

# Impact Of Mokata Watershed Project On Rural Development With Special Emphasis On Aquatic Resource Generation

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***Abstract: Watershed is a geo hydrological unit that drains to a common point in the drainage system. It is surrounded by a ridge line which ends at the common draining point encircling the watershed. Smaller watersheds are called micro watersheds which covering an area between 500 – 1500 hector, with an average area of 1000 hector. Watershed Management is an integrated approach for the development of abiotic and biotic components within the watershed area. It involves optimum utilization of natural resources for overall development. It includes natural resource management, soil and water conservation, employment generation, erosion control, agricultural improvement, community mobilization etc. In India now emphasis is given on micro level planning. It is considered as the best fitted regional planning machinery. As micro watershed holds smaller area so it is treated as an ideal unit of micro level planning. India is a developing country. About 70% population live in rural areas with agriculture as the prime occupation. So for overall development of this country, there need the development of rural areas at first. Rural development is a process to improve the economic and social life of rural people particularly the rural poors. It aims at improving the well being and self-realization of people of rural area through collective process. Rural development process brings change among rural community from traditional way of living towards progressive living. It is a dynamic process which includes agricultural development, infrastructural development, village industrial development, employment generation, women empowerment, economic improvement, social development and cultural development. Thus rural development is the process of improving the living standard of masses of low income population of rural areas and making the processes of development self-sustained. On the other hand aquatic resource play an important role in case of water, food and other aquatic product supply. Watershed management in rural areas sometime play this kind of role. Integrated watershed development and management program is the current thrust of rural development planning in India. It also fulfills the basic needs of rural development phenomena like – agricultural development, rural industrialization, employment generation, poverty alleviation, rural infrastructural development, women empowerment, social mobilization etc. Thus it is said that micro watershed management helps in rural development. In this paper, an attempt has been made to show the impacts of Mokata micro watershed project of Ausgram – II block of in East Burdwan district on rural development particularly in case of agriculture, employment, infrastructure, education, women empowerment, people's participation, animal husbandry, income generation, migration, SHG formation, health etc. This paper also helps us to know about some present problems of the study area. Some suggestions have been also made for further development of the rural life.***

***Key Words: Watershed, Rural Development, Aquatic, SHG, Women Empowerment.***

## **1. INTRODUCTION**

Watershed is a geo hydrological unit that drains to a common point. It is surrounded by a ridge line, which starts from and ends at the same common point duly encircling the watershed (Mani, N.D. 2005). Watershed as land and water areas, contribute runoff to a common point (Watzel, 1957). Smaller watersheds are called micro watersheds which covering an area between 500 – 1500 hectors with an average area of 1000 hector (SLUSI). Watershed management is an integrated approach for overall development of abiotic and biotic components of the watershed area. It involves adoption of rational and optimum utilization of natural resources and their conservation measures (Singh, Savindra, 2015). Watershed Development is an integrated method to increase production by better utilization of resources without any adverse effect on natural balance. It solves local problems by traditional knowledge and cooperation of local people (Gurjar & Jat, 2008). Major objectives of watershed development and management includes – 1.Conservation, up-gradation and utilization of natural resources, 2.Ground water improvement, 3.Prevention of degraded land, 4.Soil erosion control, 5.Agricultural improvement, 6.Aquatic resource generation, 7.Employment generation, 8.Migration reduction, 9.Participation of watershed community in resource development etc. In India now emphasis is given on micro level planning because it is considered as the best fitted regional planning machinery. As micro watershed has smaller area so it is treated as an ideal unit of micro level planning. India is a developing country. About 70% population lives in rural area with agriculture as the main occupation. So for overall development of this country, there need the development of rural areas at first. Rural development is a process to improve the economic and social life of rural poor. It is a dynamic process which brings change among rural community from traditional life to progressive living. Rural development is the process of quality of life improvement and economic well being of rural people (Wikipedia). Rural development changes all components of life i.e. – social, economic, technological, natural and political. Here each components of rural life change in a desired direction. It is a multi-dimensional concept which refers to quantitative and structural changes of economy. It refers to long term increase of rural income, attitudinal change of rural people, their motivation and institutional set up (Rukhsana, 2009). Rural development indicates both economic betterment of people and greater transformation of people. There need to increase people's participation in rural development programs, decentralization of planning better lands reforms and greater access over credit. These processes will bridge the gap between urban and rural life and will upgrade the standard of living of rural people (Agarwal, Surbhi, 2016). Watershed management is such a rural development related activity which ensures all such above aspects. Three basic elements of rural development (Todaro, 1995) are –

1. Basic necessities of life – foods, clothes, shelter, basic literacy, primary health care, security and property of life.
2. Self respect – every person seek self respect, dignity or honour.
3. Freedom – political, ideological, economic and social freedom.

National plan for rural development is based on – 1.Development of agriculture, forestry and food industry, 2.Prevention of natural resources and environmental protection, 3.Promotion of employment, improving social infrastructure and quality of life of rural areas (Surchev, P. 2010).There are some indicators of rural development (Singh, Katar, 2009) –1.Agriculture production, efficiency, 2.Agricultural work force, 3.Rural healthcare infrastructure, 4.Rural

educational infrastructure, 5.Rural amenities, 6.Transport facilities, 7.Rural financial infrastructure, 8.Standard of living of rural people. On the other hand aquatic resources play an important role in case of water, food and aquatic product supply. Fish is one of the important aquatic fauna which is responsible for nutrition supply. In watershed area aquatic ecosystems play vital environmental functions like- recycling of nutrients, purification of water, supplying of food, ground water recharge and habitation for living organisms. Micro watershed development is such an activity which fulfills all such above objectives and requirements of rural development as well as aquatic resource generation. So for rural development watershed development and management could be applied as one of the means. Here in case of Mokata micro watershed project of Ausgram – II block of East Burdwan district, some basic objectives of rural development have been achieved.

