Research Article

Effects of Joint Forest Management on Livelihood of Local Communities in Khyber Pakhtunkhwa, Pakistan

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Abstract | This study measured the effects of Joint Forest Management (JFM) on livelihood of local communities in Khyber Pakhtunkhwa, Pakistan. Purposively three forest divisions had been selected namely Swat, Kalam and Siran of Malakand and Hazara forest regions. The study based on cross sectional data. Data were collected from 321 randomly selected households in three JFM (experimental group) and nearby three non-JFM (control group) villages, located in the same forest-ecological and socio-economic settings. The study analyzed the effects of JFM on local livelihood by using binary logistic regression. Odds ratio analysis of the social and natural assets data showed that the Joint Forest Management approach had significantly increased the social and natural assets of the participants. In terms of financial asset, odds ratio in favor of 'NTFPs income' and 'employment opportunities' for JFM sample households were 2.289, 2.501 times respectively more than non-JFM sample households. Trainings imparted by forest department significantly improved the skills, knowledge and leadership abilities of the JFM participants (human asset) as compared to non-participants but JFM did not contributed to resolve the health and educational problems of the participants. Regarding the physical asset indicators, data results of two groups showed no significant variation. It was concluded that overall livelihood assets condition of JFM participants was better as compared to non-participants. This study therefore suggested that physical and human assets of the JFM participants should be enhanced for further strengthening of JFM approach in Khyber Pakhtunkhwa.

Received | March 22, 2021; **Accepted** | May 13, 2021; **Published** | July 11, 2021
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Citation | Ahmed, A. and M. Zulfiqar. 2021. Effects of joint forest management on livelihood of local communities in Khyber Pakhtunkhwa, Pakistan. *Sarhad Journal of Agriculture,* 37(3): 975-983.
DOI | https://dx.doi.org/10.17582/journal.sja/2021/37.3.975.983
Keywords | Joint forest management, Joint forest management committees, Livelihood, Assets, Binary logistic regression

Introduction

Natural forests are the most important components of the Earth's ecosystem and major sources of rural livelihoods in under developed countries. Forest greatly serves a household in the hard times (FAO, 2016). Therefore, wisely use of these resources has the prospective to eradicate poverty from remote mountainous areas (FAO, 2009). Despite rapid development in economic and agricultural field, forests are still one of the major sources of livelihood and food security specifically in rural areas in the under-developed countries (Das, 2010; Kar and Jacobson, 2012; Hogarth *et al.*, 2013; Angelsen *et al.*, 2014). Local communities of remote mountainous areas face high level of poverty and they fulfill most of their livelihood requirements from forest resources (Sunderlin *et al.*, 2005; Shackleton *et al.*, 2007). They mostly depend on non-wood forest products in order to satisfy their basic needs such as food, medicine and income (Belem

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et al., 2007). Forests have great potential in mitigating climate change impacts and greatly help countries in attaining sustainable development goals. As target 15.2 of sustainable development goal focused on to promote the implementation of sustainable management of all types of forests by 2020 in whole world. Achievement of SDG 15 by a country will be helpful to achieve other SDGs because this goal is directly and indirectly related to other SDGs like SDG 1(no poverty), SDG 2 (zero hunger), SDG 6 (provision of fresh water) and SDG 10 (reduced inequalities) (Baumgartner, 2019).

Following the World Commission on Environment and Development (WCED, 1987), the process of decentralization of forest policies was begun in many developing countries and they shifted their forest policies from centralized government management towards participatory management (Agrawal *et al.*, 2008; Biswas and Choudhry, 2007). Participatory approaches such as community based forest management, participatory forest management, collaborative forest management, joint forest management (JFM), decentralized forest management and community forestry have become widely accepted approaches for forest management worldwide (Shrestha and McManus, 2008; Lund and Treue, 2008; Blomley and Iddi, 2009). All of these approaches are differ in design, specific objectives, origin and resources yet their aim was same i.e. ownership and participation of local communities in forest management for sustainable growth (Webb and Shivakoti, 2008).

