Key factors influencing tree planting decision of farmers on farm land: A case study in Malakand, Pakistan

Pervez Khan[1], Bui Manh Hung[2,*], Le Dinh Hai[3], Sohail Ahmad[1], Faisal Khan[1], Sajjad Ullah[1], Adnan Ahmad[1,4], Shiou Yih Lee[5]

[1]Department of Forestry, Shaheed Benazir Bhutto University Sheringal Dir Upper, Pakistan
[2]Department of Forest Inventory and Planning, Faculty of Forestry, Vietnam National University of Forestry, Xuan Mai, Chuong My, Hanoi, Vietnam
[3]The Faculty of Development Economics, University of Economics and Business, Hanoi, Vietnam
[4]Department of Environmental sciences, Quaid -i- Azam University Islamabad, Pakistan
[5]Faculty of Health and Life Sciences, INTI International University, Nilai, 71800 Negeri Sembilan, Malaysia

*Corresponding author e-mail: hungbm@vnuf.edu.vn

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Abstract. In order to cope with forest degradation and deforestation, farm forestry is a new tool for plantation purposes that combat these issues. Planting trees on farmlands is the most practical and viable approach given in the current situation in Pakistan for recovering the degraded forest lands, ensuring the sustainable use of marginal areas, and satisfying the rural requirements for the benefits of trees, both economically and non-economically. Therefore a socio-economic study of farmers in relation to tree planting is very important, to understand farmers perception about farm trees growing. In this study a total of 120 households were surveyed and interviewed in district Malakand for factor affecting farm tree planting decision. The result of step wise binary logistics regression analysis indicated that the factors including: Education level, Attitude of tree planting and silviculture knowledge were significantly influenced on tree planting decision of household in the study area. The total household income for planter was significantly higher than non-planter. The study result may provide the basis for proposing solution for future to strengthen trees planting decision for plantation, with the intention of promoting household engagement and attract farmers towards plantation activities in the study area.

Keywords: value of trees, commercial tree growing, farm forestry, tree planting, binary logistics regression.

1. Introduction

Farm forestry is a new and emerging discipline in devolving countries. It attracts peoples to get and fulfil their demand for fuelwood, fodder for animals and timber by planting suitable trees on farmlands (Anwar et al., 2017). Thus Farm forestry is a farming system that integrates commercial trees growing under farmers management to produce wood and non-wood goods, promotes sustainable natural resource management and boosts agricultural output (NSW, 2003). In Pakistan, the importance of farm forestry was recognized in the late 1970s when the United States Agency for International Development (USAID) launched forestry planning and development project from1985 to 1994, to provide wood to market and alleviate poverty. Majority of social forestry programs were primarily focused on biological and technical concerns, with little to no attention placed on understanding the viewpoint of local peoples or prospective beneficiaries of the project, therefore People's participation in farm forestry is minimal (Malik, 1989).

In Pakistan in the development of farm forestry the most important variables are human not physical (Dove, 1995). An efficient farm forestry planning system can be developed by analyzing the features of the homes and farms. Therefore it is crucial to do a socioeconomic analysis of farmers and their relationship. Sinclair (1999) indicated the there is a deficiency of quantitative and predictive understanding regarding traditional agroforestry practices and how to increase their adoption. Developing new strategies to encourage farmers to plant trees and improving existing systems can be designed if the characteristics of farms and farmers are studied regarding tree planting in existing agroforestry (Nair & Dagar, 1991). Singh R.P.R. Kumar and Singh N.P. (2006) reported, the main obstacles to the adoption of farm forestry were farmers living in poverty, outdated agricultural techniques, and inadequate infrastructure, particularly with regard to market services. Akbar et al. (2000) suggested the reason for the limited acceptability is that farmer’s perspectives on the variables influencing their decisions are not given enough consideration. Arnold and Dewees (1998) argue that, in order to effectively encourage tree planting on farms, strategies must take into account farmer’s tree management practices within the framework of household livelihood strategies. They noted that little is known about ‘‘farmers' perceptions of the value of trees’’ and the obstacles they face in developing tree resources. Local Politics also has been found to influence the outcomes of farm forestry interventions in Bangladesh (Dove, 2003).

With a 2.1% deforestation rate, Pakistan has lost over 0.21 million hectares of forest, or 0.043 hectares on average every year (FAO, 2001). Pakistan has a limited forest resource covers 4.8% (excluding 4.59% farmland plantations) of its total territory. The amount of forest cover in the area is insufficient to meet the material needs of the expanding population, the growing industry, and the continued process of environmental and ecological degradation (Pakistan Economic Survey, 2004). To restore degraded forest areas, ensure sustainable use of marginal lands, maintain good quality land, and meet the needs of rural communities to derive economic and

non-economic benefits from trees for their livelihoods (Khan et al., 2011), planting trees on the farmland is the most practical and workable solution in the current conditions of Pakistan.

Assessing and resolving farmers' perceptions of the factors driving farm level tree planting will be critical to the future success of farm forestry in Pakistan. This may be achieved by understanding our comprehension of the attitude towards farm forestry, the perceptions and beliefs of the underlying farmers, and the interaction between these factors in shaping the decision to plant trees on farmlands. Therefore, this research aimed to investigate the main factors that influence households' decision to plant trees on farms in the study area, specifically i) assessing the current situation of tree planting on farmland in Malakand, ii) identifying the factors that influence households' decision to plant trees on farmland in Malakand, and iii) investigating the constraints that farmers face when planting trees in the study area in order to propose recommendations for improving tree planting on farmland in Malakand.

2. Materials and methods

2.1. Study area

The study area (District Malakand) is located in Pakistan's Khyber Pukhtunkhawa Province's northern regions. Its coordinates are 34° 35´ North latitude and 71° 57´ East longitude. Lower Dir district borders it on the north, Swat district borders it on the east, Mardan and Charsadda districts border it on the south-east and south-west, respectively, and Mohmand and Bajaur agencies border it on the west. It covering an area of 952 square kilometres (95,200 hectares). Out of the total reported area i.e. 52,134 hectares is uncultivated, while 43,066 hectares is cultivated (Pervaiz, 2009; Haji, 2017). Agriculture is the main source of income for the resident. The main cash crops grown in the region include maize, rice, tobacco, sugarcane, and wheat (Haji, 2017). The soil is moist loamy with an average rainfall (600 to 650 mm) is not enough. Climate of the area is dry with a maximum temperature exceeds over 40° C to 6°C. Malakand is 2705 feet above the sea level.

