



Article Type: Research Article

Article Ref. No.: 21022400713IF

<https://doi.org/10.37948/ensemble-2021-0301-a009>



INVOLVEMENT OF WOMEN IN FOREST CONSERVATION-A COMPARATIVE ANALYSIS OF FRINGE VILLAGES IN SUNDARBAN BIOSPHERE RESERVE

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Abstract:

The participation of women in the environmental movements and their association with forest resources in some areas are notable throughout the world. A comparative study to understand the perception and participation of women in forest protection programmes in the fringe villages of Sundarban Biosphere Reserve is the main focus of this paper. Four villages from two blocks of Sundarban Biosphere Reserve are selected. The entire work is mainly based on primary data. For comparative analysis, Chi-square and Cramer's V values are used. The ordinal regression method is used for relationship analysis. Although there are many differences in socio-economic factors and involvement in 'Forest Protection Committees (FPCs)', there are no disagreements in the perception of women regarding the significance of forest protection of Sundarban. In fine, the focus is given on the inclusion of women's ideas in the decision-making process for the advancement of Sundarban Biosphere Reserve.

Keywords: Decision making, Inclusion of women, Perception study, Women participation

1.0 Introduction:

The man-environment relationship is a significant part of Geographical research. Among all environmental components, the forest is a fundamental biospheric element upon which more than 12 million dwellers are involved worldwide (Dutta, 2018). Ninety percent of poor people of the world are dependent on forest resources for sustaining their life (Ratsimbazafy, 2012). In the present decades, a considerable percentage of the forest area has been lost (Pawar K et al., 2015). Transformation of forest area to agricultural land, commercial logging and unregulated forest clearance are the causes of tropical forest losses (Tadesse, 2017; Datta, 2012). As a result, who are dependent on forest resources or located just beside the adjacent areas of protected forest are included in the most disadvantageous parts of society (Balakrishna et al., 2019).

Forest protection is the process of maintaining the remaining forest area sustainably. Conservation of forest is an emerging international issue. The engagements of local people, especially women, are significant (Pawar K et al., 2015; Tindall D et al., 2013). Women are more connectedly involved with forest elements than men (Dutta, 2018). As per Vandana Shiva, an Indian environmentalist, women have an inherent connection and partnership with nature (Jackson, 1993; Banerjee et al.,

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2015). Women's interconnection with the environment is also described by eco-feminism (Banerjee et al., 2015).

Several climatic events have struck the Sundarban mangrove forest of West Bengal, and man-animal conflict is part of their daily lives. Despite the harsh situation, women treat and nurture forest resources in a more sensitive way than men. Due to such affection, the involvement of women in planning processes and incorporation of their ideas can develop a new way of conservation. Based on 298 respondents, this paper provides a comparative perspective of the participation of local women in forest protection and their perception regarding the significance of such committees (Karnath, 2012).

1.1. Objectives:

- To understand the involvement of women in forest protection programmes.
- To pretend the women awareness in forest protection.
- To determine the influence of different socio-economic components in forest protection.

2.0 Materials and Method:

The data collection period was between December 2019 and February 2020 after the devastating cyclone Bulbul (November 2019). Total 298 women were selected from the study area covering four villages, namely Pakhiralay (V1) and Lahiripur (V2) from Gosaba Community Development Block and Purba Gurguria (V3) and Kaikhali (V4) from Kultali Community Development Block. The purposive sampling method is used in this study. The sample size is selected using Taro Yamamane's equation, 1967 (Nhem et al., 2019). The formula is

$$n = \frac{N}{1+N(e)^2} \dots\dots\dots Eq. 1$$

Where n=sample size, N= population size, e=level of precision or sampling error.

For this study, 10% sampling error is considered. By using this formula sampling size of four villages are Pakhiralay (78), Lahiripur (73), Purba Gurguria (73) and Kaikhali (74).

