Socioeconomic Impacts of the Billion Trees Afforestation Program in Khyber Pakhtunkhwa Province (KPK), Pakistan

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Abstract: In recent decades, the terrestrial ecosystem in Khyber Pakhtunkhwa Province (KPK), Pakistan, has undergone tremendous destruction. To restore environmental conditions, the government implemented the Billion Tree Afforestation Program (BTAP), with a high target to impact multidimensional aspects of the terrestrial ecosystem. The government claims that it is local residents who have benefited the most from the BTAP. Hence, the objective of this research was to examine the socioeconomic impact and local rural perception of the BTAP in three districts of KPK. Primary data were collected from 406 households. Fundamental orientation theory was used to assess the social impacts of the BTAP, while cost–benefit analysis was applied to examine its economic impact. The results show that the overall social impacts of the BTAP are satisfactory and beneficial, increasing social sustainability by 69% between 2014 and 2018. Additionally, based on the cost–benefit analysis and perception-based analysis, it was found that the BTAP positively affects the economic conditions of rural households. The community livelihood increased during the program, with a total net income of 6.9 million USD in the three districts of KPK. It is concluded that the majority of respondents have benefited from participation in the BTAP. The sustainability of rural livelihood is one of the main concerns related to the establishment of the BTAP. Effort is needed by the government and other parties to both increase rural household income and to protect the environment.

Keywords: afforestation; Billion Trees Afforestation Program (BTAP); social impact; community livelihood; deforestation; KPK Pakistan

1. Introduction

In Pakistan, the terrestrial ecosystem has undergone tremendous destruction in recent decades as a result of population expansion, poor governance, and economic instability [1,2]. Deforestation, grassland degradation, and desertification, among other reasons, have caused severe environmental disturbance, such as wildlife habitat loss, dust storms, increased soil erosion, and reduced water resources [3–7]. Furthermore, people's livelihoods have been badly affected, as shown by the prevalence of food insecurity and poverty, and a decrease in employment [8–12].

More recently, researchers have increasingly recognized that deforestation has negative impacts in many aspects [13]. Deforestation makes the environment unfavorable in many ways. For example, it accelerates soil erosion, increasing the chances of flooding, which in turn destroys crops and livestock [14]. The solution to deforestation is afforestation/reforestation at various intervention levels (modest, intensive, and prohibitive) [15]. Each level has different time and capital (especially financial

capital) requirements, and uses different forestation techniques. Afforestation can increase forest and tree cover, which improves ecosystem quality and thus positively affects living organisms and confers socioeconomic benefits to human society, (e.g., increasing daily income and improving human livelihood) [16].

Qamer, Shehzad [2] stated that, because of the extensive deforestation in Pakistan, about 170,684 ha of forest was depleted between 1990 and 2010. Deforestation in Pakistan is driven by diverse factors [17]. To tackle these challenges, in 2014, the provincial government of Khyber Pakhtunkhwa Province (KPK) launched a project named the Billion Trees Afforestation Project (BTAP) [18]. The BTAP is recognized as one of the largest afforestation projects in Pakistan in terms of public investment, geographic scope, and the number of local people impacted [19]. Hence, it has been considered an important step towards promoting sustainable land use and forest restoration [20].

The BTAP covers 28 forest and watershed divisions of the three forest regions (Southern forest (region 1), Northern forest (region 2), and Malakand forest (region 3)) in KPK. During Phase 1 (2014 to 2016), the government allocated a budget of Rs 1815.18 million, which helped to initiate the activities of the program. Subsequently, Phase 2 (January 2016 to June 2017) was approved, with a budget of Rs 8217.25 million; this phase was the main period of execution and implementation [21]. During these two periods, commercial logging and grazing were completely banned, while forest burning and timber production were substantially reduced. In the meantime, about 593,232 ha of suitable grassland and barren land were planted with different species of trees (via mountain closure and planting). Specifically, 263,153 ha were allotted for afforestation, 306,983 ha were set aside for natural regeneration by banning logging and grazing, and 23,096 hectares were used for sowing and aerial seeding. According to the third-party monitoring report Word Wide Fund [22], the overall average survival rate of a plantation of the BTAP project in July 2017 was 88.75%.

According to the KPK government, BTAP differs from other forest programs in Pakistan for a couple of reasons. First, the program objectives are not only to restore degraded forestland, but also to enhance human livelihoods by engaging poor people from the local communities in the different project tasks [23–25]. In particular, the program engages millions of rural residents as core agents of project implementation, including a large private nursery scheme. Two types of nurseries were established—potted nurseries and bare-rooted nurseries. Each nursery produced approximately 25,000 seedlings, with seedlings from the potted nurseries and bare-rooted nurseries having a value of RS 6 and RS 9, respectively. About 13,000 nurseries were distributed across the districts of KPK [22,26]. According to the KPK Forest Department, the target of planting one billion seedlings was achieved in 2017; in Phase 3 (2017–2020), the forest department is supposed to invest Rs 7710 million in order to maintain and protect the built assets [27]. To do so, a total of 4509 ad hoc forest guards from the peripheral local communities (forest Nighabaan) were hired to watch and patrol the forests by restraining illegal cutting. Another vital step that has been taken by the Forest Department is the construction of fencing, which helps prevent trespassing. Under the principles of range management, local forest officials are supposed to take the responsibility of protection, and are likely to transfer the successful area of the BTAP project to the local community at the end of Phase 3 [19,23].

Government reports indicate that the BTAP has generated over 0.5 million employment opportunities [22,28]. That is, local residents have benefited from the project, as Nighabaan were recruited, nurseries were financed, contractors were assigned, and laborers were employed for afforestation activities [26]. Hence, the objective of the present investigation was to examine the socioeconomic impact of the BTAP on the local community. First, in order to assess the social impact, we applied the orientors theory framework of Bossel [29], which has been extensively applied in ecosystem studies (Müller, M. Leupelt (eds.), 1998). According to Bossel [29], orientors are the set of criteria that are relevant for the evaluation of systems performance and sustainability. A system that satisfies all of its basic orientors with respect to viability and performance will have better fitness and sustainability. It is obligatory to obtain the minimum satisfaction for each orientor, otherwise the

sustainability of the whole system would be compromised. We utilized these orientors to create a formal and deeper understanding of the behavior of the BTAP.