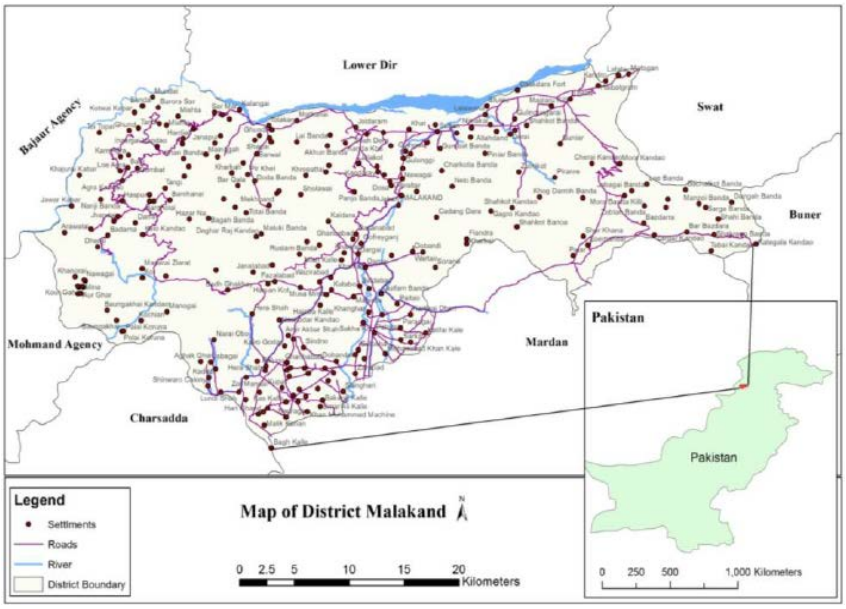


Figure 1. Map of the study area (Iqbal et al., 2017)

2.2. Study method

2.2.1. Theoretical framework of the study

To investigate the factors influencing farmers' decisions, such as the planting of trees on farm, many different theoretical and methodological approaches have been developed (Mercer, 2004; Pattanayak et al., 2003; Walters et al., 2005). Therefore the theoretical framework of this study was taken from the literature review (Conceptual model). These include socio-economic variables (Opportunity cost of production, market price, risk and excess, economic incentives) household characteristics (education level, age, household assets size of household, household's yearly income and on-farm income for the household), farm characteristics (land area owned and planted with trees, incentives, land availability, planting material, distance to market, existing forest resource), biophysical factor (soil type, soil quality, soil nutrients and slope aspect etc) and institutional factor (property right, secure production right, secure transportation right and land tenure etc).

2.2.2. Conceptual model

A wide range of factors influence smallholders tree planting activities. These factors are identified, summarized and presented in the conceptual model in Figure 2.

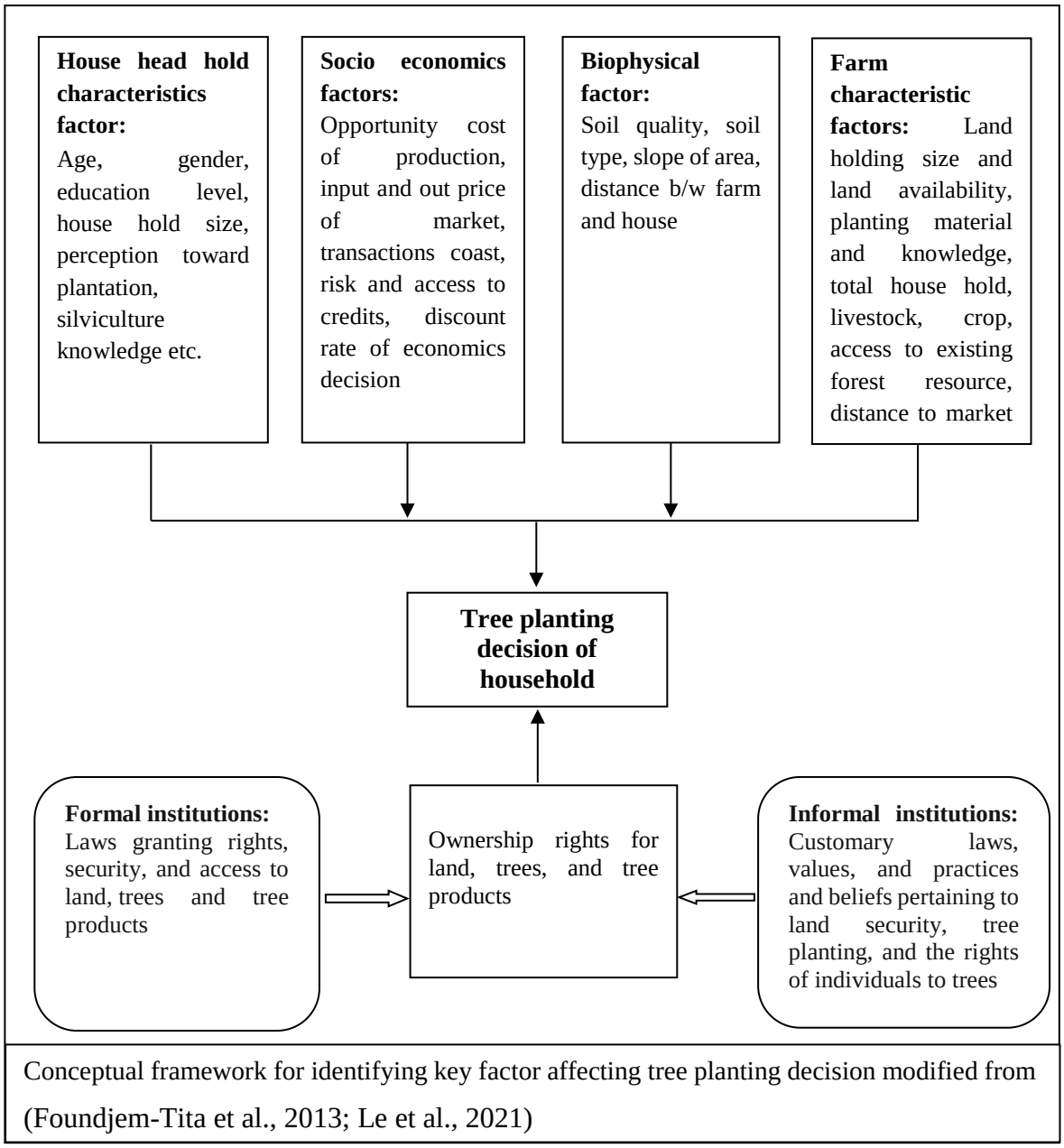


Figure 2. Conceptual models for identifying key factors affecting tree planting decision