The prepared questionnaire was divided into three sections. The first portion discusses general information of the respondents in village wise. The second portion of the questionnaire deals with the participation of local women in forest-related issues. In the 3rd section, the significance of the forest protection committee as per women perception is included. Socio-economic factors are measured in continuous quantitative values. However, the questions addressed towards the participation of women in any forest protection and significance of FPCs are measured on an ordinal scale by maintaining order or rank (Tadesse, 2017). Involvement of women in forest protection programmes, plantation programmes and participation in the meetings are rated using 3 points Likert scale as not involved=1, involved=2, and highly involved =3. Training related to plantation and other socio-economic development is rated using no training=1 and trained=2. Women perceptions about the significance of any forest protection programmes are rated as not important=1, important=2, highly important=3 (Tadesse 2017; Nhem et al., 2019).

To discuss the socio-economic condition of women and participation of women in forest protection village-wise to each question were examined with the help of chi-square (χ^2) test of independence and strength of significance at p = less than 0.05 (Badola, 2012; Karnath, 2012). Cramer's V is also calculated to assess the relationship. The value of Cramer's V ranges between 0 to 1. 0 means no association, and 1 indicates a perfect relationship. The ordinal regression method is used to discuss

the impact of independent variables on the participation of women in forest protection and tree plantation programmes. Mc Fadden's value is also calculated. The Fadden's value varies between 0.2 to 0.4, indicating excellent goodness of fit. (Karnath, 2012; Tadesse, 2017).

3.0 Study area:

Crisscrossing channels, creeks, islands, and amalgamation of all trophic levels have created a unique man environment relationship in the deltaic part of the Ganga-Brambhaputra river system, West Bengal, India (Mukhopadhyay, 2012). The Sundarban region is highly enriched with its biological and ecological diversity (Adhikary, 2012). The location of Indian Sundarban is between 21°32' N to 22°40' N and 88°03' E to 89° E (Datta, 2012).

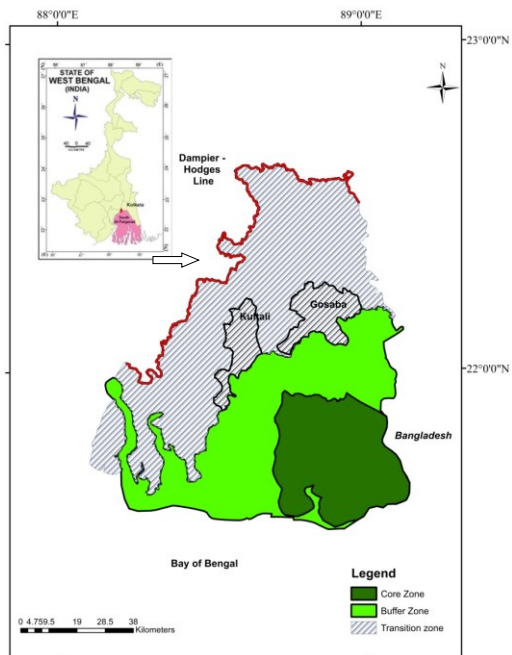


Fig.1: Location of the study area (Source: WBFD, 2019)

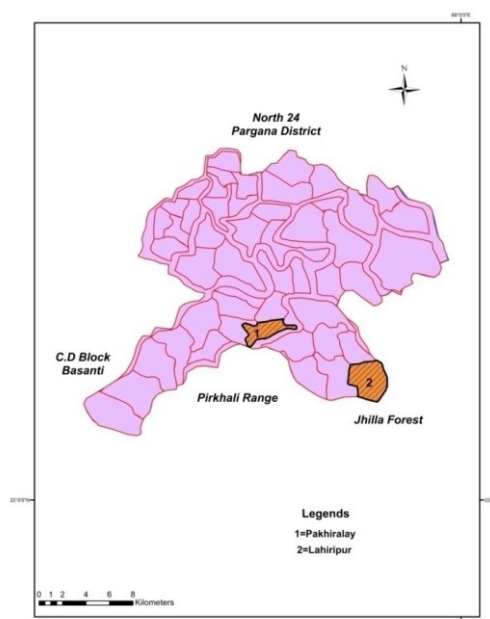


Fig. 2: Location of perception study villages of Gosaba Block (Source: WBFD, 2019)