Second, we examined the improvement in the livelihoods of the local communities by employing two different approaches—a cost-benefit analysis (CBA) [30] and a perception-based appraisal [31]. CBA is an effective method to evaluate the economic impacts of projects [32–35], while perception-based appraisal is often used to evaluate the success of any project based on the subjective judgment of local communities [36,37]. To the best of our knowledge, the current study is the first to investigate the socioeconomic impact of the BTAP on local communities. We believe that this study is important and timely to understand the potential ramifications of the BTAP, allowing it to be more effectively implemented.

The remainder of this paper is structured as follows. In Section 2, we introduce the research setting, data sources, and methodology. In Section 3, we present our results, including the socioeconomic impacts of the BTAP and the perceptions of local households on their livelihood. In Section 4, we present our discussion and conclusion. Finally, in Section 5, future research directions are given.

2. Materials and Methods

2.1. Study Area

The current research was conducted in three adjacent districts of KPK (see Figure 1), namely, Shangla, Swat, and Lower Dir. These districts cover a combined area of 8505 km^2 and have an estimated population of 4.51 million [38], with each having 0.76, 2.31, and 1.44 million, respectively [39]. According to the Pakistan Forest Institute (PFI) and the United Nation Development Program (UNDP) [40,41], the area occupied by natural forest in the Shangla, Swat, and Lower Dir districts is 49.9%, 55.3%, and 26.7% of the total area, respectively. The Shangla district is less developed, and is one of the poorest districts of KPK, with the majority of residents living in rural areas. On the other hand, the Swat and Lower Dir districts consist of both urban and rural areas [39,41]. The Shangla and Lower Dir districts each have three forest sub-divisions, while the Swat district has five. Elevation in the area ranges from 500 to 4000 m. In the southern, eastern, and western regions, the weather is transitional between a semi-moist temperate to dry temperate, whereas the northern part is in a dry temperate climatic zone with more precipitation (snow) in winter (January and February) as a result of Mediterranean westerly winds [42]. The majority of the rural population of these districts lack the basic facilities required for everyday life, and their main sources of income is small-scale farming, livestock, remittances, and other local businesses. Therefore, the KPK government gave a special attention to these areas and invested a huge budget (Rs. 17.72 Billion) in the BTAP in order to rehabilitate the degraded land as well as to increase the livelihoods of the local inhabitants. Table 1 details the expenditures of the three phases of the BTAP until May 2019. These factors make the region an ideal place to examine the socioeconomic impacts of the BTAP.

Table 1. Total expenditures involved in the implementation of the Billion Trees Afforestation Project (BTAP) between 2014 and May 2019 (in million Rs).

Phase	Expenditure				Total
	Forest Management	Afforestation	Compensation to Nurseries	Operational Cost	
Phase 1 (2014 to 31 December 2015)	369	389.678	878.21	168.145	1805.033
Phase 2 (1 January 2016 to 30 June 2017)	400.937	4403.176	2293.384	146.123	7243.62
Phase 3 (1 July 2017 to May 2019)	1097.877	3594.649	399.879	178.782	5271.187

Source: Khyber Pakhtunkhwa forest department.
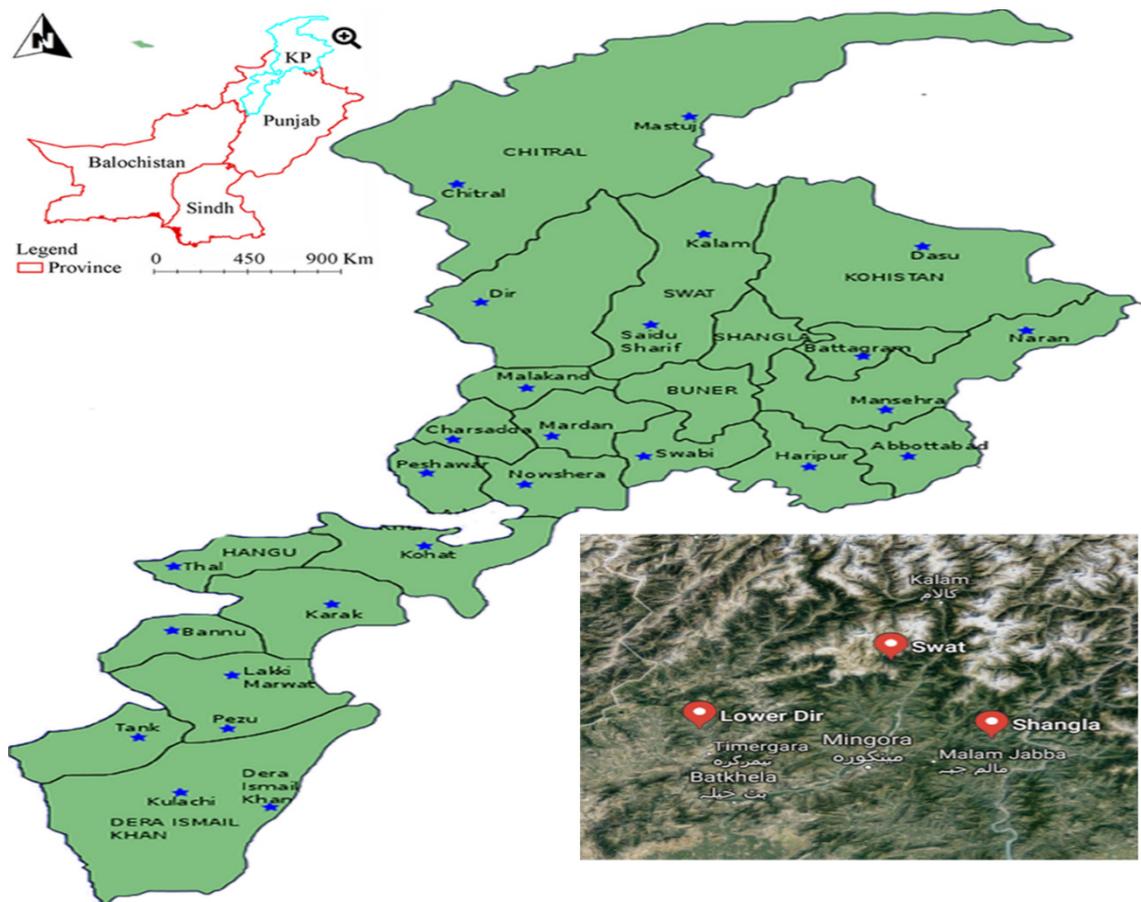
Figure 1. Map of the study area (Khyber Pakhtunkhwa Province (KPK)).