2.2.2.1. Socio-economic factors

In tropics and sub-tropics several studies have found that socioeconomic factors affect farmer's tree planting activities (Emtage & Suh, 2004; Mahapatra & Mitchell, 2001; Simmons et al., 2002). Smallholders differ significantly in their socioeconomic, perceptional (i.e., attitudes, beliefs), and motivational traits (Scherr, 1995). These elements must be taken into account in order to identify areas that are both economically and ecologically suitable for growing trees. These include the opportunity cost of the various production factors, access to markets for inputs and outputs, transaction costs, risk and credit availability, and the discount rates of economic decision-making

units. Production costs are negatively correlated with planting trees, particularly in areas with poor physical infrastructure, which makes it difficult to access markets and provides no incentive for production. On the other hand, metropolitan areas close to companies that consume wood are more viable because the cost of transportation to the markets does not pose a barrier (Scherr, 2004).

Tree planting is also influenced by farmer's access to loans and credit (Scherr, 1997). Lack of funds is a major obstacle to planting trees for low-income farmers (Byron, 2001). Tree planting activities is influenced by the farm's location in regard to markets, particularly when wood is grown for cash sales. Tree planting also put farmers to the risks of changing prices, unstable tenure, and natural disasters because trees take a long time to mature (Angelsen & Wunder, 2003). This lengthy waiting period with high risks does not benefit poor farmers, who frequently rely heavily on their few farm resources to survive on a day-to-day basis (Dewees & Saxena, 2014; Dewees, 1997). Only the farmers who have access to affordable loans, can afford the lengthy payback period between planting and trees harvesting (Arnold, 1996).

2.2.2.2. Biophysical factors

Biophysical factors, which impact tree planting activities, include site conditions, soil properties, slope aspect, and the distance between the house and farm. Tree planting can be a a practical solution for marginal lands use, when agricultural crops are unsuitable (Cossalter & Pye-Smith, 2003; Evans, 1992). Farmers who live in or near their farms are able to manage and protect their trees more efficiently (Arnold, 1996). Trees on farm reduce time spent by household and labour burden together forest products from far-off places, especially when there are few natural forests (Arnold & Dewees, 2014).

2.2.2.3. Household characteristic factors

To understand farmer preferences, socio demographic data such as age, gender, education, and social standing might be utilized (Pattanayak et al., 2003). Gender which has been found to have impact on the amount of tree planting, house hold with male head or higher male member likely to plant more trees (Pattanayak et al., 2003; Scherr, 1995). Age and education are other indicators of human capital, and it has been discovered that these factors enhance the probability of planting trees since they boost environmental awareness and knowledge with tree-planting techniques (Simmons et al., 2002).

In fact, education is a vital priority for sustainable forestry at all levels (Schmidt et al., 1999). Well educated and young leaders in villages have been innovative, engaging in tree planting (Song et al., 2004). In some cases, it is been discovered that a household's age can affect their choice to plant particular crops (Walker & Homma, 1996). In general, older farmers are more capable of taking on risk than younger ones (Thacher et al., 1996). It is usually recommended that younger households plant a variety of crops that can provide a steady income and food instead of trees (Walker & Homma, 1996). Tree planting activity is influenced by the farm's proximity to markets, particularly when wood is generated for commercial sales. Access to the market is made

more difficult in remote locations with low population densities and inadequate physical infrastructure. Wood consuming industries close to urban area are more feasible, where by markets transportation expenses do not provide a barrier (Scherr, 2004).

2.2.2.4. Farm characteristics/resource endowments

Important farm attributes and resource endowments include livestock, the amount of intensification, the size and availability of land holdings, the household income as a whole, the accessibility of the current forest resources, and the farm's distance from the market. Land is necessary for planting trees, but the poorest farmers typically own very little or have limited access to private land, leaving them with no alternative but to cultivate yearly returns-producing staple food crops rather than the more slow-growing trees (Simmons et al., 2002; Summers et al., 2004). Hence, it is often found that farmers who own larger tracts of land tend to plant more trees than farmers who own smaller tracts of land (Summers et al., 2004).

Farm location in relation to market also influences tree planting activity. Due to lower market transportation costs, farmers who are located close to production facilities and markets and have adequate infrastructure have favorable market conditions for planting and maintaining trees (Scherr, 2004). Low population densities remote areas and inadequate infrastructure make difficult to access the market. Urban areas close to wood consuming industries are more viable, whereby transport costs to the markets are not a constraining factor (Scherr, 2004). Wealthier farmers are more willing to take risky investments, like trees planting (Mahapatra & Mitchell, 2001; Scherr, 1995).

2.2.2.5. Institutional and policy factors

Policy and Institutional elements are security of land and tree tenure, extension services, information sources and incentives etc. Globally, there have been modifications to forest governance frameworks that have strengthened local rights to the land and trees (Kaimowitz, 2003; Luttrell et al., 2011). Decision-making over tree planting involves the rights to land and trees. Planting trees is not being done by farmers whose land tenure rights are unclear (Hyman, 1983). Land tenure is closely associated with trees tenure. Farmers who lack legal land ownership often believe they are unable to own the trees and, as a result, do not plan to plant trees. (Tengnäs, 1994) found out that the majority of Kenyan farmers believe investing in tree cultivation on land that is not legally theirs to be inappropriate and unappealing.

2.3. Data collection

2.3.1. Sampling design and sample size

Data was collected through questionnaire by surveying and interviewing a total of 120 households in 10 different villages by stratified random sampling technique (Appendix 2). The sample size was based and determined on the formula of (Tabachnick & Fidell, 2007).