**Location of the study area and about the study area :**

Mokata micro watershed is situated in Ausgram – II block and in Bubbud police station of East Burdwan district, West Bengal, India. This watershed is situated between 23°28'30" N to 23°32'01" N latitude and 87°31'09" E to 87°34'30" E longitude. Total geographical area of this micro watershed is 1416.88 hector (according to Deputy Director of Agriculture, Soil & Water Management, Burdwan). This project was under National Watershed Development Project For Rainfed Area (NWDPA – 11<sup>th</sup> plan). The effective project area is 770.00 ha. This micro watershed consists of the parts of mouzas like – Parisa, Mokata, Bhatkunda, Premganj, Balarambati, Bardoba etc. But major activities have been done in Parisa, Mokata, Bhatkunda, and Bardoba mouzas. In the northern part there is Kunur river which is the main drainage line of this watershed. This watershed comes under Vindhyan old alluvium sub region. Soil developed on older alluvium flood plain. Uplands are covered with light textured soil with rapid infiltration rate. Low lands are with heavy textured soil with slow infiltration. This region is sloping towards river Kunur i.e. towards north. Southern part is upland i.e. 35%, medium land covers 55% and low land covers 10% area. Out of total effective project area, 710 ha. land is arable. Annual average rainfall is 1427.40 mm. Mean summer and winter temperature are 37<sup>o</sup> C and 14.8<sup>o</sup> C respectively. Relative humidity is high from June to October i.e. 78%. Out of the total geographical area, 620.88 ha. land is under forest cover. Major crops are paddy, wheat, mustard, potato, til, sugar cane etc. Important animal and bird population includes – cow, buffalo, goat, sheep, pig, hen, duck etc. Fishing is done in some ponds. Major source of incomes are agriculture, fishery, poultry, goatery, piggery, household manufacturing like – plate making by sal leaves, shop keepers, traders, labors, government services etc. Total number of population of this micro watershed was 3826 with 50:50 male, female ratio. The literacy was 78%. Out of total population 75% belongs to SC/ST. Total land holding families are 466 and land less families are 198. (PRA – Participatory Rural Appraisal Report).

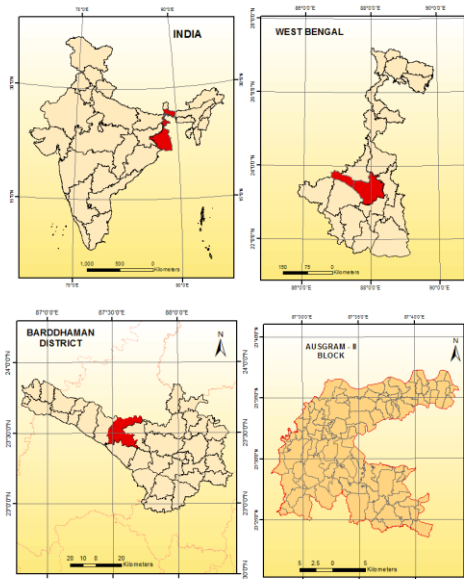


Fig: 1 Location of the study area

### **Rationale behind the selection of the study area:**

Ausgram – II is an under developed block. Mokata and its surrounding area are characterized by forest cover, land degradation, lateritic land, un-fertility of soil, huge SC/ST population concentration etc. Besides before watershed project, this area faced many problems like – 1.High rate of soil erosion, 2.Shortage of drinking water in summer, 3.Lower agricultural productivity, 4.Huge water loss in rainy season, 5.Lack of rain water harvesting structures, 6.Crop failure due to water crisis, 7.Siltation in ponds, field drains etc, 8.Shortage of irrigation water, 9.Decreasing soil fertility, 10.Problems of un-employment, 11.Lack of women empowerment, 12.Out migration, 13.Lack of SHG performances, 14.Mass poverty among weaker section, 15.Forest degradation.

All such above problems are the problems behind rural development also. Many problems have been solved by watershed based rural development planning. As presently integrated watershed development and management is considered as the current thrust of rural development planning in India. So the selection of this block, to achieve the fruitful effects of rural development by watershed development project, is highly justified.

### **2. OBJECTIVES OF THIS STUDY:**

Major objectives of this study are –

1. To show the impacts of watershed development in the study area.
2. To study the socio-economic impacts of watershed development project on rural development.
3. To investigate the nature of rural development through women empowerment, SHG formation and people's participation in watershed area.
4. To know the nature of aquatic resource development in the watershed area.
5. To find out recent problems in the study area.
6. To formulate proper suggestions for further improvement of rural life.

### 3. DATABASE & METHODOLOGY:

Present paper is mainly based on extensive field survey and primary data. Besides some secondary sources like – DPR (Detailed Project Report) for Mokata micro watershed project, books, journals, maps have been followed. Various calculation and cartographic techniques have been also applied. For mapping ARC GIS – 10.3 software has been used.

#### Impact of Mokata micro watershed project on various aspect of Rural Development:

##### (A) Agricultural development

Watershed development is an eco-friendly approach for efficient use of soil and water for more agricultural production (Arneja, C.S. & et.al. 2005). Recently for rain fed farming, scientific conservation of rain water through integrated development of watershed is preferred.