2.2. Questionnaire Design, Sample Size, and Data Collection

The data used in this study were obtained in 2018 from a household survey based on a stratified random sampling strategy [9], using a pre-designed questionnaire (see Appendix C for details). To avoid the possible misinterpretations of items or ambiguities in the response categories, in the first week of January 2018, a pre-tested of 50 households in KPK was done. In mid-February 2018, a six-person investigation team surveyed the three districts. Of the 11 forest sub-divisions in these districts, we randomly chose seven forest sub-divisions based on the geographic coverage of the program and our personal knowledge of the general regional conditions. The sample districts were not of a uniform geographical size, with the Swat district being bigger than the other two. Therefore, we randomly chose three out of the five in the Swat district, and two out of the three from each of the Shangla and Lower Dir districts. The forest sub-divisions chosen from the Swat district were Mingora, Matta, and Kabal; those from the Shangla district were Alpuri and Karora; and those from the Lower Dir district were Timergrra and Chakdara. Then, union councils, villages, and households were randomly selected from each of the chosen forest sub-divisions. In general, two union councils were selected from each forest sub-division ($2 \times 7 = 14$ union councils), three villages were selected from each union council ($3 \times 14 = 42$ villages), and around 10 households were randomly selected from each village ($10 \times 42 = 420$ households). A total of 420 questionnaires were executed (i.e., one per household) and 406 were considered valid to be used in the analysis (Table 2).

Table 2. Number of respondents in the sample districts.

No.	Targeted District	Forest Sub-Division	Total Area under the BTAP (km^2)	Number of Respondents
1	Shangla	Alpuri	49	58
		Karora	50	58
2	Swat	Kabal	47	57
		Matta	49	58
		Mingora	51	59
3	Lower Dir	Timergrra	37	59
		Chakdara	39	57
	Total			406

2.3. Data Analysis

2.3.1. Social Sustainability

Orientation theory was used to examine the social sustainability of the BTAP [29,43]. This theory consists of seven basic orientors—effectiveness; existence; security; freedom of action; coexistence; adaptability; and lastly, a systemic orientor, namely psychological needs [29]. These orientors help to define the sub-sectors of a system, which are economic systems, infrastructure, social systems, government, other systems, individual development, and resource and environment [44]. Thus, we used these seven orientors to evaluate the social sustainability of the BTAP program (see Table 3). According to Bossel [29,44], the assessment of orientor satisfaction provides a measure of total system viability and sustainability in a given environment. This can be achieved by identifying the indicators that provide all of the essential information about the viability of the orientors and sub-sectors, as well as their rate of change and how they contribute to the sustainable development of the total system (Table 3). Bossel (1999) argues that the indicators set is independent of a particular ethical commitment, as its selection will be much more effective if it is representative of orientors and sub-sectors. Following this argument, we used social sustainability indicators that we believe capture all aspects of the orientors and sub-sectors in the current research, with respect to viability and sustainability, and all aspects of their contributions to the viability and sustainability of the BTAP system.

For instance, the BTAP has the potential to enforce its existence, as regular training programs and awareness campaigns for participants are integral parts of the project policy. The system is effective, as it creates multiple employment and business opportunities for local residents. Because of the high financial liquidity of BTAP, the system has the ability to support its participants in terms of pre-payment to small–medium forest enterprise (SMFE) entrepreneurs, loss compensation, the recruitment of family members in the case of unforeseen events (i.e., injury, death), and medical insurance, and thus provides them with the opportunity to enjoy freedom. Additionally, a separate special security unit has been established to look after the area under BTAP. This unit has been equipped with modern and up-to-date weapons, with the purpose not only of protecting project cover, but also of protecting the workers from the timber mafia as well as wild creatures. As the BTAP helps participants satisfy their basic needs by enhancing their financial strength, the participants therefore invest in the education of their next generation in order to improve their adaptability to new challenges. Previously, forest-based employment and businesses comprised mostly of male participants. However, because of extensive awareness campaigns, female participants have also started playing a part, thus satisfying the coexistence sub-sector of orientation theory. Overall, we believe that the project has been successful in meeting the environmental as well as social objectives, and has therefore satisfied the psychological need of the participants. Further details are shown in Table 3.

Table 3. Sub-sectors, orientors, and indicators.

Sub-Sector	Orientor	Viability of Sub-System	Contribution to Total System	Indicators
Infrastructure	Existence	Is the system compatible with, and can it exist in, its particular environment?	Does the system play a part in the existence of the total system?	Facilities for training and education
Economic System	Effectiveness	Is it effective and efficient?	Does it contribute to the effective and efficient operation of the total system?	The probability of participating in the BTAP program.
Government	Freedom of action	Does it have the necessary freedom to respond and react as needed?	Does it contribute to the freedom of action of the total system?	Financial liquidity
Social system	Security	Is it safe, secure, and stable?	Does it contribute to the safety, security, and stability of the total system?	Threat
Individual development	Adaptability	Can it adapt to new challenges?	Does it contribute to the adaptability and flexibility of the total system?	Desire to provide better education to children
Other (actor) systems	Coexistence	Is it compatible with interacting sub-systems?	Does it contribute to the compatibility of the total system with its partner systems?	Contribution of females to the family income
Resources and environment	Psychological need	Is it compatible with psychological needs and culture?	Does it contribute to the psychological wellbeing of people?	Sense of achievement

Source: Bossel's 1999 report on indicators of sustainable development.