Pakistan inherited traditional state-owned forest management system which was formulated by the British Empire in sub-continent in 1800s. After independence, centralized system failed to satisfy the growing needs of the local communities. Therefore, Khyber Pakhtunkhwa province of Pakistan also followed the participatory forest management paradigm and introduced Joint Forest Management under the forest policy of 1999 and forest ordinance 2002 (Shahbaz, 2009). In Pakistan different forestry related studies have been conducted such as importance of forest protection in poverty reduction (Khan and Khan, 2016) factors that cause deforestation (Ali *et al.*, 2006) economic benefits from forest (Haq *et al.*, 2015; Ali *et al.*, 2018) forest management policies (Shahbaz *et al.*, 2007) and decentralization of forestry sector in Pakistan (Steimann, 2003) but no comparative study has been conducted like the studies of other countries of the world to systematically evaluate the effects of JFM on all the five assets of livelihood. Therefore, considering this research gap, this study was designed on the research questions that (1) What is the level of participation of local population in JFM? (2) What are the benefits of JFM to local communities? (3) How the present JFM approach can be made more effective and sustainable? Based on these research questions major objective was designed to investigate the effects of joint forest management on livelihood of JFM and non-JFM villages. The present study will fill the gap in literature and will be very useful for policy makers and forest department think tanks of Khyber Pakhtunkhwa.

Theoretical framework of the study

This study used sustainable livelihoods framework (DFID, 2001) which summarized assets in terms of five categories as social asset (institutions, mutual trust and networks for cooperation), financial asset (income and employment opportunities), natural asset (access and use of natural resources), physical asset (paved roads, streets and water supply) and human asset (skills, knowledge, leadership, education and health). These assets are interrelated with each other (Pandey, 2005).

Materials and Methods

Research and indicators design

The present study was based on cross sectional data. Effects of JFM were assessed through a comparison between JFM village (experimental group) and nearby and closely similar non-JFM village (control group) where forest management was carried out through traditional approach, located in the same forest-ecological and socio-economic settings. Pandey (2005) indicators design was used. Some other international research studies and organizations (FAO, 2001; Carney, 2002; CICI, 2003; Mcdonalda and Laneb, 2004; MP, 2007; Christopher, 2008 ; Don, 2008) were also consulted for designing the indicators for this study. Qualitative data was transformed to quantitative data through rating scale method for analysis purpose.

Study sites

Study sites selection was done in four stages. In first stage, Khyber Pakhtunkhwa province blessed with large area of natural forests was purposively chosen. In the second stage, two forest regions Hazara and

Malakand were selected purposively because these two regions have maximum forests and local communities greatly depends on it for their livelihood. In third stage, Siran forest division from Hazara forest region while Swat and Kalam forest divisions from Malakand forest region were selected purposively because JFM approach was initially implemented passionately in these divisions. In fourth stage, from each Forest Division, one JFM village (experimental group) and nearby one non-JFM village (control group) were selected purposively. Thus, six villages consisting of three study sites were selected. The first site was in Siran forest division where Doga village was managed under JFM and nearby Keri village was not managed by JFM approach. The second site was in Swat forest division where Lalku village was JFM and nearby Fazal Baig Garhi village was non-JFM. The third site was in Kalam forest division where Utror village was JFM while Gabral village was non-JFM.

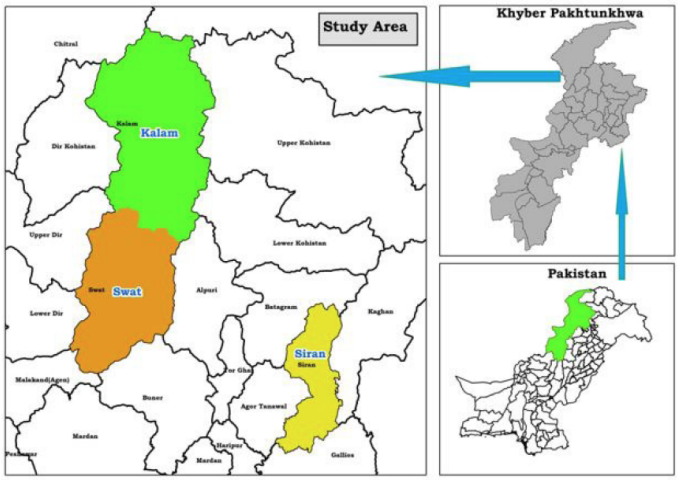

Figure 1: *Map showing Pakistan, Khyber Pakhtunkhwa and study areas (Kalam, Swat and Siran).*
Source: *GIS Lab. Forestry Planning and Monitoring Circle, Peshawar.*