Table: 1 Increased amount of Land for different crops due to watershed development.

Crop	Increase land after project (ha).
Paddy (Aman)	70
Wheat	35
Oil seed	20
Potato	10
Vegetable (winter)	3

(Field Survey)

The area of crop production has been increased due to watershed development, it is due to the improvement of water supply. As area of winter crops have been increased, so people's economic condition has been also improved.

Table:2 Productivity of some crops

Crops	Pre-project production (kg/ha)	Post-project production (kg/ha)	Difference	% increase
Paddy	4000	5500	1500	37.5
Wheat	1700	3000	1300	76.47
Mustard	950	1400	450	47.37
Til	700	1200	500	71.43
Potato	17000	23000	6000	35.29

(Field Survey)

It is observed that production rates are higher in post-project situation almost in case of every crops. Wheat has maximum production increase i.e. 76.47% and potato has lowest position i.e. 35.29%. It is mainly due to irrigation development, water and soil quality improvement.

Table: 3 Situation of Agricultural Machinery Use (on the basis of 50 sample families from each mouzas)

Mouzas	Pre-project				Post-project			
	Tractor	Pump set	Spray machine	Thrashing machine	Tractor	Pump set	Spray machine	Thrashing machine
Parisa	00	06	15	18	01	20	5	40
Mokata	00	10	12	17	01	25	35	43
Bardoba	00	03	07	12	00	16	20	25
Bhatkunda	01	14	17	22	03	30	40	43

Total	01	33	51	69	05	91	130	151
Difference					04	58	79	82
% increase					400	175.76	154.90	118.84

(Field Survey)

Situation of agricultural machinery has been also developed due to watershed development. Due to watershed development, purchasing capacity of man has been improved so the number of agricultural machinery has been also increased. Among pump set, spray machine and thrashing machine use, pump set has maximum increase i.e. 175.76% in the watershed area. It is a good sign. Irrigation development is the main cause of agricultural development. Before watershed main sources of irrigation were two river lift irrigation, ponds, some deep tube wells and rain water, but after watershed development, there has been a change in command area. Now about 100 hectares of extra land get irrigation by six new water harvesting structures and two farm ponds. Besides 1700 meters drainage line also helps in agricultural operation. Due to irrigation development winter crops are now grown in a steady form.

Table: 4 Effect of HYV seed & chemical fertilizer use (on the basis of 50 farmers from each mouzas)

Mouzas	Item	No. of families before project	No. of families after project	Difference	% increase
Mokata	HYV crops	22	43	21	95.45
	Chemical fertilizer	18	45	27	150.0
Parisa	HYV crops	23	47	24	104.35
	Chemical fertilizer	27	44	17	62.96
Bardoba	HYV crops	07	21	14	200.0
	Chemical fertilizer	02	15	13	650.0
Bhatkunda	HYV crops	15	39	24	160.0
	Chemical fertilizer	12	42	30	250.0

(Field survey)

Through watershed development, agricultural practice of people has been also changed. Now maximum farmers use HYV seeds and chemical fertilizer to increase production. In case of both chemical fertilizer and HYV seed use Bardobamouza has significant position i.e. there is 650% and 200% increase in use. Previously the SC/ST farmers of such mouzas were linked with traditional method of agriculture but after watershed development this practice has been changed due to the diffusion of innovation.

### **(B) Rural infrastructure development through CPR (Common Property Resource) development**

CPR's are the resources in which every villagers have co-equal rights and villagers manage, maintain, protect and construct these resources with equal right and responsibilities (Rajora, Rajesh, 1998). Natural CPR's include land and forest resources and man made CPR's include village tank, community hall, roads, school, playground, tube wells etc. Some common

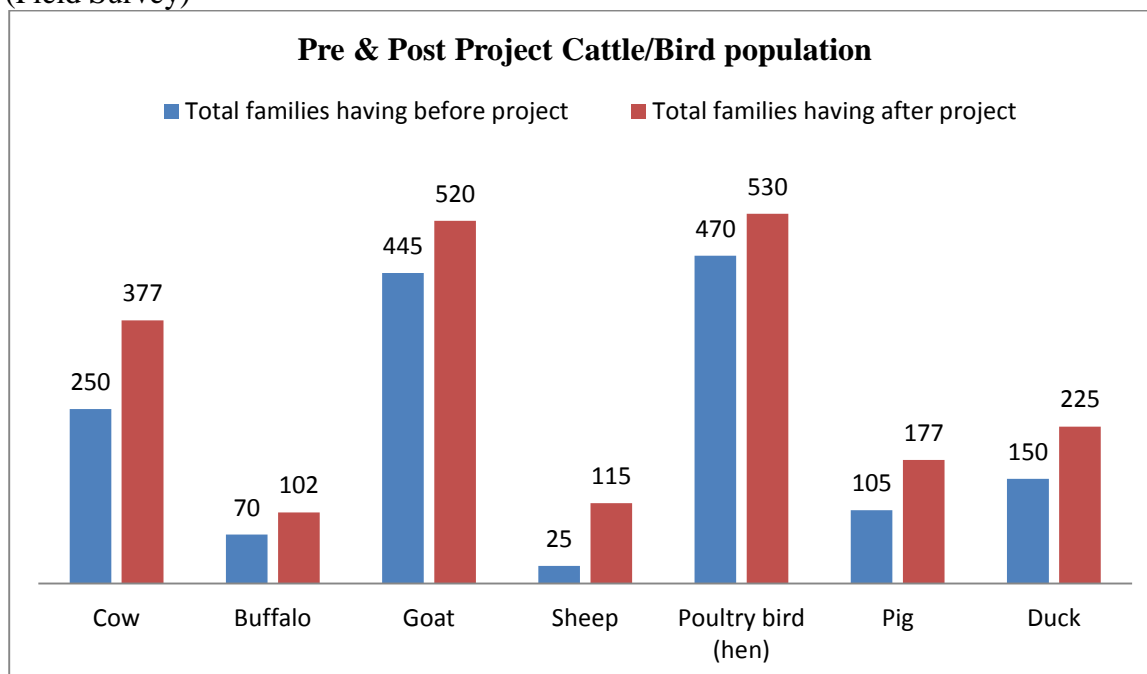
CPR's have been developed by this project. These are afforestation in about 7 hectors of lands, land levelling in about 12 hectors of lands. Besides there are other activities like one check dam, six water harvesting structures, 20 re-excavated water harvesting structures,two farm ponds, five re-excavated farm ponds, horticulture development in about 1.5 ha. lands, field irrigation channel of about 1700 meters, drainage line treatment in one drain, one play ground in Mokata, twenty six inlet outlet in ponds, two culverts, about 500 mts.murum road, one community hall in Mokata etc. Besides fishing are done in about 50 ponds. These all CPR's have improved man's various activities like agriculture, daily life etc.