A measuring scale from 0 to 4 was used to grade the impact of the orientors. Mean values of 0–1 for all of the respondents for each orientor were considered to reflect an unacceptable social system; mean values of 1–2 were considered to reflect an acceptable social system; mean values of 2–3 were considered to reflect a good social system; and mean values of 3–4 were considered to reflect a system with an excellent condition. The data for these measures were collected in the questionnaire survey outlined above. Specific questions were designed in order to capture the meanings of these measures. For instance, to capture the essence of the psychological requirements connected to the BTAP, participants were asked whether their sense of achievement was improved by participating in the BTAP, and whether the BTAP helped to preserve the environment of the area. The answers to these questions were scaled from 0 to 10, indicating low to high levels of achievement. For each measure, in order to make it consistent with the impact values of the other orientors, the number chosen by the respondent was divided by 2.5. Thus, an integrated social evaluation of the BTAP was obtained by summing all the seven equally weighted orientors.

2.3.2. Cost-Benefit Analysis (CBA)

CBA is an efficient technique for evaluating the economic effects (feasibility) of projects. A project is economically viable if its revenues exceed its expenses; otherwise, the project will fail and should therefore be terminated [32]. Our economic assessment of the BTAP was based on CBA. The costs and benefits for the households involved in the project were evaluated in order to determine whether families could make financial profits by engaging in the project, and can be considered as an indication of the effectiveness of the project.

The CBA data were also obtained through the survey (Appendix C). Respondents were asked to complete six types of questions in the questionnaire related to household income and expenses, namely (1) the costs and profits from lands prior to the construction of nurseries; (2) the costs and subsidies from lands after the construction of nurseries; (3) the costs for reforesting bare mountain lands; (4) the income of Nighabaan forest; (5) the income from other jobs, such as processing primary products from

the "extra time" and running small businesses, resulting from having less land to cultivate nurseries; and (6) the costs and profits from breeding livestock, honey bees, and so on.

The calculations were based on different years of bare mountain forestation and farmland reforestation implementation, for example:

$$N_{01}I_{01} = L^*_{01}(A_{01} - B_{01} - C_{01} + D_{01}), \tag{1}$$

where $N_{01}I_{01}$ represents the net income of the households resulting strictly from Phase 1 of the BTAP, and from conversions of barren and other lands into forest, grassland, and nurseries; L^*_{01} is the total area of land converted in Phase 1 (in ha); A_{01} represents government subsidies to households as a participation cost, which were different for each work category; B_{01} represents the costs of land conversion; C_{01} are the net profits before land conversion; and D_{01} is the net income from other local jobs (small businesses, remittances, livestock production, and so on). The following equations were used to calculate the net income of the households in Phase 2, resulting from the project activities implemented in Phase 1:

$$N_{02}I_{01} = L^*_{01}(A_{02} - B_{02} + D_{02}), \tag{2}$$

where $N_{02}I_{01}$ is the net income of the households in Phase 2 resulting from the project activities implemented in Phase 1, and L^*_{01} is the total area of lands converted, calculated on the basis of the total from Phase 2.

Similarly, the net income of the households in Phase 3 resulting from the project activities implemented in Phase 1 and Phase 2 can also be calculated. All of the numerical values are expressed at their present value. The annual interest rate used in these calculations is 5.875%.

2.3.3. Livelihood Perception Analysis

In order to evaluate the impact of the BTAP on the livelihoods of local rural households, this study also elucidated the perceptions of local residents as to how the BTAP has affected their livelihoods and income. We focused on how local people perceived the impacts of the BTAP on their livelihoods by means of a pre-designed questionnaire (Appendix C). Each question had several possible answers, however the respondents could choose only one. The respondents were asked the following questions relevant to their livelihood: (i) "What do you think, which one is more important, environment or economy?"; (ii) "Is there any adverse effect of environmental degradation on your health?"; (iii) "Is the BTAP worthwhile?"; (iv) "Has the BTAP increased your income?"; (v) "Has the BTAP improved your livelihood?"; (v) "Has the BTAP achieved its goals?"; and (vi) "Do you support the policy to ban logging and grazing?".

The questionnaire was further divided into four parts, covering categories such as personal and demographic characteristics (age, annual income, gender, and education), BTAP activities, and social changes. At the end of the survey, all of the collected data were compiled in a Microsoft Excel 2010 sheet (Albuquerque, NM, USA). Finally, a regression analysis and bivariate correlation were conducted using the IBM SPSS software version 23 (Armonk, NY, USA).

3. Results

3.1. Assessment of the Social Impact of the BTAP

The social impact of the BTAP from 2014 to 2018 was investigated in the three districts of KPK. Generally, an increasing trend of social sustainability was found in the study area. As shown in Table 4, the impact grades of the seven orientors, which range from 1.67 to 3.48, indicate that the BTAP has different levels of social sustainability. The mean value of the seven orientors in the Malakand division, that is, 2.76 (69%) of the sample, shows that the BTAP program has an overall "good" level of social sustainability in this division. During the assessment, two out of the seven basic orientors, namely "system security" and "co-existence", were measured by "threat" and "contribution of females to the

family income", and resulted in scores of 1.93 and 1.88, respectively (i.e., below 2), indicating a barely acceptable or poor condition. The three orientors of existence, adaptability, and psychological need were measured by facilities for training and education, as well as by the desire to provide a better education to children, and obtained sense of achievement scores of 2.9, 2.92, and 2.91, respectively. The fact that the scores of the orientors range from 2–3 indicates the good condition of the program. In our social assessment of the BTAP, two basic system orientors, namely "freedom of action" and "effectiveness", were measured by "financial liquidity" and "probability of participating in the BTAP program"; the scores of these orientors were between 3.33 and 3.48, indicating an excellent condition of the program. Overall, the results of the assessment show that the BTAP has a positive influence on rural households in the study area.