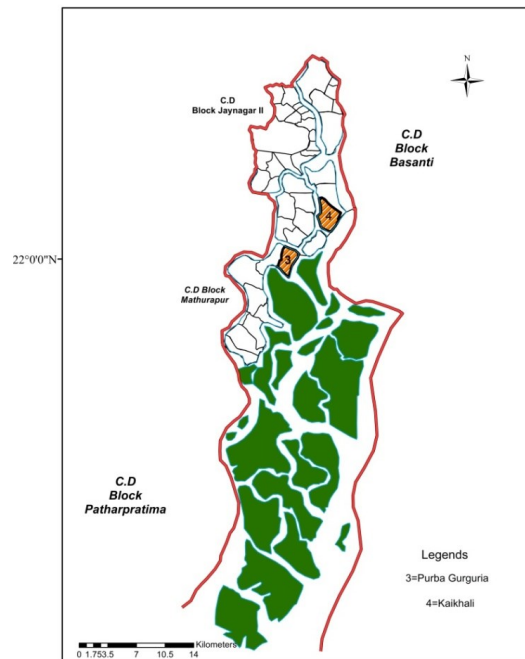


Fig. 3: Location of perception study villages of Kultali Block (Source: WBFD, 2019)

In the core and buffer zone of the Sundarban Biosphere Reserve, National Park, Reserve Forest and Wild Life Sanctuaries are located. The transition portion of Sundarban Biosphere Reserve consisted of different Community Development Blocks. Four villages have been selected from this transition zone of Sundarban Biosphere Reserve, covering two blocks (Fig. 2) (Fig. 3). The involvement of women in Joint Forest Management Committees has been considered a basis in this village selection for comparative analysis, which was identified from the previous pilot survey in the year 2018. Among these four villages, in Pakhiralaya village, the involvement of women in JFMC is comparatively in a better position as per perception study. In Lahiripur village, women involvement in JFMC is significantly less. That is why these two villages are considered for comparative study from Gosaba Block to understand whether there are any differences between the involvement and perception of women or not. The same study has covered two villages of the Kultali block. In Purba Gurguria village, the moderate impact of JFMC is observed, and in the case of Kaikhali village, there is no existence of JFMC.

4.0 Results and Discussion:

4.1 General description of the respondents:

Age: There are no significant differences among the two villages of Gosaba block regarding the age group of the respondents (Table 1).

In the cases of the Kultali block, the maximum numbers of women respondents are from the middle age group, followed by the young and elderly age group (Table 2).

Education: For Pakhiralay and Lahiripur villages, the educational scenario is similar (Table 1). A significant difference is present in educational status among the Purba Gurguria and Kaikhali villages. The educational scenario of Purba Gurguria village is better than Kaikhali village (Table 2).

Table 1: General description of the respondents of the villages of Gosaba Block

Characteristics	Pakhiralay (in %)	Lahiripur (in %)	X ²	df	P Value	Cramer's V
Age:						
Less than 30	28.2	19.2	4.036	2	0.133	0.163
30 to 60	56.4	75.3				
Greater than 60	15.4	5.5				
Education:						
No Education	41.0	35.6	4.003	3	0.261	0.163
Primary	25.6	28.8				
High School	20.5	30.1				
College	12.8	5.5				
Occupation:						
No work	32.1	45.2	10.066	6	0.09	0.266
Agriculture	19.2	15.1				
Collection of Fish & crab	17.9	6.8				
Agriculture+ Collection of Fish & crab	9.0	11.0				
Small scale industry	6.4	5.5				
Agriculture+ Animal husbandry	5.1	11.0				
Others	10.3	5.5				
Resident:						
Not permanent	29.5	8.2	10.992	1	0.001	0.270
Permanent	70.5	91.8				
Family member:						
Less than 5	62.8	57.5	5.021	2	0.081	0.182
5 to 10	32.1	42.5				
Greater than 10	5.1	-				