The study area has 2 nations Pushtuns and Gujars. Pashtuns are the permanent residents of the area, while gujars are nomads. We interviewed 10 households head (with 3 different wealth

status categories (Poor, Moderate and Rich; Table 1)) in the village having households numbers above 50, 12 having more than 100 and 15 having household more than 150 respectively, from each village (Appendix 3).

Table 1. Household Sampling in study area

No	Household	No of Interviewer to be sampled	Rich		Moderate		Poor	
			Pushtuns	Gujars	Pushtun	Gujars	Pushtun	Gujars
1	121	12	10	10	46	24	20	10
2	167	15						
3	132	12						
4	189	15						
5	93	10						
6	79	10						
7	150	12						
8	89	10						
9	147	12						
10	143	12						
Total	1310	120	20		70		30	

2.4. Data analysis

The qualitative information was gathered during the survey, compiled, summarized and tabulated. Data were analyzed by IBM SPSS Statistics (IBM corp, 2011) and Micro Soft Excel (Microsoft Corporation, 2007).

2.4.1. Descriptive statistics

Using descriptive statistics basic feature of the data were described. Qualitative variables were analyzed by calculating frequencies, making crosstabulation tables in order to identify the association between indicator/dependent variable (Tree planting decision) and independent variables (Table 2 and 3).

2.4.2. Bivariate analysis

The bivariate correlation procedure computes the Pearson's correlation coefficient for the quantitative variable. To identify an association between tree planting decision by household (dependent variable) and factors (independent variables) Pearson's correlation was used. Factors found significantly associated with an independent variables in the bivariate analysis (Sig. <0.05) were considered as a candidate in stepwise binary logistic regression with the independent variable. In step wise regression factors was entered if the significant of their relationship with an

independent variable Sig. <0.05, was removed from the stepwise regression, and if the significance of their relationship with an independent variable become Sig. ≥0.10.

Binary logistics equation function is:

$$\text{Ln} = \left[\frac{P(Y=1)}{P(Y=0)}\right] = B0 + B1X1 + B2X2 + \cdots + BiXi \quad (1)$$

Where: P(Y=1) = P_0: probability of the households decides tree planting decision;

P(Y=0) =1-P_0: the probability of the household decides not tree planting decision

Xi: the independent variable

To investigate relationships with continuous drivers for the binary indicators "Tree planting decision by households (0 or 1)," Student's t-test was used, while the Pearson's $\chi 2$ test was utilized to investigate associations with categorical drivers. The study used linear regression to investigate correlations with continuous drivers for the continuous dependent variable "Area will be planted," and the Student's t-test was utilized to investigate associations with categorical drivers. In bivariate analyses drivers found to be significantly associated (Sig. <0.05) with indicators were considered as candidates in stepwise multiple regressions with indicators (Brace et al., 2006; Ho, 2006).

2.4.3. Regression models

Before data analysis first round check was used, to ensure no violation of the assumptions of normality, linearity, multicollinearity among the variables. Multiple linear regressions were used for the continuous variable. In statistic, logistic regression is a regression model where the dependent variable is categorized. The binary logistic regression was applied to determine the key factors that influence to tree planting decision which gives a positive response. These drivers would be statistically significant if the indicator had the Sig. < 0.05 at 95% confidence level. Forward stepwise binary logistic regression was used for binary dependent variable. Drivers were included in the stepwise regressions if their association with an indicator had a significance level of Sig. <0.05. They were excluded from the stepwise regressions if their link with a dependent variable had a significance level of Sig. ≥0.10.

The drivers were arranged in the stepwise regressions according to how strongly (lowest p-value) or least strongly (highest Sig) they linked with a dependent variable (Brace et al., 2006; Ho, 2006). Binary logistic regression procedure contains two variable dependent variable and independent variable. Dependent variable has two value (0="No"; 1="Yes"), whereas an independent variable can be contained more than two values. Determined the factors brief model in which the variables were tested, Pearson's correlation was used. The result in which significant values were less than 0.05 (5%) were chosen as the factors which influence the involvement of local peoples to tree planting decision in a 95% confidence level.

3. Results

3.1. Community characteristics of the households in the study area

Table 2 indicated characteristics of the household. In general the interviewed respondent 18.3% were illiterate, 30% were with primary and middle school education, up to 34.2% were high and high secondary school, 9.2% was with a bachelor, while only 8.3% was master degree holder in different field of expertise. Most of the farmers invested their own money which accounts for almost 57.5%, while the poorer investor takes10 % from forest program and 32.5% from banks. Attitude of the farmers towards tree planting was 60.9% favourable, while 22.5% show the negative response of unfavourable followed by 16.7% indifferent. Regarding plantation management 22.5% responded it is difficult to manage, 32.5% said its medium, while 45% said that it is easy to manage plantation. For silviculture knowledge 50.8% respondent did not have good silviculture knowledge, while 49.2% know silviculture practices. 48.3% of the interviewees did not know about any forestry program, in contrast, 51.7% respondents knows about forestry program which is launching by different organizations. 55.8% of the respondents took part in forest program, while 44.2% did not take part in the forest program.

Table 2. Community characteristics of the household in the study area

Variable	Frequency	Percent	Cumulative Percent	Variable	Frequency	Percent	Cumulative Percent
Education Level				**Attitude toward tree planting**			
Uneducated	22	18.3	18.3	Very favorable	17	14.2	14.2
Primary & middle	36	30	48.3	Favorable	56	46.7	60.8
High & secondary	41	34.2	82.5	Indifferent	20	16.7	77.5
Bachelor	11	9.2	91.7	Unfavorable	19	15.8	93.3
Master	10	8.3	100	Very unfavorable	8	6.7	100
Total	120	100		Total	120	100	
Plantation management				**Knowing about the forestry program**			
Difficult	27	22.5	22.5	No	58	48.3	48.3
Medium	39	32.5	55	Yes	62	51.7	100
Easy	54	45	100	Total	120	100	100
Total	120	100					
Knowledge of silviculture				**Participation in forest program**			

No	61	50.8	50.8	No	53	44.2	44.2
Yes	59	49.2	100	Yes	67	55.8	100
Total	120	100		Total	120		

3.2. Characteristics features of the households in the study area for Quantitative parameters

Table 3 showed the descriptive statistics of the quantitative variable. The household head age ranged from 28 years minimum to 75 years maximum with a mean of 54.9 years. Majority of the respondent (47.5%) were found in the age group 41-60 years followed by 35% > 61 years. The total land area begins with a 0.2-hectare minimum to 10-hectare maximum with a 4.7-hectare mean. The majority (59%) of the respondents had a land area from 3-5 hectares followed by 25.7% from 6-8 hectares. Farmers having forest, ranged from 0-4.5 hectares maximum. Those having 0-2 hectares were (87.5%) followed by 3-4 hectares (10.9%), while >4 hectares was 1.6%. Similarly household income ranged from lowest 109000 to 1,500,000 highest Pakistani rupees with a mean of 330,597.50 rupees. Poor peoples were accounted for 45.8%; average peoples were 50.2% and 4% was rich.