**(C) Animal resource development**

Table: 5 Status of animal resource

Cattle/birds	Total families having before project	Total families having after project	Difference	% increase
Cow	250	377	127	50.80
Buffalo	70	102	32	45.71
Goat	445	520	75	16.85
Sheep	25	115	90	360.00
Poultry bird (hen)	470	530	60	12.77
Pig	105	177	72	68.57
Duck	150	225	75	50.00

(Field Survey)



**Fig: 2**

From animal resource development point of view Mokata watershed project has a significant impact. There has been an increase almost in every case of both cattle and bird rearing families after watershed development. Sheep has 1<sup>st</sup> position i.e. 360% increase. Then come

pig i.e. 68.57%. The position of poultry bird rearing families stood last position i.e. only 12.77% increase. This overall increase indicates production of meat, milk & egg which will improve the nutritional pattern of rural people.

#### **(D) Income generation & mode of savings**

Due to watershed development, there has been a change in case of income generation or in employment pattern. Average man days have been increased. There has been a change in case of cottage industries through SHG formation due to watershed development like – plate making, broom making, mat making etc. Previously average income of the labour class was Rs – 1500 per month which is now become 3000 per month. As level of income has been increased so there is a change in case of savings pattern. Previously 50% families were without savings. Maximum families had little savings per month which is below Rs. 500. Only some few families had above Rs. 1000 savings per month.

Table: 6 Present pattern of savings (on the basis of 50 families per mouza)

Savings Per month	Mouzas & families			
	Mokata	Bhatkunda	Parisa	Bardoba
No savings	Nil	Nil	Nil	05 (10)
Below Rs. 500	19 (38)	25 (50)	13 (26)	30 (60)
500 – 1000	25 (50)	20 (40)	29 (58)	13 (26)
Above 1000	06 (12)	05 (10)	08 (16)	02 (04)
Total	50 (100)	50 (100)	50 (100)	50 (100)

(Brackets indicates percentage)

(Field Survey)

Only Bardoba mouza has 10% no savings families out of total families. Above Rs. 1000/month savings families are very little almost in every mouzas. Mokata and Parisa have maximum families under Rs. 500 – 1000/month savings. But Bhatkunda and Bardoba have maximum families under below Rs. 500/month savings as there are maximum concentration of poor minorities SC and ST population.

#### **(E) Education status**

Table: 7 Situation of education

Mouzas	Total number of students from 1 to P.G. level before project	Total number of students from 1 to P.G. level after project	Difference	% increase
Mokata	102	142	40	39.22
Parisa	97	127	30	30.93
Bardoba	82	115	33	40.24
Bhatkunda	127	225	98	77.17

(Field Survey)

After watershed development number of school going children specially the girl child has been increased. The increase is maximum in case of Bhatkundamouza i.e. 77.17% and Parisa has last position 30.93%. It is nothing but due to their consciousness and economic



development. After watershed development poverty has been eliminated and income has been increased so the level of educational development has been improved.

**(F) Health care facilities.**

Table: 8 Medical facilities (Families going to hospital/doctor)  
 (on the basis of 50 families)

Mouzas	Pre-project	Post-project	Difference	% increase
Mokata	22	42	20	90.91
Bhatkunda	18	38	20	111.11
Parisa	25	43	18	72.0
Bardoba	12	32	20	166.67

(Field Survey)

In case of talking of medical facilities, Bardoba has an increased position i.e. 166.67% and Parisa has last position i.e. 72%. In Bardoba previously maximum people believe in magical man to solve their health problems but after watershed development the situation has been completely changed. Now they go to doctors or hospital for any problem. This situation is mainly due to their financial improvement and increasing health consciousness.

**(G) Migration reduction**

There is a close relation with out-migration and watershed development. Generally due to proper watershed development there is a reduction in migration rate. Migration depends on social, economic, political and environmental factors. Employment potentiality of a region controls the rate of migration (Devi, Suman, 2015). In the study area before watershed development the rate of migration among SC/ST population was more but after watershed development it has been reduced. It was mainly for daily earnings.