Source: Field survey 2019-20

Table 2: General description of the respondents of the villages of Kultali Block

Characteristics	PurbaGurguria (in %)	Kaikhali (in %)	X ²	df	P Value	Cramer's V
Age:						
Less than 30	24.7	29.7	2.242	2	0.326	0.124
30 to 60	69.9	59.5				
Greater than 60	5.5	10.8				
Education:						
No formal education	17.8	62.2	30.207	3	0.000	0.453
Primary	43.8	20.3				
High school	24.4	13.5				
College	11.0	4.1				
Occupation:						
No work	26.0	21.6	53.598	5	0.000	0.604
Agriculture	11.0	32.4				
Collection of Fish & crab	4.1	21.6				
Agriculture+ Collection of Fish & crab	2.7	17.6				
Small scale industry	35.6	5.4				
Agriculture+ Animal husbandry	20.5	1.4				
Others	-	-				
Resident:						
Not permanent	15.1	23.0	1.489	1	0.222	0.101
Permanent	84.9	77.0				
Family member:						
Less than 5	39.7	48.6	1.415	2	0.493	0.098
5 to 10	46.6	41.9				
Greater than 10	13.7	9.5				

Source: Field survey 2019-20

Occupation: There are no differences in the occupational structure of the villages of Gosaba Block. Collection of crab, fish and agriculture is the main occupation of both villages. Besides, some women are involved in small scale industries and animal husbandry. In the case of Pakhiralay village, some other occupational options have developed due to the development of eco-tourism facilities. Although the scope for women is limited, some respondents are involved as workers in hotels and run some small shops depending on the markets developed in Pakhiralay village (Table 1).

Occupational structure varies with two villages of Kultali block. In the case of PurbaGurgia village, besides the collection of fish and crab, women are involved in several small scale industries, and many women are involved in animal husbandry (Table 2). In Kaikhali village, women are mainly engaged in collecting fish and crab, and sometimes they work as agricultural labor (Badola, 2012).

Residential Information: There are significant differences in residential parameters in the Sundarban Tiger Reserve Division. This factor mainly depends on marital status (Table 1).

In the case of the Kultali block, most of the women of this Block are permanent residents of Sundarban (Table 2).

Family member: Most of the families have less than five members in Pakhiralay and Lahiripur village. There are no differences in the status of family members in all cases. (Table 1; Table 2).

4.2 Involvement of women in forest protection:

Women's involvement in Forest Protection Committees: There are differences in female involvement in FPC among Pakhiralay and Lahiripur villages. In Pakhiralay, the impact of the Joint Forest Management Committee (JFMC) is comparatively high. Besides JFMC, several NGOs and self-help groups are also working simultaneously (Table 3).

Table 3: Involvement of women in forest protection programmes in the villages of Gosaba Block

Characteristics	Pakhiralay (in %)	Lahiripur (in %)	χ^2	df	P Value	Cramer's V
Involvement in any Forest Protection Committees:						
Not involved	28.2	11.0	7.749	2	0.021	0.227
Involved	39.7	42.5				
Highly involved	32.1	46.6				
Involvement in tree plantation in Sundarban:						
Not involved	28.20	17.8	2.708	2	0.258	0.134
Involved	23.07	21.9				
Highly involved	48.71	60.2				
Meeting participation related to conservation of Sundarban:						
Not involved	44.9	58.9	4.748	2	0.091	0.178
Involved	15.4	17.8				
Highly involved	39.7	23.3				
Training related to plantation and socio-economic development:						
No training	85.9	87.7	0.103	1	0.748	0.026
Trained	14.1	12.3				

Source: Field survey 2019-20



Table 4: Involvement of women in forest protection programmes in the villages of Kultali Block

Characteristics	Purba Gurguria (in %)	Kaikhali (in %)	χ^2	df	P Value	Cramer's V
Involvement in any Forest Protection Committees:						
Not involved	60.3	94.6	25.295	2	0.000	0.415
Involved	31.5	5.4				
Highly involved	8.2	-				
Involvement in tree plantation in Sundarban:						
Not involved	60.3	56.8	4.797	2	0.091	0.181
Involved	31.5	41.9				
Highly involved	8.2	1.4				
Meeting participation related to conservation of Sundarban:						
Not involved	72.6	75.7	2.076	2	0.354	0.119
Involved	24.7	24.3				
Highly involved	2.7	-				
Training related to plantation and other socio-economic development:						
No training	90.4	95.95	1.776	1	0.183	0.110
Trained	9.6	4.1				

Source: Field survey 2019-20

The impact of JFMC is less in Lahiripur village. Despite the low impact of JFMC, women of Lahiripur village are involved in several NGOs and self-help groups (Table 3). This village is just beside the Sajnekhali Wild Life Sanctuary. Here, people are highly dependent on forest resources. Women are highly interested in joining any forest protection programmes.