Sampling of households, data collection and data analysis
The six study villages were comprised of total 1946 households. By using the Sekaran (2003) model table, the 321 households were selected randomly from given total population of 1946 households at 95% confidence level with 5% margin of error. Furthermore, these 321 households (157 JFM and 164 non-JFM) were allocated through proportionate sampling method among six villages while applying Bowley (1926) proportional allocation formula. Total households of doga village were 412 out of which 68 households were selected randomly. Keri village was consisted of total 238 households out of which 39 households were randomly selected. From total 346 households of utror village 57 households were selected randomly. Gabral village total households were 384 out of which 64 households were randomly selected. From total 195 households of lalku village 32 households were randomly selected and from total 371 households of fazal baig garhi village 61 households were selected randomly. Data was collected through household interview schedule and focus group discussion. Binary logistic regression was used to study the association between a binary dependent variable and one or more independent variables. It is vigorously used to study the dependence of binary response variable on discrete or continuous independent variables. The binary logistic regression equation is given as:

$$p_i = \frac{e^{(\beta_0 + \beta_1 x_i)}}{1 + e^{(\beta_0 + \beta_1 x_i)}} \quad \ldots (1)$$

$$Log(p_i) = \log\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 D_i \quad \ldots (2)$$

$$Yi = \beta_0 + \beta_1 D_i + \varepsilon_i \quad \ldots (3)$$

Where;
Y_i = dependent variable which is categorical; The log symbol refers to a natural logarithm and $\beta_0 + \beta_1 D_i$ is the popular equation for the linear regression line. P_i can be computed from the regression equation also. Knowing regression equation, the expected probability can theoretically be calculated that $Y_i = 1$ for a given values of D_i.

Results and Discussion

Social asset
Social asset indicators/variables (Table 1) were taken as response variables while group was considered as explanatory/independent variable. Odds ratio analysis (Tables 2, 3, 4, 5, 6 and 7) showed that odds of participation level in JFMC/VC meetings, participation level in forest protection activities, degree of trust and relationship with JFMC or VC, degree of trust and relationship with forest department, women participation level in forestry activities and conflict resolution process for JFM sample households were 12.382, 126.827, 68.933, 5.197, 20.347, 2.297 times respectively more than non-JFM sample households. Results also showed a significant difference between the two groups ($p < 0.05$) (Tables 2, 3, 4, 5, 6 and 7). Table 2 revealed that JFM socially organized the villagers on a single platform and empowered them in making decisions at village level regarding

Table 1: *Livelihood assets, indicators and rating scales for measurement.*

Assets	Indicators	Rating scales to measure
Social	Level of participation in JFMC/VC meeting	Low = 0, High = 1
	Level of Participation in forest protection activities.	Low = 0, High = 1
	Degree of trust and relationships with members of JFMC/VC	Poor/Low = 0, Good/High = 1
	Degree of trust and relationship with forest department staff	Poor/Low = 0, Good/High = 1
	Level of women participation	Low = 0, High = 1
	Conflict Resolution	Difficult = 0, Easy = 1
Financial	Income earned from the sale of NTFPs	Low = 0, High = 1
	Income earned from forest employment	Yes= 1, No= 0
Physical	Collective actions for physical infrastructure	Yes= 1, No= 0
Natural	Access to timber	Difficult=0, Easy= 1
	Collection and availability of NTFPs	Low = 0, High = 1
	Collection and availability of firewood	Low = 0, High = 1
	Collection and availability of fodder	Low = 0, High = 1
	Forest protection and improvement interventions	Yes= 1, No= 0
	Community opinion on forest condition	Degraded=0, Improved=1
Human	Knowledge and skills gained	Yes= 1, No= 0
	Leadership ability	Yes= 1, No= 0
	Education	Yes= 1, No= 0
	Health	Yes= 1, No= 0

Table 2: *Parameter estimates assuming level of participation in JFMC/VC meetings as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	2.516	.339	55.236	1	.000	12.382
Intercept	-.024	.156	.024	1	.876	.976

Table 3: *Parameter estimates assuming level of participation in forest protection activities as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	4.843	.432	125.872	1	.000	126.827
Intercept	-1.918	.234	67.384	1	.000	.147

Table 4: *Parameter estimates assuming degree of trust and relationship with JFMC or village committee as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	4.233	.604	49.128	1	.000	68.933
Intercept	-.295	.158	3.487	1	.062	.745

Table 5: *Parameter estimates assuming degree of trust and relationship with forest department staff as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	1.648	.243	46.113	1	.000	5.197
Intercept	-.767	.168	20.905	1	.000	.464