Table 3: Characteristics features of the households in the study area for quantitative parameters

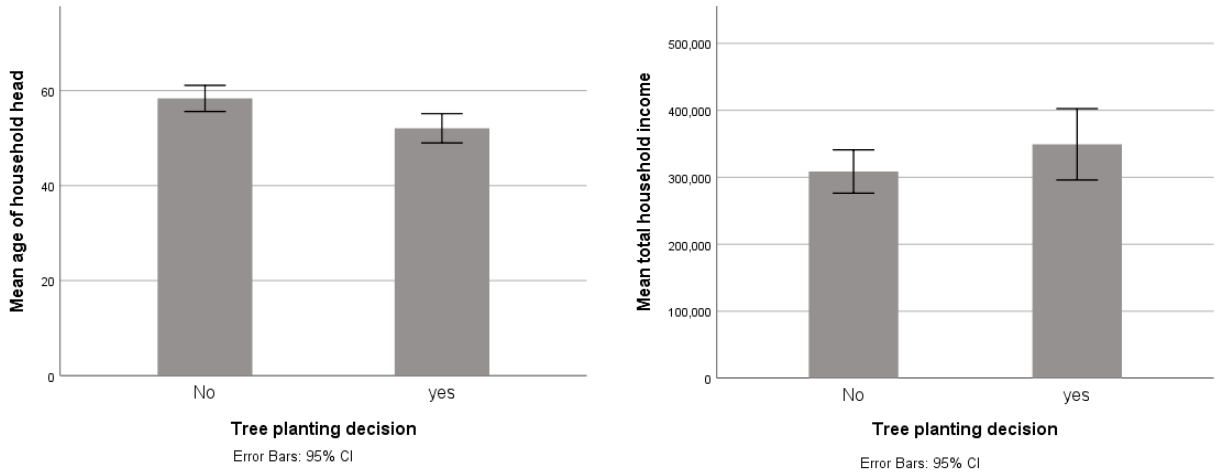
Variable	Frequency	%	Minimum	Maximum	Mean	Std. Dev.
Household head age (years)						
20-40	21	17.5	28	75	54.96	11.84
41-60	57	47.5				
>61	42	35				
Total land area (hectare)						
0-2	16	9.8	.2	10	4.71	1.759
3-5	71	59				
6-8	31	25.7				
>8	2	1.6				
Forest land area (hectare)						
0-2	105	87.5	.0	4.5	1.747	1.020
3-4ha	13	10.9				
>4 ha	2	1.6				
Total household income (Pak Rupees)						
100,000-300,000	55	45.8	109,000	1,500,000	330,597.5	178,357.93
300,000-450,000	48	40				
450,000-600,000	12	10.2				

>600,000	5	4				

Note: Std. Dev. was the standard deviation **(**indicates deviates value from the mean value) in the table.

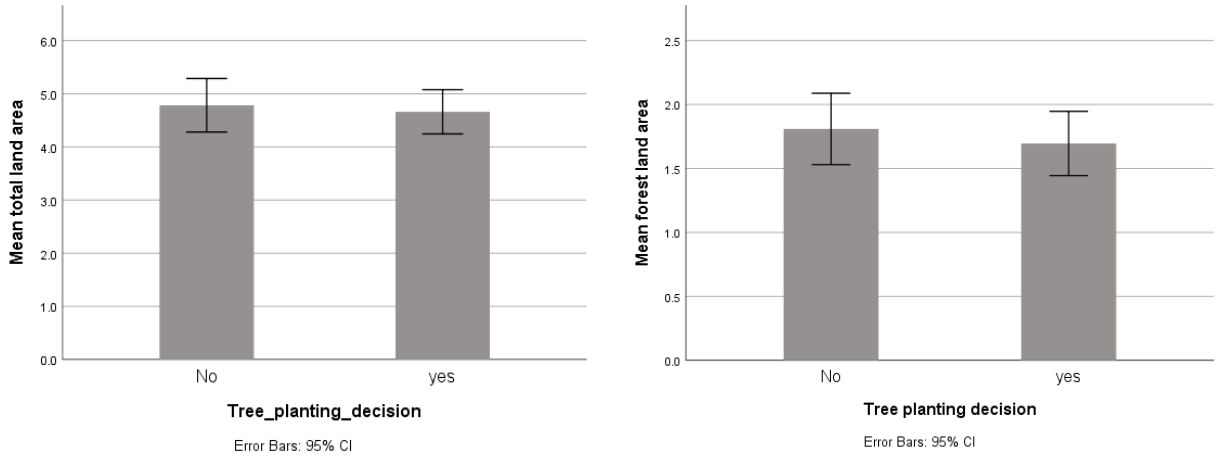
3.3. Comparison of the household characteristics for Quantitative parameters

The average age of the household's head who decide or not decide to plant. The mean age was 58.36 years for those who decided not to plant, while those who decide were 52.07 years. On the same way, the average household income for undecider was 308,600 Pak rupees, whilst it was 349,211rupees for those who decide to plant (Fig. 3). Similarly, total forestland area for those who did not want to plant was 1.80 hectares, while those who decide to plant were 1.69 hectares (Fig. 4).



a) b)

Figure 3. Graph for the mean total age of house head (a) and income of household head (b)



a) **b)**

Figure 4: Graph for the mean total land area (a) and forest land area (b)

3.4. The relationship between tree planting decision of the housholds and independent variables

The table below showed the relationship between the independent variable (qualitative) and dependent variable, tree planting decision of the household along with the Pearson correlation coefficient. The key demographic and socioeconomic characteristics of the surveyed household along with the contribution of each variable to the model were presented in Table 4 & Appendix 1. The variable which significant influence to model (Sig. <0.05) were four, Education level, Attitude of tree planting, Knowledge on silviculture and Knowing about forestry program. Chi-square statistics were used to compare the 2-log likelihood of the final model with a reduced model. An effect was removed from the final model to create the reduced model. The null hypothesis was that all parameter of that effect is 0. It is therefore that household ranking (with Sig.=0.122> 0.05), Investment capital (Sig.=0.703>0.05), Participation in forest program (at Sig.=0.529 > 0.05), and Plantation management (at Sig.=0.435>0.05) had no influence on tree planting decision by households.