In this regard, it is relevant to mention that *Madhabi Hawali* (30), involved in FPC, represents 71% of the respondents of the Pakhiralaya village, 'my name is enlisted as a member of JFMC. However, we have very few opportunities to engage in various activities to protect the forest and livelihood advancement.'

In the Kultali block, there are also considerable differences in the involvement of women in the forest protection committee. In Purba Gurguria village, Joint Forest Management Committee is active, so the involvement of women is relatively higher in this village. Besides, some NGOs and self-help groups are also working here. 39.71% of women are involved in FPCs. In Kaikhali village, the involvement of women in FPCs is only 5%. The impact of NGOs is significantly less in this village (Table 4).

Perception of *Kanaklata Mandal* (35) of Kaikhali village is mentionable from this point of view: 'officers of forest department never visit our village. No FPC is developed here, and we do not get the required help from the Government. Development of educational condition, occupation status are crucial for the progression of our village'.

Involvement in tree plantation: In both villages of Gosaba Block, women are involved in several tree plantation programmes. They are highly interested in protecting the Sundarban forest. Women who are not involved in tree plantations are also highly interested in participating in tree plantation programmes. Women of Kaikhali village, by their interest, participate in several of such programmes to protect Sundarban.

In this regard, the researcher would like to mention the statement of *Basumati Mandal* (30) of Kaikhali village, who has no formal education and collect fish, crab. She informed we depend on the forest resources to maintain our requirements. Besides, large numbers of floral and faunal families are dependent on the forest. So, we should protect the forest from satisfying our own needs and maintaining our biodiversity.'

Alea Begam (45) of Lahiripur village said 'we are involved in tree plantation under NGO named Purbasha in a scientific way. In mudflat, there are two ways of mangrove plantation by sowing and by planting. The plantation process has occurred in two modes – direct planting and raising seedlings in the nursery. For the generation of non-timber forest products – Neem, Arjun trees are planted. She added, 'we want more plantation programmes in our area.'

Participation in meetings: Several Meetings are organized by the forest dept, local Panchayet and different self-help groups to develop the condition of the Sundarban area by involving local people. The percentage of participation in several meetings of women for Pakhiralaya village is 55.12% and for Lahiripur village is 41.08% (Table 3).

In several meetings of Joint Forest Management Committees, 27.38% of women of Purba Gurguria village participate. 24.33 % of women of Kaikhali participate in meeting organized by local panchayet, an NGO named Goonj etc. Although the number of meeting occurrences in the last five years is deficient, women are interested in joining any meeting to protect Sundarban. There is no significant difference in women participation in meeting among the two villages of Kultali Block (Table 4).

It is imperative to mention one respondent views which represent the overall perceptual scenario of the local women. She proclaimed, 'we participate in meetings organized by local gram panchayet and forest dept, to conserve Sundarban. However, we do not get any scope to give our own opinions. After the meeting, we never get the domain of work as per the declaration of the meeting' (*Parul Dhara*, 40 of Purba Gurguria village).

Training related to plantation and socio-economic development: Training is organized to develop the socio-economic condition of women. Rangabelia Tagore Society provides training for women in Gosaba block. Pieces of training, including sewing activities, animal husbandry, agriculture, work related to civil works, plantation etc., are available in the Sundarban area. 14.10% of women of Pakhiralay village and 12.32% of Lahiripur village have such types of training. Such scope of training is significantly less in Kultali Block.

Vanumati Mandal (26) of Kaikhali village said, 'no training facilities are available in our village to generate alternative sources of income. We have to depend on the collection of fish and crab only for sustaining our livelihood. This mode of income is very much harmful for the physical condition of the women. Several non-timber forest products like honey, gum, tannin and different medicinal plants can be used scientifically for income generation of the local area.'