Table 6: *Parameter estimates assuming level of women participation in forest related decisions as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	3.013	.295	104.205	1	.000	20.347
Intercept	-1.199	.185	41.950	1	.000	.302

Table 7: *Parameter estimates assuming conflict resolution process as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.832	.246	11.438	1	.001	2.297
Intercept	.345	.159	4.733	1	.030	1.412

the use and management of forest. Nath and Inoue (2010) analyzed that forest dependent communities participate in meetings with external and internal stakeholders because forest policies affect their livelihoods. Results of Table 3 explored that JFMC was the most important village level institution for collective actions which actively involved native individuals in forest protection activities such as firefighting, marking of forest boundaries, establishing community forest check posts and patrolling. Pretty, (2003) and Ballet *et al.*, (2007) confirmed these findings that social asset play a crucial part in usage of natural forest on sustainable manner. Tables 4 and 5

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reported that degree of trust and relationship of sample households with JFMC/VC and forest department in JFM villages was high as compared to non-JFM villages. Some other authors (Schreckenberg *et al*., 2006; Larson *et al*., 2007; Shahbaz *et al*., 2012) also discovered that relationship and trust between local communities and forestry department was improved in the context of participatory forestry. Table 6 revealed that participation level of women in forest related activities in JFM villages was high as compared to non-JFM villages. Table 7 analysis inferred that due to participation of communities in JFM activities, they were provided additional chances to communicate face to face with each other. Therefore, clashes and ethnic enmities had been reduced considerably among the JFM participants.

Financial asset

In terms of financial asset, results in Tables 8 and 9 show that the JFM approach increased the JFM household's financial asset as earned more income from NTFPs and they were also employed in enclosures and plantations. They raised nurseries and planted free of cost plants on their farm lands provided by the department. Odds ratio analysis (Tables 8 and 9) showed that odds of income from NTFPs and 'other forestry activities for JFM sample households were 2.289 and 2.501 times, respectively more than non-JFM sample households. Tables 8 and 9 results also showed a significant difference between the two groups ($p < 0.05$). These results were also reported by some other scholars that participatory forest management increased household income level (Gobeze *et al*., 2009; Jatana and Paulos, 2017) and hence reduced household's vulnerability to stresses (Warner, 2000).

Table 8: *Parameter estimates assuming income earned from NTFPs as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.828	.250	11.011	1	.001	2.289
Intercept	.421	.160	6.946	1	.008	1.523

Table 9: *Parameter estimates assuming income earned from other forest related employment/activities as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.917	.234	15.393	1	.000	2.501
Intercept	-.853	.171	25.007	1	.000	.426

Physical asset

Table 10 showed no significant difference between the two groups ($p \geq 0.05$) regarding physical asset. These findings are in contrast to Dev *et al*. (2003) who reported that community forestry activities had improved village level infrastructure in Nepal such as drinking water supply schemes, construction of schools, community center and worship centers.

Table 10: *Parameter estimates assuming collective actions for physical infrastructure as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.123	.231	.284	1	.594	1.131
Intercept	-.576	.163	12.551	1	.000	.562

Natural asset

Natural assets are important elements of rural livelihood (DFID, 2001). Goswami and Malay, (2011) perceived natural asset as the availability of forest resource stock in sufficient quantity and quality while Das, (2012) observed them from people's access point of view. Therefore, this study grasps both types of perceptions. Table 11 results showed that odds of 'access to timber' for JFM sample households was 0.099 times low than non-JFM sample households. JFM sample households discussed that they adopted legal permit procedure which was quite complicated while in non-JFM villages this procedure was absent and community cut the trees without the approval of forest department. Data analysis (Tables 12, 13, 14, 15 and 16) showed that odds of 'collection and availability of non-timber forest products' (NTFPs), 'collection and availability of firewood', 'collection and availability of fodder', 'forest protection and improvement interventions', and 'forest condition' for JFM sample households were 2.595, 3.740, 2.087, 10.204, 19.300 times respectively more than non-JFM sample households. These results showed a significant difference between the two groups ($p < 0.05$). Tables 12, 13 and 14 discovered that JFM sample households collected more NTFPs, firewood and fodder from their forest as compared to non-JFM sample households. Reported reasons of more availability of these products by JFM sample households were implementation of management plans by JFMCs on regular basis with the technical cooperation of forest department and sustainable extraction practices. Table 15 results revealed that forest protection and improvement interventions (community check posts, patrolling in forests, check on smuggling, penalties on

local offenders, marked boundaries and seed sowing) were practiced in JFM villages while in non-JFM villages no such activities have been practiced. Table 16 analyzed the sample household's response to the question of how they would rate the present condition of their forest compared to five years ago. JFM sample households perceived that their forest condition has been improved while non-JFM sample households perceived that their forest condition degraded.