Table 4. Relationship between the independent variable (qualitative) and tree planting decision of the household and the Pearson correlation coefficient

Variable		**Total**	**Percentage**	**Chi-square**	**Df**	**Sig. (value)**
House hold ranking	Poor	33	27.5	4.20	2	0.122
	Average	62	51.66			
	Rich	25	20.83			
Ethnicity	Gujar	41	34.16	1.536	1	0.215
	Pushtun	79	65.83			
Education Level	Uneducated	22	18.33	44.11	4	.000*
	Primary & middle	36	30			
	High school	41	34.16			
	Bachelor	11	9.16			
	Master	10	8.33			
Investment capital	Forestry	12	10	0.70	2	0.703
	Bank	39	32.5			
	Self	69	57.5			
Attitude of tree planting	very favorable	17	14.16	18.01	4	0.001*
	Favourable	56	46.66			
	Indifferent	20	16.66			

	Unfavourable	19	15.83			
	very unfavourable	8	6.66			
Plantation management	Difficult	27	22.5	1.66	2	0.435
	Medium	39	32.5			
	Easy	54	45			
Knowledge on silviculture	No	61	50.83	19.47	1	.000*
	Yes	59	49.16			
Knowing about forestry program	No	58	48.33	11.91	1	0.001*
	Yes	62	51.66			
Participation forest program	No	53	44.16	0.397	1	0.529
	Yes	67	55.83			
Land tenure	No	35	29.16	2.654	1	0.103
	Yes	85	70.83			

Note: * Significant difference (Sig. <0.05). Df was the degree of freedom (Number of independent values that can vary in the data).

3.5. The relationship between tree planting decision of household and Quantitative parameters

Table 5 below showed the relationship between the quantitive variables with tree planting decision. Based on the sig value column, age of the household head were significantly different (sig=.003) among the groups of household decided to planting trees or decided not planting trees. Total land area and forest land area belong to the household not planting was not significantly different (Sig=.307) than household decides to plant trees. The total household income for those who decide to plant trees was significantly higher than those who decide not to plant.

Table 5. Tree planting decision of household and quantitative parameters

Parameter	Tree planting decision				Total		Sig. value for T-test
	No		Yes				
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	
Age of house hold head	58.36	10.20	52.08	12.43	55.22	6.28	.003

Total land area	4.78	1.86	4.66	1.67	4.72	0.123	.307
Forest land area	1.80	1.03	1.69	1.01	1.74	0.113	.545
Total house hold income	308,600	119,785.3	349,210	215,116.9	214,192.6	-40,610.6	.215

Note: Sig.value showed significant difference value for t test. Std. Dev was the standard deviation value from mean.

3.6. Key factors influencing tree planting decision of the surveyed households

3.6.1. Correlation between surveyed factors and tree planting decision of the households

Inputting factors to the binary logistic regression model, the figure which had statistically significant would be the drivers influencing to tree planting decision of household. The model contained 3 significant correlated factors (Education level, Attitude of tree planting and Silviculture knowledge) were statistically significant in differentiating between households that decided to plant trees and those that did not. The full model containing all predictors were statistically significant, X2 (3, N=120) =53.611, p<.001 showed that the model was able to distinguish between respondent who made the decision to plant trees and those who did not. The entire model accurately classified 72.5% of cases and explained between 36% (Cox and Snell R squared) and 48.2% (Nagelkerke R squared) of the variation in the decision to plant trees.

Table 6. An overview of the model for the key factors influencing tree planting decision of the surveyed household

Independent variable	B	S.E	Exp(B)	Sig value
Education level	1.222	.309	3.393	.000***
Attitude of tree planting	-.436	.214	.646	.041**
Knowledge on silviculture	1.167	.477	3.212	.015**
Constant	-1.137	.746	.321	.128*
Dependent variable: Tree planting decision of household (1=Yes; 0=No)				
Omnibus Tests of Model Coefficient:				
. Chi-square			53.611	
. df			3	
. Sig.			.000 ***	
Model summary				
. -2 Log likelihood			111.910[a]	
. Cox & Snell R Square			.360	
. Nagelkerke R Square			.482	

. Predicted percentage corrected(%)	72.5

Note: *** p< 0.01, **p <0.05, p< 0.10, NS Not significance (two tailed test), A parameter estimate changed by less than.001, causing the estimation to end at iteration number 5. B was beta parameters, S.E was standard error. Exp(B) was exponent of B and Sig value was significance value.

4. Discussion

4.1. Education level

We found that the education level of the household head has a positive influence on tree planning decision (Table 6). The more educated the head the more they involved in tree planting. Similar findings from earlier studies indicated that education is a measure of human capital, which has been demonstrated to boost the likelihood of planting trees because it increases environmental awareness and, in certain situations, comprehension of tree planting procedures (Simmons et al., 2002). In fact, for all levels of sustainable forestry, education is regarded as a key concern (Schmidt et al., 1999). It has been found that formal education have a positive relationship with tree planting anticipation and zeal (Mercer, 2004; Thacher et al., 1996). According to (Dinh et al., 2017) education has significant effects on trees planting. Another study reveals that household heads who planted trees had higher levels of education than those who did not plant trees (Etongo et al., 2015). Yet other research has shown that, young, well-educated village leaders has been the innovative ones, engaging in trees planting (Song et al., 2004). The study showing that literate farmer were more involved in tree growing than their counterparts (Gessesse et al., 2016). Farmers who have some level of education responded readily to technological advancement, such as the application of fertilizers, use of pesticides and better planting materials thus increasing their productivity (Jamala et al., 2013). According to (Amaza & Tashikalma, 2003), the literacy of farmers is significant as it determines the rate of adoption of new technology for increased productivity.