4.3 Importance of Forest Protection Committees as per women's perception:

Table 5: Perception of women related to the importance of any Forest Protection Committees of the villages of Gosaba Block

Characteristics	Purba Gurguria (in %)	Kaikhali (in %)	X ²	df	P Value	Cramer's V
Importance of any organization to the protection of Sundarban :						
Not important	8.21	1.35	75.688	2	0.000	0.718
Important	19.17	90.54				
Highly important	72.60	8.10				

Source: Field survey 2019-20

Table 6: Perception of women related to importance of any Forest Protection Committees the villages of Kultali Block

Characteristics	Pakhiralay (in %)	Lahiripur (in %)	χ^2	df	P Value	Cramer's V
Importance of any organization to the protection of Sundarban:						
Not important	16.67	16.43	0.117	2	0.943	0.028
Important	38.46	41.09				
Highly important	44.87	42.46				

Source: Field survey 2019-20

Although there are considerable differences in women's involvement in 'Forest Protection Committees', there are no differences in women's perception of the importance of such committees between Pakhiralay and Lahiripur villages (Table 5).

In Kultali Block, respondents of Kaikhali village responded that only 1.35% of women think that there is no impact of FPCs for the protection of Sundarban and the development of local people's condition. The rest of the women of Kaikhali village support 'Forest Protection Committees' for the upliftment of Sundarban. In Purba Gurguria village, 91.77 % of women support the Forest Protection committees of Sundarban (Table 6).

Kanchana Maika (36) of Purba Gurguria village believes that FPC is required to conserve the forest environment. More involvement of women in several forest-related issues is needed. She added, 'we are ready to participate in any programmes. However, in most cases, we do not get information. So, it is desirable to involve numerous local women in the developments of FPCs in an organized way.

Minoti Mandal (51) of Lahiripur village addressed that local forest behaves like their mother. However, the present nature of forest utilization is hampering the pristine nature of the Sundarban forest. So, the presence of FPC is highly important to restore the forest (Chandra, 2020).

In addition, with this statement, *Pratima Ghosal*, with an age of 47, intimated, 'locally we created a group named Antahin for the protection of Sundarban. Women will participate more in this group if income sources can be generated by this group. So, our humble request to the forest dept. that they encourage our gesture.'

4.4 Ordinal Regression Analysis:

Various literature works prove that perception and participation of local people in forest protection are dependent on several socio-economic factors such as age, educational level, occupational types, residential duration, number of family members etc. (Gillinham et al.1999; Gellich et al. 2005; Lee et al.2009; Tadesa and Kotler 2016, Tadesse 2017).

The ordinal regression method is used to understand the dependency of the involvement of women in FPC and participation in the plantation on any socio-economic factors (age, education, occupation, resident, family members, participation in meetings, training, etc.). A P-value ≤ 0.05 is considered statistically significant for this method. In Pakhiralaya village, participation in meetings has an impact on the involvement of women in forest protection programmes. McFadden value is 0.184. Involvement in the meeting is also a predictor variable for the participation of women in tree plantations. In this case, McFadden value is 0.232, which indicates a robust analysis. No participation in the meeting is negatively related in both cases for this village (Table 7).

In Lahiripur village meetings, training, family member affect the involvement of women in forest protection programmes. In the tree plantation of Lahiripur village, there are no significant predictors. Occupation, age and family members are significant predictors in the involvement of women in forest protection and participation of women in tree plantation in Purba Gurguria

village. Women in the lower age group have a positive attitude towards involvement in forest - related issues. By generation of sources of income, the involvement of women can be increased. In Kaikhali village, there are no variables that have an impact on women involvement in forest protection. In the case of the plantation, occupation and education have a significant effect. Fadden value in both cases is satisfactory (Table 7). Lastly, it can be concluded that socio-economic factors have an effect on dependent variables in Sundarban Biosphere Reserve.