Table 4. Assessment of the social impacts of the BTAP in the Malakand Division of KPK, as a "sustainable indicator".

Basic/Define Orientors	Indicators for Orientors (Sub-Sector) Measures	Impact Grade (0–4)	Score (0–4)	Final Assessment
Effectiveness	Probability of participating in the BTAP program	4	3.48	Excellent
Freedom of action	Financial liquidity	4	3.33	Excellent
Existence	Facilities for training and education	4	2.9	Good
Security	Threat	4	1.93	Acceptable
Adaptability	Desire to provide better education to children	4	2.92	Good
Coexistence	Contribution of females to the family income	4	1.88	Acceptable
Psychological need	Sense of achievement	4	2.91	Good
Total sustainability of the program		4	2.76	Good

3.2. Economical Assessment

Since the implementation of the BTAP, the households in the study area have experienced a change in household income (see Table 5). In the BTAP, a total of 593,232 ha of barren land and degraded mountains were converted to forest land. Local households involved in the BTAP, such as private and government nurseries, as well as Nighabaan forest; afforestation; and other economic sectors, were financially subsidized by the provincial government. These subsidies included 150,000 Rs for one unit (25,000 seeds) of tube nursery, Rs 225,000 for bare-rooted nurseries, and Rs 13,000 for Nighabaan forest per month (as of July 2019, 1 USD = 158 Rs). In Phases 1–3, only the subsidy for Nighabaan increased, to Rs 15,000 per month. By combining the economic benefits from the other sectors and government subsidies, it is estimated that in Phase 1, a total of 118.50 million rupees of income was generated for rural households in these three districts. These local households continued to receive economic benefits in Phase 2 and Phase 3, when the total income of these households was 184.40 million and 164.30 million rupees, respectively. As Phase 2 was the main execution period, a second batch of households participated in different activities of the BTAP. The economic income of these households in Phase 2 and Phase 3 was 354.46 million and 223.87 million rupees, respectively. At the end of Phase 2, almost all of the nursery seedlings were fully grown and sold, and the planting had also been completed. Therefore, the income of these households decreased in Phase 3, to 39.50 million rupees.

This study has found an overall economic benefit from the implementation of the BTAP in the study area. Between Phases 1 and 3, an estimated total of 1085.03 million rupees (around 6.9 million USD) of household income was generated by the rural households involved in the BTAP in the three studied districts. This income gains comprised government subsidies, such as support for nurseries (27.03%), Nighabaan income (9.51%), plantation establishment income (13.97%), income from small

businesses (22.09%), income from remittances (16.03%), and income from livestock (11.37%). It is concluded that government subsidies (27.03% + 9.51% + 13.97% = 50.51%) were the main reason behind the increase in the households' income. However, the income contribution from small businesses was also significant.

Table 5. Net household income derived from the implementation of the BTAP in the Shangla, Swat, and Lower Dir districts (Phases 1–3).

Implementation Phase	Net Income (Million Rs)		
	Phase 1	Phase 2	Phase 3
Phase 1 (2014 to 31 December 2015)	118.50	184.40	164.30
Phase 2 (01 January 2016 to 30 June 2017)	—-	354.46	223.87
Phase 3 (01 July 2017 to February 2018)	—-	—-	39.50
Total	118.50	538.86	427.67

3.3. Empirical Findings from the Local Perceptions

3.3.1. Perceived Impact of the BTAP by Net Income

As the net income of inhabitants in the study area increased from ≤86 USD to ≥107 USD per month between Phases 1 and 3, the following were determined: the proportion of respondents who believed that both the environment and economy were equally important, the proportion who believed that the BTAP had already achieved its goal, the proportion who believed that the degraded environment had a bad effect on their health, the proportion who believed that the BTAP was worthwhile, the proportion who supported the BTAP, and the proportion who felt that their income and livelihood had increased during the BTAP (Tables A1–A7 in Appendix A). The results of all of the correlations were strong and positive (R = 0.51–0.64; $p < 0.01$).

3.3.2. Perceived Impact of the BTAP by Education Level

The results of the study show that, as the education level of the participants increased from no educational background to high-school level, there was an increase in the proportion of respondents who believed that a safe and healthy environment is crucial for the economy, in the proportion of respondents who supported the BTAP, in the proportion who believed that the BTAP was worthy, in the proportion who believed that the degradation of the environment badly affected their health, and in the proportion who felt that their income and livelihood had increased during the BTAP (Tables A8–A14 in Appendix B). The correlations of all of these were moderately positive (R = 0.31–0.39; $p < 0.01$).

3.3.3. Perceived Impact of the BTAP by Sex

In this section, we analyze the perceived impacts of the BTAP by males and females with respect to income, livelihood, and health. The results indicate that the majority of respondents (male 68.2%; female 63.4%) believe that their income and livelihood improved with the launch of the project. Similarly, 87.4% of men and 76.7% of women felt that the economy and environment were equally important. Additionally, the percentages of women and men who believed that the BTAP was worthwhile and supported the BTAP were 67.8% and 72.4%, respectively.

4. Discussion and Conclusions

The restoration of degraded forests and the simultaneous promotion of sustainable development represent serious challenges to the environment and society. A large number of innovative methods to reduce forest degradation and enhance local livelihood are being formulated. Incentive-based forest programs are undoubtedly essential approaches to promote sustainability [45,46]. The implementation

of the BTAP has had a significant impact on local society, the livelihoods of households, income, and the provincial natural environment [22,47]. Thus, this study was motivated to investigate these socioeconomic impacts, with the goal of measuring the feasibility of the project and making appropriate recommendations to policy makers in order to modify the project to fit the local conditions.

Overall, the results of this study reveal that the majority of the respondents have benefited from participation in the BTAP. The program is organized by the government with the purpose of sustainable development in the rural community [48–50]. Previous studies have suggested that the effective and viable implementation of such a project is not possible without the participation of the local community [51–53]. However, support for reforestation programs is grounded in the participants' perceived and actual benefits versus losses. Similar findings were reported by Karanth et al. [54], who argued that if participants believe that the benefits obtained from these programs would overcome or exceed the likely losses, this could lead to success in long-term sustainability.