4.2. Silviculture technique

The result of this study indicated that silviculture knowledge of household head was significantly and positively related to tree planting decision of household (Table 6). Previous research of (Le et al., 2021) found the same results in which they investigated that silviculture knowledge of household head is positively correlated with tree planting decision of household. (Salam et al., 2000) indicated clearly that there is little to no farmer awareness of forestry extension initiatives, and there has been very little effort on the part of forestry employees to encourage farmers to plant trees. To achieve the full potential of homestead forestry, forestry experts and extension agents have to increase their efforts and work together more closely with nearby farmers. They should provide technical assistance, high-quality seedlings suitable for the planting site, institutional support, and the establishment of efficient marketing facilities for farm forest products so that poor farmers can come forward to enhance tree production and receive fair returns from it. Thus,

marketing support and market information for timber and other forest products are also provided by reforestation education, information, or awareness-building campaigns. This can help farmers earn more money, which can then result in improved site management and protection as well as a decreased risk of erosion and landslides (Le et al., 2014). Planting and managing trees involves specialized knowledge and abilities in many silvicultural techniques, such as knowing which species or provenances to choose for a given location, when to plant, weed, fertilize, prune, thin, harvest, and protect plantations (Evans, 1992).

4.3. Tree planting attitude

Attitude toward tree planting was found significant negatively related to tree planting decision of household (Table 6). Earlier research shows, household tree planting behavior is significantly influenced by farmer's opinions regarding planting trees, whether they are favorable or unfavorable (Nibbering, 1999; Salam et al., 2000), as well as other peoples attitudes around them (Mercer, 2004), have influenced farmer's willingness to plant trees. Tree planting attitudes change with the passage of time , which can lead to increase or decrease in tree planting activities (Nibbering, 1999). Farmers grow trees for a variety of reasons, and planting trees can support their livelihoods in numerous ways. The decision to plant trees, the species that will be needed, and the requirements for silvicultural management are all influenced by a variety of factors, including economic, environmental, social, and cultural (Evans, 1992). There are a number of challenges that farmers may encounter when planting and caring for trees, including environmental constrain, shortage of labor, resources or markets, and expertise in silviculture. Such disadvantages undoubtedly affect farmers' opinions toward and willingness to grow trees, as well as limiting the possibilities of good silvicultural management.

For many farmers, planting trees is an economically driven activity that generates income (Arnold, 2001; Salam et al., 2000). Farmers cultivate trees as cash crops when there is a market and demand for them in order to generate wood, poles, pulpwood, bark, fruits, medicine, and other products; otherwise, they do not plant (Scherr, 1997). Farmers attention won't be drawn and interested in plantations as a means of livelihood due to the government's and other implementing actors mistakes in selecting inappropriate land, providing insufficient tenure incentives, having difficult and complicated application and funding procedures, and generally making the program unappealing as a source of income for farmers (Obidzinski & Dermawan, 2010). Generally low productivity and quality of plantations documented for smallholder tree planting programs throughout Indonesia is the main constrain for farmers to plant trees on plantations. This can be attributed to inappropriate site-species matching, inadequate seedling stock, or inadequate silvicultural management including plantation protection (Nambiar, 2008).

4.4. Major constraints related to tree planting in the study area

Table 7 below showed the data related to major constraints to tree planting. 20.8% of the respondent has very less land which they allocated to agriculture crop to fulfil their livelihood need, which is

a very big constraint to tree planting decision. 4.16% said termites attacked on plant sapling and young trees, before they mature. 7.5% farmers feed backed that due to planting activities disease outbreak like pollen allergy and other disease from insects and beetles are more. 16% farmers responded that the income from planting is less compare to agriculture crop. 20% said that plantation provides a living place for insect and nest for birds, these birds and insect attacked on nearby agriculture crops and destroyed the whole area. Sometime the insect attacked on the leaves of the plantation and defoliated the entire plantation due to which rate of mortality of plantation was more. 10% farmers replied that planting cost is expensive because there was no incentive or reliefs from government and farmers had bought everything from the private market. 20.8% believed that plantation absorbed more nutrients and water than agriculture crops due to which if we plant agriculture crop next on that land then crops will not occur because of poor soil nutrients. 40% assumed that due to plantation shade occurred on the nearby field of those who did not want to plants trees and they plants up agriculture crops due to which conflict occured between farmers. 14.16% anticipated that the rotation age of the plantation is very long due to which they cannot wait for the income which they get from the plantation. 5.83% expected that root is extended to the other farmers field due to which conflicts occurred between the farmers. 14.16% guessed that there was no rigid policy from the forest department, no rules and regulation, the peoples attack tonight on the plantation, they cut and steal the young plantation which was a huge constraint to the plantation. 12.5% predicted that there was no strict policy for timber market so when plantation reached to rotation age the peoples who sat in market, know and fix their own price what they want, due to low price the farmers did not focused on plantation too much, they just plant for their own subsistence use only. 9.16% said that establishment cost was more in case if plantation was not succeeded because of termite or other unfavourable condition. 25% envisaged we did not have own land and worked as a leaser in the land of other, but control will be in the hand of the owner. 15.83% visualized that there was water scarcity during and after plantation establishment, as the study area was dry and plantation needed water at the time of establishment and after, which was a big hindrance to plantation program. 12.5% described lease problem they took land from landowners but landowners did not gives permission for plantation because plantation takes more nutrients from the soil which detoriate their land. 10% told wind was a big problem for their plantation, as the study area was muddy soil so when strong wind occur they uproot all the plantation which was mostly composed of young immature trees also during the wind the wood are cracked due to which market offers very less price in case of selling which was a disappoint for such a poor farmer so they did not prefer plantation.