Table: 9 Status of Migration

Mouzas	Before project	After project	Difference	% decrease
Parisa	126	52	74	58.73
Mokata	112	46	66	58.93
Bhatkunda	213	152	6	28.64
Bardoba	75	40	35	46.67
Total	526	290	236	44.87

(Field Survey)

It is seen that after watershed development there 44.87% is out migration reduction rate of migration reduction is lesser in case of Bhatkunda i.e. 28.64%. This reduction is due to the development of agriculture, formation of SHG and other watershed related employment generating activities.

**(H) Self Help Group (SHG) formation**

Self Help Groups are essential to overcome exploitation and for economic self reliance of rural poor. SHG's establish equity of women's status, decision makers and beneficiaries in socio-economic system of rural life (Sharma, Dr. Sanjeev Kumar, 2005). SHG's with women members are more sustainable than man members (Puhazhendhi and Joyaraman, 1999).

Table: 10 SHG situation

Mouzas	No. of groups	Type of group	Total member
Mokata	04	2-male, 2-female	10 per group
Parisa	01	Combined group	10 per group
Bhatkunda	02	1-male, 1-female	10 per group
Bardoba	02	1-male, 1-female	10 per group

(Field Survey)

Main activities of the groups are plantation works, re-excavation of ponds, plate making by forest leaves, broom making, animal rearing, fishing, & horticulture. They conduct one meeting per month. They maintain account regularly and re-payment loan timely. For up-gradation of skills they take training also. There is equal distribution of profit among themselves.

**(I) People's participation**

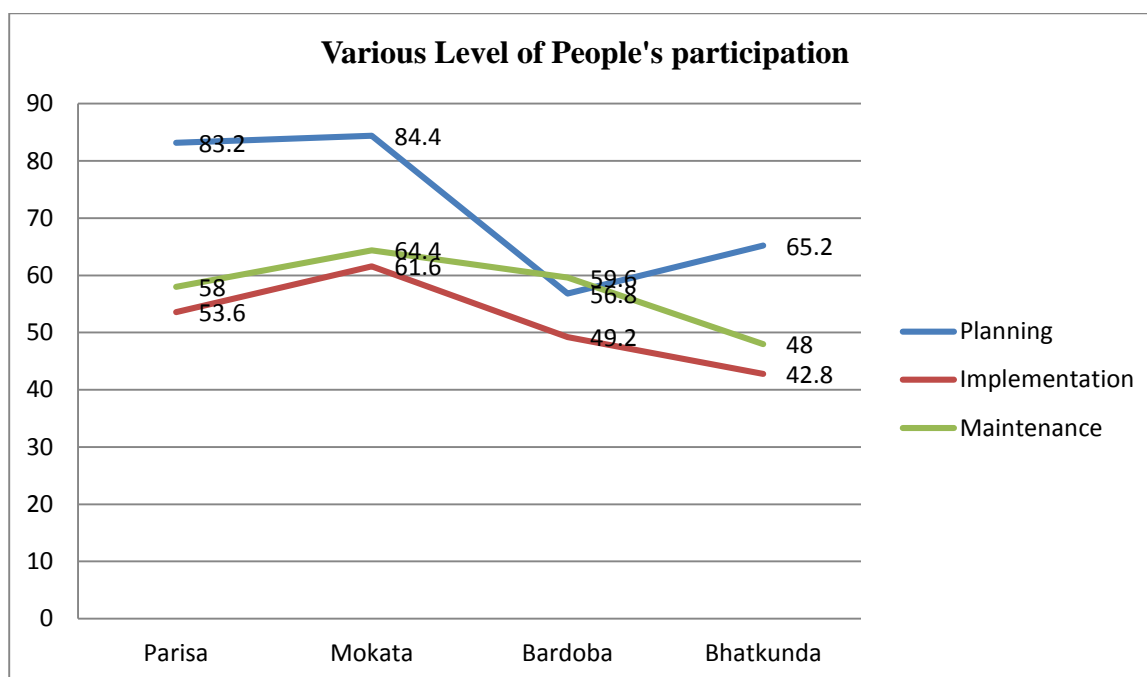
People's participation is a dynamic group process in which all members contribute towards a group objectives, share benefits among themselves, exchange information among themselves and follow equal group rules (Badal, P.S. & et.al. 2006). Age, education, family size, politics, caste, economic condition etc. control people's participation. For people's participation following ingredients are preferred – involvement of women and weaker section of society in decision making, democratic management, to make people self dependent, equity in sharing benefits of development, sharing knowledge and information etc. (Roy, UpendraNath, 2005). To test people's participation with the help of People's Participation Index (PPI) by Bagdi (2002) has been applied in Mokata micro watershed area. In this aspect 50 families from each mouza like – Mokata, Parisa, Bardoba, and Bhatkunda have been selected for interview from upper, medium and lower class categories and we get overall participation values.