The results of the social assessment show that the BTAP has a significant positive impact on the rural society of the Malakand division in terms of social sustainability. Although two out of the seven indicators—namely security and coexistence, which were measured by "threats from various mafia groups" and "contribution of females to the family income"—showed marginally acceptable scores, all of the other five indicators, namely adaptability, existence, effectiveness, financial liquidity, and sense of achievement, revealed good and excellent figures (see Table 4), which suggests a positive contribution of the BTAP in terms of social sustainability. These findings are vital, as Mullan, Kontoleon [55] argues that if the program impacts are in favor of the local residents, the chances of its failure are reduced.

Our results show that 47% of women in the study region contribute to the BTAP. A similar study conducted by Landry et al. [36] reported that 80.9% of women contributed to a similar project. A possible explanation for this may include: (1) most households do not possess land for nurseries near to their residential areas, and because of cultural constraints, they are not permitted to build nurseries away from their homes; (2) because of illiteracy, there is a scarcity of technical skills; and (3) such a step had never been taken before. Moreover, women are not allowed to participate in any technical programs, which are usually arranged by the government and NGOs operating in their districts. Supporting this notion, Uchida, Rozelle [56] theorized that a proper education is expected to result in better services. Therefore, because of a conservative mentality, men were hesitant to allow females to participate in the BTAP. Despite these issues, the 47% female participation rate was considered satisfactory by community leaders and project supervisors, as they are optimistic that with the passage of time and increasing awareness, the ratio of female participants will increase [57].

The security orientors, which were estimated by threat indicators, had lower scores, however, they were nevertheless acceptable. A possible reason for these low scores is that the forest guards were attacked by different groups, such as the land mafia, grazers, and harvesters; during the initial stage of the BTAP programs, six forest employees (forest guards and Nighabaan) were murdered by local mafia, and no proper compensation was provided to their families. However, the KPK government has recently established a separate unit, termed the forest patrol unit [58]. The responsibility of the unit is to patrol three to four times per day in order to control and lawfully handle any illegal activity. Moreover, Nighbans have also been equipped with updated armor in order to protect themselves and the forest from mafia groups and wild creatures. The BTAP is new, and the changes regarding upgrades to security and policy are recent, and it is therefore plausible that the perception regarding security will also change with time, despite the fact that the results of the present study are in favor of the acceptance of the BTAP. To ensure the sustainability of the project, the local government needs to obtain further insight in order to more efficiently satisfy the need for security. According to Uchida, Xu [48,59], the program will succeed if the needs of the local community are satisfied.

The economic impact of the BTAP was assessed via the analysis of the livelihoods of the inhabitants of the study area. The CBA and perception-based analysis indicate that the BTAP has increased the net income of households in the study region of KPK (Table 5). The trend of net income rise can be attributed to the activities that were conducted in each phase of the program. The analysis of the

perception of rural households shows that the BTAP has had a significant impact on the livelihood of the local community, despite the fact that the BTAP has a ban policy towards grazing and logging. Our study indicates that the poor people living in the study area intend to support the BTAP. During the field survey, local residents, leaders, and officials were asked why, despite a ban on grazing and logging, their income and livelihood has not been adversely affected. Their reply was three-fold. First, most of the residents of the study area only have access to poor-quality, inaccessible, or immature timber, even before the project. Second, aligned with Qamer et al. [40], much of the land in KPK was barren and deforested, but had recently been reforested by the government. Specifically, the KPK forest department identified, targeted, and rehabilitated the degraded land, which was already sidelined by the local community with respect to logging and grazing. The response to our household survey also indicated that much of the timber on the respondents' forestland had already been harvested. Lastly, the people living in the area of the BTAP are receiving financial support from the provincial government in the form of salaries and profit, and the ban on grazing and logging is therefore irrelevant to them. These results are consistent with the study of Mullan [55], who argued that bans on logging and grazing are perceived as irrelevant, and the overall livelihood of the community increases when the government provides financial support. In a similar vein, other researchers have suggested that individuals usually prefer the option of sustainable earning over short-term revenues [60]. Therefore, the loggers and timber mafia of the past have now been transformed into tree planters and forest protectors.

With government subsidies accounting for 50.51% of the total rise in income in the study area during the study period, household income depends heavily on government financial support. It is unclear what will happen to rural household incomes when the government ends the subsidies after Phase 3 of the BTAP. The large proportion of governmental financial support to the net income of the households creates some difficulties for sustaining the long-term household income level after the BTAP. Therefore, the government should allow the community to manage forests by themselves, thus producing a community forest, and should also present opportunities for locals to change their livelihoods to ones that do not involve the use of timber—for example, harvesting NTFPs (non-timber forest products), planting fruit trees, and breeding livestock. This can be a win–win solution for forest conservation and the fulfillment of human wellbeing [16,61]. To implement livelihood change strategies, the academic sector, the business sector, the community NGOs and civil society organizations, and the government can collaborate to provide technical and vocational training to process the NTFP or other products and processing equipment. The government could also provide means for the locals to access funding sources so that households can adopt desirable land use practices that both accomplish the goals of the BTAP and provide them with sufficient income to survive. Finally, rural residents must be given access to the same government funds for education, health care, and pensions that are provided to urban residents. To ensure the sustainability of the project over the period of five years, audit regarding funding and management is required. This will highlight the shortcoming and will open a new window for the improvement in policies. If these efforts can be properly made, the aims of increasing rural household incomes and protecting the environment will be likely attained.

5. Future Directions

This study investigated the impacts of the BTAP based on the actual and perceived benefits of the local people. Future research may also examine the possible negative social, economic, and cultural impacts of the BTAP on the local inhabitants. It is believed that if the BTAP is properly implemented, it is more likely to offset the negative results of logging bans. Apart from improving people's livelihoods and social sustainability, the BTAP is expected to mitigate problems such as biodiversity loss, soil erosion, water runoff, and flooding. Thus, researchers ought to investigate the environmental impacts of the BTAP as well.