Table 7. Major problems faced by farmer related to tree planting in study area

No	Problem	Percentage	No	problem	Percentage

1	Not enough land	20.8%	10	Extension of root to other field	5.83%
2	Termite attack	4.16%	11	Management consideration	34.16%
3	Disease out break	7.5%	12	No policy	14.16%
4	Less income	16%	13	Less market price	12.5%
5	Attract insect and birds which defoliate the forest	20%	14	Establishment coast	9.16%
6	Make land bare	22.5%	15	Do not have own land	25%
7	Absorb nutrients and water	20.8%	16	Water scarcity	15.83%
8	Shade on nearby field	40%	17	Lease problem	12.5%
9	Long rotation age	14.16%	18	Wind problem	10%

4.5. Suggestions

4.5.1. Suggestion based on the need for rigid and incentive oriented policy from government

Following its independence in 1947, Pakistan experienced a decrease in timber supply from India and pressure on Pakistani forests for timber supply was increased. The Government of British India's 1894 forest policy was passed down to Pakistan. Following colonization, the British began the task of settling their new territory. The Indian Forest Act of 1878 gave the state authority over forests and resulted in the nationalization of one-fifth of India's landmass. The Government of Pakistan adopted and carried out the Indian Forest Policy of 1927, which established rules for forest conservancy, until 1955. Then the policy of (1955, 1962, 1975, 1980, 1991, 2000, 2008, and 2013) was implemented, all were designed to increase the area covered by forests. Every government sets policies in accordance with the party platform that it has explained. Laws and institutional frameworks are created to augment government revenue, depriving people of their rights to natural resources and stifling their ambitions by centralizing bureaucratic powers" but unfortunately nothing was practical, which is the failure of forest sector. For policy implementation, the following suggestions are needed.

- The goal of the forest policy should be to reduce poverty among those who live in forests by using a systematic approach to development, such as training in non-timber forest products, education, health care, and infrastructure development etc.
- Forestry in Pakistan is a provincial responsibility, with provincial forest department is in charge of planning, implementing, and overseeing forests. Yet policy is a federal responsibility.

Due to inadequate coordination between federal and provinces forestry sector is fragmented. Therefore, it is recommended that steps be taken to enhance federal and provincial government coordination.

- Due to lack of political spirit forest policies are frequently changed. Government representatives formulated policies without considering the needs of the local population. It is suggested that more focus on forest dweller should be given when implementating forest policy.
- The forest policy should be flexible to be adopted according to the local circumstances. Therefore, it is advised that district-level decentralization of state forest management be implemented in order to enable forest management to be tailored to the specific conditions of the local area.
- Only when policies are in line with people's existing livelihood strategies, social environments, and capacity for adaptation livelihood will be secured. The most important thing is people, not the resources they utilize or the governments that look out for them. Following this principle would guarantee the provision of a sustainable living, but it would also increase the participation of all societal segments in sustainable natural resource management. In this context, it is important to recognize that creating jobs and income is just as important as increasing government revenue. Furthermore, forestry should serve as a tool rather than the goal of sustainable forest management policy, as failure to do so will leave the poor trapped in a cycle of overexploitation following all failed forest policy initiatives.
- In forest protection, motivating local people incentives act as a barrier. It is recommended to offer financial or non-financial incentives to the local population in order to encourage their participation in forest conservation and protection efforts.

4.5.2. Suggestions based on rising of education

From Tables 5, 6 & Appendix 1, it is clear that in the study almost all non-planters were uneducated or primary and middle school literate, as a result, it is very hard to convince them on the importance of plantation, while in comparison bachelor and master degrees holders were100% planter. It the same time 48.3% and 44.2% interviewee was unaware about forestry programs and participation in forest programs respectively. As in Pakistan mostly the elder male are head of the family and most of the head in the study area were uneducated it is not the time that they will get the formal education but it is suggested that the forest department should have to arrange a monthly or yearly meetings related to plantation by adopting propaganda strategy through meetings, discussions, to explain the importance of plantations and to listen to the problems of the farmers.

4.5.3. Suggestion based on the attitude of tree planting

According to (Meijer et al., 2015) tree planting significantly depended on the attitudes of the farmers. Attitude or behaviour change plays an important role in the success of tree planting activities. This research investigated that the number of planters (41.6%) was higher than non-

planter (19.6%). Through interviews, it was concluded that the most claimed factors was less market price and no intervention from govt. As we know that incentives influence on the attitude of tree planting of household, it is therefore suggested that incentive and subsidy attract the farmers. The more incentives and subsidy the household receive, the more they would like to plant trees. The government should also intervene in market policy for price and ban on a 3rd person for negotiation, that the farmers can get the full money. Debug should be paid in case of wind destruction or termites, birds and insect attack. Accepting the seedling of farmer's nursery also attract farmers toward trees planting

4.5.4. Suggestion based on silviculture technique

Silviculture techniques are the backbone for plantation. From Table 6, it can be seen that half of the total interviewees (50%) told that they did not know about silviculture knowledge and techniques. The majority of farmers believed they would get high rates for their wood, but they were unaware of how crucial silvicultural management is to enhancing plantation production and quality. They also didn't realize that silvicultural techniques may raise the price they would receive for their wood. In Pakistan thinning is undertaken 2nd and 3rd year after plantation and plantation rotation depending on the objective of the plantation. It is, therefore, this study recommended that the district forest department should consult extension and forest officer through propaganda strategy to aware the local peoples about the importance of the silviculture technique and give training to local peoples related to silviculture technique to increase productivity from the plantation.

5. Conclusion

The aim of this study was to determine the key drivers that influence farmers tree planting decision in district Malakand Pakistan. Based on our analysis agriculture was the main occupation of the peoples. 2/3 of the respondents were in favour of planting. 55% hire labores for planting, while 45% did not hire labor. 69.2% have tree planting experience, while 30.8% did not have experience. The variables with significant influence to model (Sig.<0.05) were four, Education level, Attitude of tree planting, Knowledge on silviculture and Knowing about forestry program. All the predictors in the full model were statistically significant, X^2 (3, N=120) =53.611, Sig. <.001 indicating that the model was able to distinguish between respondents who decided or not decided planting trees. The model as a whole explains between 36 % (Cox and Snell R squared) and 48.2% (Nagelkerke R Square) of the variance in the decision of tree planting and correctly classified 72.5% of cases. The study suggested some solution, they were rigid and incentive oriented policy by government for plantation, secure tenure right, training and awareness rise for farmers through propaganda strategy related to planting. Government policy supports for poor households in case of failure and establishing planting forest for community groups.

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