Table: 11 PPI Values

(Total n = 200)

Stages of program	Parisa	Mokata	Bardoba	Bhatkunda	Total
Planning	83.2	84.4	56.8	65.2	72.4
Implementation	53.6	61.6	49.2	42.8	51.8
Maintenance	58.0	64.4	59.6	48.0	57.5
Overall PPI (%)	64.93	70.13	55.2	52.0	60.57

(Field Survey)



**Fig: 3**

From overall participation analysis it is clear that there is moderate participation index i.e. 60.57%. Mokata mouza has 1<sup>st</sup> position i.e. 70.13%. Parisa has 2<sup>nd</sup> position and Bhatkunda has last position. In case of various activities of people's participation, planning has better position i.e. 72.4% and implementation has lower level of participation i.e. 51.8%. In case of individual analysis, Mokata has better position in planning i.e. 84.4%, in implementation 61.6% and in maintenance 64.4%. In case of maintenance Bardoba has 2<sup>nd</sup> position because tribal population of Bardoba by their own labour protect or maintain the structures. In Mokata, participation in planning has 1<sup>st</sup> position, it is due to people's seriousness and interest. The position of implementation is not so satisfactory. It is due to their lesser responses, lack of interest, lack of proper campaigning, lack of training etc. So to achieve higher level of participation, there need more seriousness and interest of maximum people.

**(J) Women's empowerment**

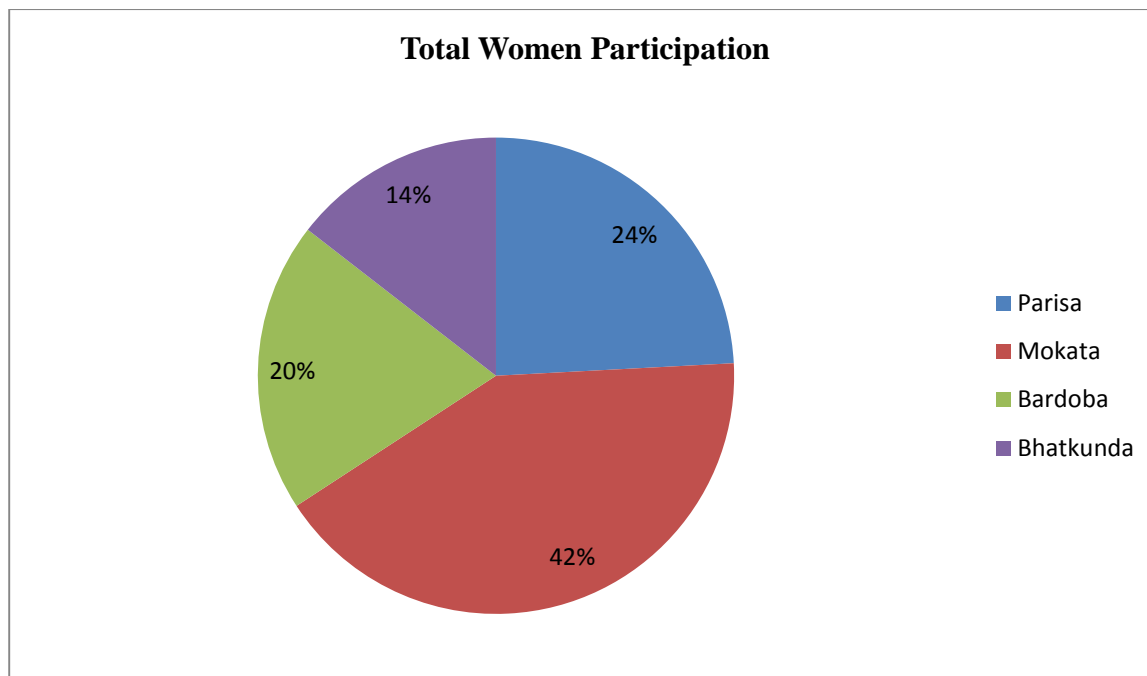
Simply women empowerment means social, economic & political capability development of women. Through women empowerment, women gain greater share of control over material resources, human resources, intellectual resources, financial resources etc. Another components of empowerment are knowledge, awareness, self-image and autonomy (Joshi, Meenakshi, 2004). Watershed management is such an activity through which rural women get some strength from social, political and economic point of view. Through women's participation and empowerment, equity in gender issues come in watershed area.

Table: 12 Nature of women's participation through membership in Mokata micro watershed

Type of membership	Parisa	Mokata	Bardoba	Bhatkunda	Total	%
Committee member	10	12	08	04	34	12.64
Group member	30	50	20	20	120	44.61
General participants at the time of actual work	25	50	25	15	115	42.75

Total	65 (24.16%)	112 (41.64%)	53 (19.70%)	39 (14.50%)	269 (100%)	100
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(Field Survey)



**Fig: 4**

In Mokata micro watershed, group member's percentage is larger i.e. 44.61% than other which indicates their maximum participation in SHG (Self Help Group) activities. Among all mouzas Mokata mouza has higher women involvement i.e. 41.64% and lower position in case of Bhatkunda i.e. 14.50% because in Bhatkunda, there is minority concentration. In Mokata mouza, women from different level are involved but in Bhatkunda it is lesser due to less interest, superstition and lack of proper knowledge of people. Women involvement develops their socio-economic status in both family and in society. It improves their awareness, responsibility, leadership skill, self-confidence etc. It increases their savings. So there need much more women's participation in watershed related activities.