Finally, similar studies can be carried out on more aggregated secondary data with a longer temporal scale, a broader spatial scale, and more complete area coverage, in order to obtain robust empirical findings to more comprehensively understand the effects of the BTAP.

Appendix A

Table A1. Income correlations results.

		Income	Which One is More Important? Environment or Economy?
Income	Pearson Correlation	1	0.518 **
	Significant (two-tailed)		0.000
	N	406	406
Which one is more important? Environment or economy?	Pearson Correlation	0.518 **	1
	Significant (two-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Table A2. Income correlations results.

Correlations			
		Income	Does Environmental Degradation Affect Your Health?
Income	Pearson Correlation	1	0.501 **
	Significant (two-tailed)		0.000
	N	406	406
Does environmental degradation affect your health?	Pearson Correlation	0.501 **	1
	Significant (two-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Table A3. Income correlations results.

Correlations			
		Income	Is the BTAP Worthwhile?
Income	Pearson Correlation	1	0.603 **
	Significant (two-tailed)		0.000
	N	406	406
Is the BTAP worthwhile?	Pearson Correlation	0.603 **	1
	Significant (two-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Table A4. Income correlations results.

Correlations			
		Income	**Has the BTAP Increased Your Income?**
Income	Pearson Correlation	1	0.582 **
	Significant (two-tailed)		0.000
	N	406	406
Has the BTAP increased your income?	Pearson Correlation	0.582 **	1
	Significant (two-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Table A5. Income correlations results.

Correlations			
		Income	**Has the BTAP Improved Your Livelihood?**
Income	Pearson Correlation	1	0.606 **
	Significant (two-tailed)		0.000
	N	406	406
Has the BTAP improved your livelihood?	Pearson Correlation	0.606 **	1
	Significant (two-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Table A6. Income correlations results.

Correlations			
		Income	**Has the BTAP Achieved Their Goals?**
Income	Pearson Correlation	1	0.640 **
	Significant (two-tailed)		0.000
	N	406	406
Has the BTAP achieved their goals?	Pearson Correlation	0.640 **	1
	Significant (two-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Table A7. Income correlations results.

Correlations			
		Income	**Do You Support the Ban Policy?**
Income	Pearson Correlation	1	0.613 **
	Significant (two-tailed)		0.000
	N	406	406
Do you support the ban policy?	Pearson Correlation	0.613 **	1
	Significant (two-tailed)	.000	
	N	406	406

** Correlation is significant at the 0.01 level (two-tailed).

Appendix B

Table A8. Education correlations results.

		Illiterate to Master Education	Which One is More Important? Environment or Economy?
Illiterate to Master Education	Pearson Correlation	1	0.382 **
	Significant (2-tailed)		0.000
	N	406	406
Which one is more important? Environment or Economy?	Pearson Correlation	0.382 **	1
	Significant (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Table A9. Education correlations results.

Correlations			
		Illiterate to Master Education	Does Environmental Degradation Affect Your Health?
Illiterate to Master Education	Pearson Correlation	1	0.305 **
	Significant. (2-tailed)		0.000
	N	406	406
Does environmental degradation affect your health?	Pearson Correlation	0.305 **	1
	Significant. (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Table A10. Education correlations results.

Correlations			
		Illiterate to Master Education	Is the BTAP Worthwhile?
Illiterate to Master Education	Pearson Correlation	1	0.315 **
	Significant. (2-tailed)		0.000
	N	406	406
Is the BTAP worthwhile?	Pearson Correlation	0.315 **	1
	Significant. (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Table A11. Education correlations results.

Correlations			
		Illiterate to Master Education	Has the BTAP Increased Your Income?
Illiterate to Master Education	Pearson Correlation	1	0.337 **
	Significant. (2-tailed)		0.000
	N	406	406
Has the BTAP increased your income?	Pearson Correlation	0.337 **	1
	Significant. (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Table A12. Education correlations results.

Correlations			
		Illiterate to Master Education	**Has the BTAP Improved Your Livelihood?**
Illiterate to Masters education	Pearson Correlation	1	0.351 **
	Significant. (2-tailed)		0.000
	N	406	406
Has the BTAP improved your livelihood?	Pearson Correlation	0.351 **	1
	Significant. (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Table A13. Education correlations results.

Correlations			
		Illiterate to Master Education	**Has the BTAP Achieved Their Goals?**
Illiterate to Masters education	Pearson Correlation	1	0.395 **
	Significant. (2-tailed)		0.000
	N	406	406
Has the BTAP achieved their goals?	Pearson Correlation	0.395 **	1
	Significant. (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Table A14. Education correlations results.

Correlations			
		Illiterate to Master Education	**Do You Support the Ban Policy?**
Illiterate to Masters education	Pearson Correlation	1	0.310 **
	Significant. (2-tailed)		0.000
	N	406	406
Do you support the ban policy?	Pearson Correlation	0.310 **	1
	Significant. (2-tailed)	0.000	
	N	406	406

** Correlation is significant at the 0.01 level (2-tailed).

Appendix C

Questionnaire for "Billion Trees Afforestation Project", Malakand Division, Khyber Pakhtunkhwa Province (KPK), Pakistan.

Part I. Introduction
(1) Brief introduction on the "Billion Trees Afforestation Project" in KPK (Removed)
(2) Socio- economic, environmental and Geo graphic description of study area (Removed)
(3) The implementation of the "Billion Trees Afforestation Project" in KPK (Removed)
(4) Questionnaire annotations (Removed)

Part II. Socio-economic aspects
We, as Ph.D. Scholars in North East Forestry University China, Herbin, do not represent any official or governmental organization. We are simply interested in your opinions regarding the "Billion Trees Afforestation Project". Your answers will remain anonymous, and you can be assured that your identity

will never be exposed. Tick [] on an option or fill in blanks with your answer, respectively. One answer one item.

Section "A": Your opinions on the Billion Tree Afforestation Project (BTAP).