Table 7: Ordinal regressions examining the relationship between dependent and predictor variables

Variable	Pakhiralay	Lahiripur	Purba Gurguria	Kaikhali
Involvement in any forest protection programmes:				
McFadden value				
X ² goodness of fit (df)	0.184	0.157	0.499	1.000
P	130.792 (111)	101.605 (98)	58.313 (74)	0.000 (34)
Likelihood Ratio	0.097	0.381	0.910	1.000
X ² (df)				
P	31.188 (17)	22.029 (16)	63.768(16)	31.122 (15)
Significant predictor variable	0.019 Not involved in meeting: W=11.255 P=0.001	0.142 Not involved in meeting: W=4.104 P=0.043 No training: W=4.442 P=0.035 Family member (less than 5): W=4.698 P=0.030	0.000 No work: W=10.127 P=0.001 Agriculture W=7.574 P=0.006 Age (less than 30) W=48.019 P=0.000 Family member (5-10) W=4.430, P=0.035	0.008
Participation in tree plantation				
McFadden value	0.232	0.207	0.499	0.243
X ² goodness of fit (df)	128.562 (111)	84.038(98)	58.313 (74)	105.148 (83)
P	0.122	0.842	0.910	0.051
Likelihood Ratio				
X ² (df)	37.827 (17)	28.627(16)	63.768 (16)	26.747(15)
P	0.003	0.027	0.000	0.031
Significant predictor variable	Not involved in meeting: W=16.830 P=0.000		No work: W=10.127, P=0.001 Age (less than 30): W=48.019 P=0.000 Family member (5-10): W=4.430 P=0.035	Occupation: W=164.793 P=0.000 Primary education: W=3.942 P=0.047

Source: Field survey 2019-20

5.0 Recommendation and Conclusion:

Every village has different challenges and issues regarding several socio-economic and other facilities. Therefore, it is urgent to draw attention to all the villages as per their necessity.

- As per the perception study, In Pakhiralay village JFMC is present. However, it is not properly organized. Eco-tourism has developed in this area as an alternative source of income. The scope for participation of women in such work is minimal. There is a gap between enlisted as a member of JFMC and being involved in activities under JFMC. Due to less and inadequate sources of income, women have to depend on forest resources in many cases, leading to man-animal conflict. So, it is suggested that maintenances of JFMC in a more organized way and

involvement of women by providing training for the generation of alternative sources of income are necessary. The development of eco-tourism by involving local women is also required.

- Fewer sources of income for women, several environmental issues and man-animal conflict are very prominent in this village. In Lahiripur village, several NGOs are working very well. The educational scenario is progressive in this village and women are involved at a higher rate than other villages in forest-related issues. To dilute the existing problems, good collaboration between Govt. and NGOs, the inclusion of women views, emotions and ideas in planning by providing positions for women in decision making bodies may be helpful for the development in this remotest part of Sundarban Biosphere Reserve.
- Joint Forest Management Committee is present in Purba Gurguria village. As per the perception study inclusion of members and work under JFMC is not transparent. Some political factors may be the leading issue in this regard. Some small scale industry based on non-timber forest products is developed in this region, and some women are dependent on animal husbandry for their income. The scenario of Purba Gurguria village suggests more inclusion of women in self-help groups by proper awareness programme, reduction of conflict within JFMC etc., are crucial.
- Among these four villages, Kaikhali is a very underdeveloped village. Educational status is deficient in comparison to other villages. The source of income of Kaikhali village is the collection of crab and fish, which is very much harmful for their health.
- There is a minimal scope of sources of income for the generation of livelihood. The impact of the forest dept. and NGOs are very limited in this village. From the perception study, it is recommended that Govt. should take special care of this village. Developments of alternative sources of income, true collaboration between NGOs and Govt. organizations are needed. Development of educational status and other facilities are also essential for this particular village.

The protection and conservation of the mangrove forest of Sundaraban is an emerging issue in this present context. This research may be a pioneer work to enhance these protection programmes by including women participation and their perception of Sundarban forest. In this study, the village wise findings may be helpful for policymakers. By overcoming the shortcomings or limitations of this work, future researchers can develop a new avenue of research work. In the case of Sundarban this will become the right approach in the planning process, and on the other hand, it will enhance the self-respect among the women in the studied villages, which is most desirable.

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