**Aquatic Resource Development:**

Aquatic resources means water related resources including wet lands, streams, lakes, rivers, reservoirs, ponds, ground water etc. and flora-fauna within them. It may be permanent seasonal, natural or man made water bodies. This water resource has important role to sustain aquatic life. Aquatic resources play an important role in case of water, food and other aquatic product supply. Fish is one of the important aquatic fauna which is responsible for nutrition supply. Fisheries and aquaculture provide benefits in terms of food supply, livelihood improvement, nutrition supply and health improvement. Besides in watershed area aquatic ecosystems play vital environmental functions like- recycling of nutrients, purification of water supplying of food ground water recharge and habitation for aquatic life etc. Aquatic resource development and management helps in irrigation, drought reduction, fishing, and adequate water resource utilization within watershed area. These are also important aspects of rural development. In Mokata watershed area aquatic resources have been developed to improve fishing and agricultural activities. Fishing is applied to catch other aquatic planktons

and animals like molluscs etc. After watershed development there has been a tremendous change in case of fishing activities in the study area. Many people now take fishing as main occupation there. Now fishing is done almost in 70 ponds in Mokata watershed area which were 50 before the project. Extra 20 ponds have been excavated by this projects which are almost used for fishing also. About 200 families linked with this activity for income generation. Ponds are not only used for fishing activities but also for irrigation sources in winter cropping. Local people also use pond water for their domestic needs. besides there is one minor check dam. There are 22 inlet/outlets of ponds. Out of new 20 ponds, 10 are directly used for agriculture purposes and 10 other for domestic activities. There is about 1000 meters raw field drain to supply irrigation water.

Table: 13 Number of fishing ponds

Mouza	Before watershed project	After watershed project	% increase
Parisa	12	17	41.67
Mokata	21	27	28.57
Bardoba	10	14	40.00
Bhatkunda	07	12	71.43
Total	50	70	40.00

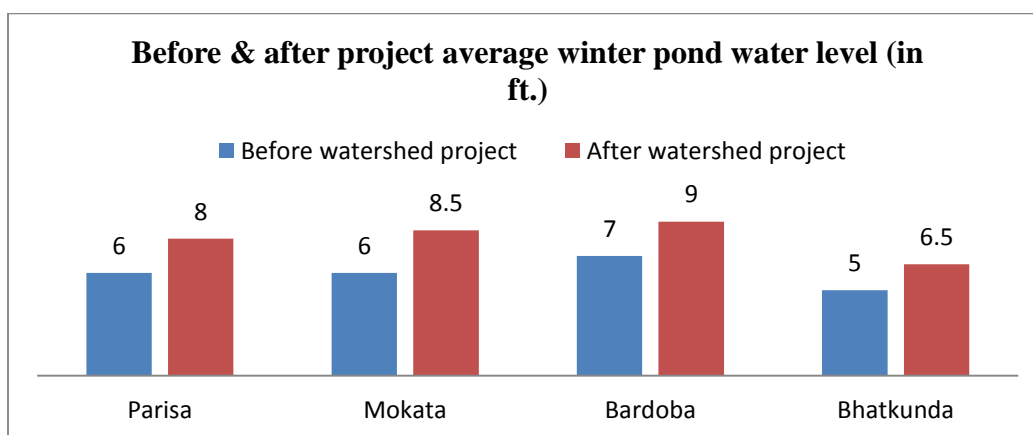
(Field survey)

There is a good development in case of new ponds due to watershed development activities. It ultimately improves rural development mechanism. Due to watershed development, there is 40% overall increase of new ponds which improve area's aquatic environment in terms of irrigation and fishing activities. Bhatkunda has highest position i.e. 71.43% increase of ponds in this watershed. It is also an effective step to improve the ground water condition.

Table: 14 Average winter pond water level in pre & post project phase (in ft.)

Mouza	Before watershed project	After watershed project
Parisa	6.0	8.0
Mokata	6.0	8.5
Bardoba	7.0	9.0
Bhatkunda	5.0	6.5
Average	6.0	8.0

(Field survey)



**Fig: 5**

Due to watershed development rain water harvesting rate has been improved to catch more water in various ponds as well as to improve ground water level. After watershed development there is about 33.33ft. increase of average winter pond water level in post project situation. Bardoba and Mokata mouza have better position in that case. As there is increased pond water level so there is fruitful effect in case of winter crop cultivation.

Table: 15 Pre & post project average tube well ground water table situation in pre monsoon months (in ft.bgl.)

Mouza	Before watershed project	After watershed project
Parisa	25	12
Mokata	30	13
Bardoba	20	09
Bhatkunda	35	13
Average	27.5	11.75

(Field survey)

Post project decreased ground water table in pre monsoon months indicates good sign in water harvesting situation. In every mouza there is decreased in the amount of ground water table that means water level of the tube well has been increased. Due to the improvement of water harvesting structures by watershed project, the ground water table has been uplifted which has improved the underground aquatic resource condition. It has solved the drinking water scarcity in summer.

Table: 16 Number of families engaged in fishing activity

Mouza	Before watershed project	After watershed project	% increase
Parisa	18	30	66.67
Mokata	35	100	185.7
Bardoba	12	35	191.67
Bhatkunda	10	35	250.0
Total	75	200	166.67

(Field survey)

Fishing is considered as an important primary activity in rural areas particularly in watershed area. It is an important supporting income generating activity of rural poor. After watershed development there 166.67% increase in fishing activity in the study area. Bhatkunda has