(1) Are you over 18 years old?
Yes_____ No_____
(2) Are you familiar with your family's situation?
Yes_____ No_____
(3) Please choose a number that can denote the likelihood of you participating (implementing) in the project over the long-term. "0" denotes that you will not; numbers from "1" to "10" denote the increasing probability of your implementing the project, while "10" represents your strong willingness to participated (implement) the project.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

(4) Having taken part in the project, do you feel more tense or more relaxed compared to before? Please choose a number to denote your feelings. "0" denotes that you feel no change; increasing numbers on the left denotes a rising sense of being tense, while increasing numbers on the right denote a rising sense of being relaxed.
    —-Increasingly tense no change increasingly relaxed—-

5, 4, 3, 2, 1 0 1, 2, 3, 4, 5

(5) Do you feel a greater sense of achievement (i.e., are you happy with the advantages that your activities have brought to your community and to your descendants) once you participated in a project that could enhance the natural environment of the area? Please choose a number to denote your feelings. "0" denotes no change and the increasing numbers from "1" to "10" indicates a progressively greater sense of achievement.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

(6) Do you feel incapable of individually improving the KPK natural environment? Do you hope that the next generation will receive greater educational opportunities, and hence have sufficient knowledge to resolve the problem? Please choose a number to denote your feelings. "0" means that you do not hope so. Increasing numbers from "1" to "10"denote the increasing degree in your hopes.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

(7) Do you believe that the BTAP project is strong enough to support forest based entrepreneurs and employees in terms of financial liquidity. Select "0" if you feel that it is not likely to happen. Express your feelings of hope on a scale which ranges from 1 to 10, where 1 denote minimum and 10 indicate maximum.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

(8) Is the project organized enough to influence the local community to rely on BTAP for their livelihood. Select "0" if you feel that the BTAP is incapable. Express your feelings of hope on a scale which ranges from 1 to 10, where 1 denote minimum and 10 indicate maximum.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

(9) Do you believe that system provides opportunities that were not possible before its existence.

For example, there were no earning opportunities for women before, does the system provide such platform. Select "0" if you feel that the BTAP is incapable. Express your feelings of hope on a scale that ranges from 1 to 10, where 1 denotes the minimum and 10 indicates the maximum.

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Section "B": Participation of Women, and Perceived Livelihood.

(10) How did participating in the project increased your family's income?
a. Yes _____; b. No _____; c. Partly _____; d. No-opinion _____.
Increased (or decreased) by _____%?
(11) Do mainly male or mainly female individuals in your family engage in project-related work?
Male ___; Female ___; Share equally ___.
(12) Percentage of female individuals' contribution to the family's total earnings:
Before participation in the project: _____%; After participation in the project_____%.
(13) Have the female individuals in your family ever taken part in training or meetings about the project?
Never ___; Sometimes ___; Often ___.
(14) What do you think, which one is more important?
a. Environment _____; b. Economy _____; c. Equally important _____; d. No-opinion _____.
(15) Is there any adverse effect of the environmental degradation on your health?
a. Yes _____; b. No _____; c. Partly _____; d. No-opinion _____.
If the answer to question (15) was "Yes", please answer the following sub-section.
(b). What do you think, BTAP would help to protect environment?
Yes _____; No_____; No-opinion_____.
(16) Is the BTAP worthwhile?
a. Yes _____; b. No _____; c. Partly _____; d. No-opinion _____.
(17) Has BTAP increased your livelihood?
a. Yes _____; b. No _____; c. Partly _____; d. No-opinion _____.
(18) Have the BTAP achieved its goals with respect to increasing income?
a. Yes _____; b. No _____; c. Partly _____; d. No-opinion; _____.
(19) Are you supporting the ban policy on grazing and logging?
a. Yes _____; b. No _____; c. Partly _____; d. No-opinion _____.

Section "C": The cost and benefits of "Nursery grower, Nighabaan, and others" after BTAP implementation.

Definitions:
A. Nursery grower; government provided subsidies for nursery grower, raising seeds/trees for the project.
B. Nighabaan; protected the plantation area or closure, and the government provided a salary. These are also known as green jobs.
C. 1 ha = 20 kanals
(20) Nursery land costs and profits prior to conversion:
Area _____ hc; crop species _____; cash costs for one year (including costs of seeds, fertilizers, pesticides, charges for water, farming machinery, agricultural taxes, contract fees, etc.) _____ Rs; labor cost _____; total yield_____ kg; price _____Rs. Kg1.
(21) Nursery land costs and profits after conversions:
Area _____ hc; year of conversion 20___; species _____; cash cost of one year (including costs of seedlings or seeds, fertilizers, pesticides, water charges, farming machinery, etc.)
Rs. _____; labor cost _____; total trees_____ number; price _____Rs. per/tree.
(22) Nighabaan per month income before and after participation in the BTAP
Before_____ Rs.; After_____ Rs.

(23) A part from nurseries and Nighabaan provided by the government, is there any other source of income in your family?

Yes _____; No _____; No-opinion_____.

If the answer to question (23) was "Yes", please fill in the following blank.

The family has other sources income (such as sheep, cattle, dry grass selling, or other business).

Income from livestock _____Rs; income from other business_____Rs; income from surplus laborers_____ Rs.

(24) Costs for afforestation and reforestation on bare mountain lands:

Area _____ hc; year of conversion 20___; species _____; cash cost of one year (including costs of seedlings or seeds, water charges, farming machinery, etc.) _____ Rs.; labor cost _____Rs.; total trees_____ number.

Section "D": Demographics and Personal Information.

The following questions will help in the analysis of the survey's results. Your answers will be kept secret confidential now and in the future. Tick on an option or fill in the blank with your answer.

(23) Sex: Male _____ Female _____

(24) Age: _____

(25) Religion: _____

(26) Address: _____ District_____

(27) Educational level:

Illiterate _____ Primary school _____ Middle school _____

High school and secondary school _____ Bachelor or Master _____

(28) How many members are there in your family? _____ individuals

(29) Your family's net annual income is: _____for one year

(30) Please write any suggestions or advice you may have regarding the BTAP.

(31) Please write any suggestions or advice regarding the questionnaire.

Thank you very much!

Investigator's signature: _____

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