Table 11: *Parameter estimates assuming access to timber as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	-2.311	.352	43.227	1	.000	.099
Intercept	2.633	.312	71.120	1	.000	13.909

Table 12: *Parameter estimates assuming collection and availability of NTFPs as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.954	.252	14.302	1	.000	2.595
Intercept	.370	.159	5.426	1	.020	1.448

Table 13: *Parameter estimates assuming collection and availability of firewood as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	1.319	.270	23.934	1	.000	3.740
Intercept	.345	.159	4.733	1	.030	1.412

Table 14: *Parameter estimates assuming collection and availability of fodder as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.736	.253	8.482	1	.004	2.087
Intercept	.550	.162	11.512	1	.001	1.733

Table 15: *Parameter estimates assuming forest protection and improvement interventions as response.*

Parameter	B	S.E.	Wald	DF	P-value	Exp (B)
JFM	2.323	.307	57.327	1	.000	10.204
Intercept	-.147	.157	.876	1	.349	.864

Table 16: *Parameter estimates assuming forest condition as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	2.960	.533	30.865	1	.000	19.300
Intercept	.684	.165	17.103	1	.000	1.982

Human asset

Human asset indicates the skill, knowledge, capacity to work, education and good health that allow people to take different action (DFID, 2001). From Tables 17 and 18 it was analyzed that odds of 'knowledge and skills' and 'leadership ability' variables for JFM sample households were 57.067, 4.626 times, respectively more than non-JFM sample households. Results also showed a significant difference between the two groups ($p < 0.05$). It means that there were more sample households in JFM participating villages who got knowledge and skills as compared to sample households in non-participating villages. Similarly, workshops and trainings imparted by forest department developed the leadership in participating villages as compared to non-participating villages. However, data results (Tables 19 and 20) revealed that under joint forest management 'education' and 'health' opportunities were not provided by JFMCs/VCs to both the JFM and non-JFM sample households in study areas and data results of two groups were non-significant.

Table 17: *Parameter estimates assuming knowledge and skills as response.*

Parameter	B	S.E.	Wald	DF	P-value	Exp (B)
JFM	4.044	.483	70.055	1	.000	57.067
Intercept	-.630	.164	14.750	1	.000	.533

Table 18: *Parameter estimates assuming leadership ability as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	1.532	.240	40.716	1	.000	4.626
Intercept	-.711	.166	18.335	1	.000	.491

Table 19: *Parameter estimates assuming education facilities improved as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	.257	.225	1.306	1	.253	1.292
Intercept	-.295	.158	3.487	1	.062	.745

Table 20: *Parameter estimates assuming health facilities improved as response.*

Parameter	B	S.E.	Wald	Df	P-value	Exp (B)
JFM	-.358	.227	2.494	1	.114	.699
Intercept	-.122	.156	.609	1	.435	.885

Conclusions and Recommendations

On the basis of the findings, it is concluded that over-

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all livelihood assets condition of Joint Forest Management (JFM) participants was better as compared to non-participants. Significant improvement has been occurred in social and natural assets of th JFM participants. The JFM positively contributed to the participant's financial asset indicators and thus reduced their vulnerability to stresses. Human assets of the participants were better to some extent as compare to non participants however, there was no significant difference found between the physical asset of both participants and non-participants.

In light of the findings, it is recommended that concerned forest department should develop human and physical assets of the participants for further strengthening of JFM approach. Network of Joint Forest Management Committees should be constituted throughout the province so that non-participants may be offered opportunities and bring them on board in order to improve their livelihood.

Novelty Statement

This study explored the realities about Join Forest Management approach in Khyber Pakhtunkhwa which is greatly helpful for the forest policy makers to control deforestation and improving livelihood of the forest dependent communities.

Author's Contribution

Ayaz Ahmed: PhD scholar, who did research, data collection, analysis and wrote draft of the manuscript. **Muhammad Zulfiqar**: Major supervisor, provided technical guidelines and overall supervision of the whole study.

Conflict of interest

The authors have declared no conflict of interest.

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