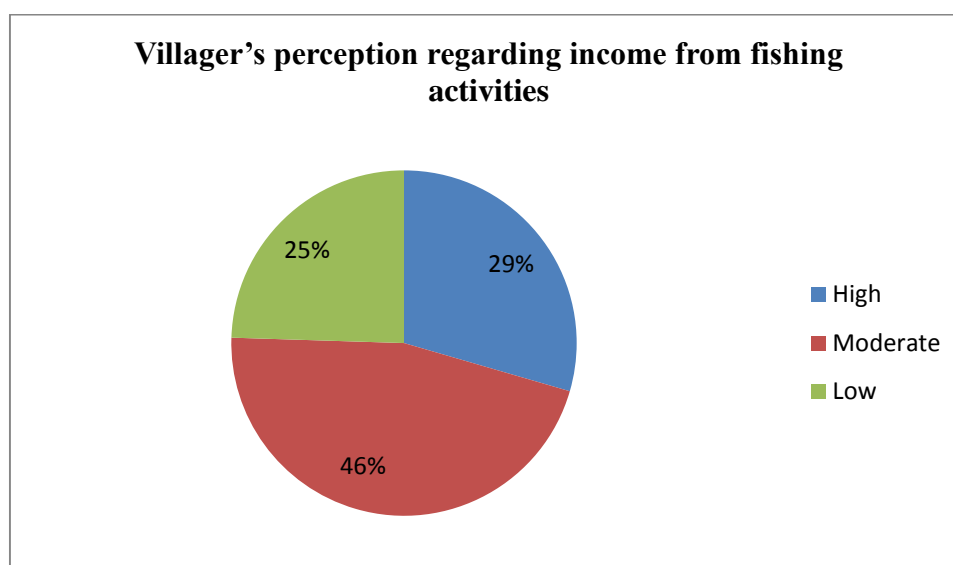
maximum i.e. 250% and Parisa has minimum i.e. 66.67% fishing development. By fishing villagers can improve their nutritional level as well as financial condition.

Table: 17 Villager’s perception regarding income from fishing activities after watershed project

Mouza	Number of Villagers	Perception		
		High	Moderate	Low
Parisa	30	10	10	10
Mokata	100	30	45	25
Bardoba	35	09	17	09
Bhatkunda	35	10	20	05
<b>Total</b>	<b>200 (100)</b>	<b>59 (29.5)</b>	<b>92 (46.0)</b>	<b>49 (24.5)</b>

(Brackets indicate percentage)

(Field survey)



**Fig: 6**

Overall villager’s perception regarding income in the watershed area is of moderate type i.e. 46%. About 29.5% villagers said as high income generating phenomenon and remaining indicate low i.e. 24.5%. This supporting fishing activity helps in case of income generating and livelihood pattern of the resource poor villagers in a significant extend within the watershed area.

**Major findings:**

1. In Mokata micro watershed project, there is moderate type of participation index i.e. 60.57%.
2. From CPR point of view, water harvesting structure has good position – i.e. six water harvesting structures, 20 re-excavated structures, two farm ponds, 5 re-excavated farm ponds have been constructed.
3. In case of HYV seed and chemical fertilizer use, Bardoba has better position i.e. 200% and 650% increase in total families.
4. In case of animal resource development, sheep has best position i.e. 360% increase in total population.
5. After watershed development, there is 77.17% increase of students in Bhatkunda.

6. Post-project, medical facility is more in Bardoba mouza i.e. 166.67% families are now taking doctor and hospital facility.
7. Increase of women's membership Mokata has 1<sup>st</sup> position 41.64%.
8. After watershed development wheat has maximum production increase i.e. 76.47%.
9. From SHG point of view, Mokata mouza has 1<sup>st</sup> position, as there are four groups with two male and two female group.
10. Overall migration reduction of the watershed area is 44.87%.
11. Due to watershed development there is 40% overall increase of new ponds to improve area's aquatic environment.
12. There is increase in winter pond water level (ft.) and pre monsoon ground water table (ft.bgl.) after watershed development.

**Present problems behind rural development:**

Though watershed development has solved many rural problems but still there are some problems.

1. There is lack of revolving fund for post watershed maintenance works.
2. Lack of SHG's in the study area.
3. Political interferences in various activities.
4. Lack of awareness and interest of people.
5. Conflict within groups & between members.
6. Lack of proper communication among members.
7. Lack of high cost technology.
8. Poor marketing of agricultural commodities.
9. Lower education level and confidence of people.
10. Lack of training programs relating with watershed structural measures and SHG activities.
11. Lack of high class women's participation.
12. Lack of scientific method of agriculture and irrigation.
13. There is no proper rule for the equal distribution of pond water at winter cropping season.
14. There is lake of commercialization of fishing activities.

**Recommendations:**

Along with watershed development following measures should be taken to keep the spirit of rural development in the study area.

1. Arrangement of financial assistance for post project monitoring.
2. Encouragement of further SHG formation.
3. Proper conflict resolution among villagers.
4. Middle men are to be avoided for agricultural marketing.
5. Arrangement of proper training for villagers and SHG members.
6. More women's should be encouraged.
7. Maximum use of bio-fertilizer.
8. Arrangement of zero tillage and drought farming.
9. Stopping of shallow, submersible and boro cultivation.
10. Watershed development should be kept beyond political interferences.
11. There need to improve drinking water & sanitation situation.
12. Improvement of cottage and rural household industries through infrastructural development.
13. Provisions for rural cultural development.



14. Proper water resource management steps are to be implemented in the study area for fruitful utilization of aquatic resources.

#### 4. CONCLUSION

It is clear from the above discussion that Mokata watershed development project has greater impacts on rural development, specially in case of agriculture, rural infrastructure, income generation, women empowerment, animal resource development, SHG formation as well as aquatic resource generation. It will ultimately fulfill local people's various demands. There need proper monitoring of all such project activities in long term basis. Though there are many problems but all such problems should be solved by proper association and participation of watershed committee members, villagers and government officials.

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