plantation protection reduces grazing, alternative fodder sources may be needed. Where forest use is increased, harvesting rules and regeneration measures are required. The design of afforestation should therefore incorporate the complete livelihood system of beneficiary households.

### **CONCLUSION AND RECOMMENDATIONS**

#### **CONCLUSION**

The study examined the relationship between FWRDP afforestation and forest-based livelihood diversification among 50 beneficiary households in District Bajaur. The evidence shows that forests remain deeply connected with household livelihoods. Seventy-two percent of respondents reported dependence on forest income. The project established approximately 3,268 hectares of plantation and combined afforestation with check dams, small water-storage ponds, community organization and training. The livelihood results show increased reporting of several forest-related activities after the intervention, while chi-square analysis identified significant associations between forest-income dependence and fuelwood, labouring, animal grazing and animal fodder.

At the same time, the findings highlight important limitations in the reach of institutional support. Only 24 percent of respondents reported membership in Forest Department community organizations and 42 percent had received afforestation-related training. This indicates that the environmental intervention was broader than the institutional and knowledge support available to individual households. The results therefore support a livelihood approach in which plantation is accompanied by continuous training, community participation, market linkages and alternative income opportunities.

The study does not establish that FWRDP caused all observed changes. The analysis is cross-sectional and based on a relatively small sample. Nevertheless, the evidence provides a useful empirical picture of the way forest resources are connected with household livelihood activities in beneficiary communities and identifies practical areas for improving the sustainability of future afforestation interventions.

#### **RECOMMENDATIONS**

1. Expand practical afforestation, nursery-management and plantation-protection training to households that have not received technical training.
2. Strengthen community organizations formed through the Forest Department and provide them with clear roles in plantation planning, maintenance, protection, monitoring and benefit sharing.
3. Improve institutional linkages among beneficiary communities, the Forest Department, FWRDP-related institutions and private nursery growers.
4. Promote forest-compatible livelihood activities such as nursery raising, beekeeping, medicinal plants and other non-timber forest products where ecological and market conditions permit.
5. Continue watershed measures such as check dams and small water-storage ponds in plantation areas and monitor their physical condition after project completion.
6. Develop practical alternative household energy options so that increased dependence on fuelwood does not create additional pressure on planted and natural forests.
7. Provide alternative fodder arrangements where plantation protection restricts grazing and monitor the livelihood effects of such restrictions.
8. Use locally appropriate and ecologically suitable tree species, with consideration of water requirements, biodiversity, soil conditions and household needs.
9. Conduct periodic monitoring of plantation survival, household participation, forest-income dependence and livelihood outcomes so that project management can respond to emerging problems.

10. Undertake follow-up research using larger samples and panel data to distinguish project effects from wider changes in rural livelihoods.

### LIMITATIONS

The study is based on a cross-sectional household survey of 50 beneficiary respondents and therefore examines associations rather than experimental causal effects. The findings are specific to the selected FWRDP communities in District Bajaur. In addition, forest-based activities are influenced by wider changes in agriculture, markets, energy availability, household labour and government policies. These factors should be considered when interpreting the relationship between afforestation and livelihood diversification.

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