

Community Perception About Climate Change And Adaptation Strategies In Kakdwip Block Of The Indian Sundarban Region

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Abstract: *This research investigates the local people's knowledge of climate change, their perception about the impacts of climate change and the adaptation measures undertaken by them to cope with any climatic emergency in the Kakdwip block of the Indian Sundarban region. A total of 110 households were selected through a stratified random sampling method and data was collected using a questionnaire survey. The results of the study indicate that although local people have poor formal knowledge, they have adequate real-life experience and knowledge about climate change. Most (76.9%) of the farmers said that this climate change is responsible for the decline in the profit from cultivation in the area compared to the past. According to 96.7% of fishermen respondents, fish species in rivers are also declining. It was also observed that local people have taken various adaptation measures such as the use of high yielding variety of seeds, drought-resistant crops, crop insurance, livestock rearing and poultry, proper waste disposal, rainwater harvesting and afforestation. Although the government has taken various measures towards climate change, more effective steps need to be followed to implement appropriate adaptation strategies for climate change in this region.*

Key words: *Climate change, People's perception, Impact, Adaptation strategies.*

1. INTRODUCTION

Climate change is the biggest threat to earth. It will not only destroy the balance of weather conditions but also is very harmful to all life in the near future, especially in developing countries. According to the United Nations Framework Convention on Climate Change (UNFCCC) "A change of climate which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over a comparable time period". As a result of climate change, drought, flood, cyclone, thunderstorms and lightning, sea level rising and coastal erosion have increased, which is affecting ecosystem-balance and human life very much. That is why climate change is a vital issue that has received significant international attention over the last few decades so as to be prepared for the situation. In addition to taking effective measures to address the challenges, people should be made aware of it to equip them with life-saving abilities in case of any climate

extremity. Climate change has emerged as one of the most important environmental issues for both developed as well as developing countries. Adaptation and mitigation plans are required to reduce the ecological and social impact of climate change. In order to counter climate change, there is a need for public perception and awareness about climate change and its impact and adaptation.

There are many important research articles, which helped in gaining knowledge about community perception about climate change and adaptation strategies. Md Aminul Haque (Haque et al, 2012) examined the local perceptions of climate variability in the southern part of Bangladesh through 450 households survey. Krishna R. Tiwari, K. D. Awasthi and Bishal Sitaula (Tiwari, Awasthi & Sitaula, 2014) attempted an important study on people's knowledge on climate change. Nani Maiya Sujakhu (Sujakhu et al, 2015) explored farmers' knowledge on climate change and adaptation in the Melamchi Valley of Nepal through a survey of 365 households. Ndungu Charles Kimani and S. K. Bhardwaj (Kimani & Bhardwaj, 2015) did excellent work on people's perceptions and adaptations to climate change in the Mid-Hills of Himachal Pradesh, India. Prince T. Barimah, Samuel O. Kwadwo and Oppong David (Barimah, Kwadwo & David, 2015) also conducted an important case study on people's knowledge and perception of climate change in Asunafo North District of Ghana to determine the knowledge level among local people of climate change and adaptation measures. Md. Jalal Uddin (Uddin et al, 2015) pointed out the community perception and experience in climate change adaptation related to water and the environment. Bhagat Suberi (Suberi et al, 2017) discussed community experience of climate change and the implications of climate change adaptation measures. Monirul Alam, Khorshed Alam and Shahbaz Mushtaq (Alam, Alam & Mushtaq, 2017) also conducted an important study on climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh. Research work of Sarkar and Padaria (2010), Khan et.al (2012), Calvo and Apilado (2015), Delaporte and Maurel (2018), Daba (2018), Ghosh et.al (2018), Poudel, Funakawa and Shinjo (2017) etc. are also considerable in community perception about climate change and adaptation strategies.

There are circum studies on Indian Sundarbans but is not village level or block level and it is looked at climate change in relation to adaptation strategies from an international perspective but not in from local perspective. The study was designed to analyse the perception of the local community about climate change and adaptation strategies to cope with changing climatic conditions.

2. OBJECTIVES

1. To understand the perception of local people on climate change.
2. To know whether the local people have used traditional methods and local knowledge to adapt to climate change.

3. METHODOLOGY

3.1 Study Area

Kakdwip block of South 24 Parganas district in West Bengal is under the Indian Sundarbans region, this block faces extreme climatic events. This block is selected as a study area. Kakdwip block is a part of the lower Genetic delta. There are various natural features can be seen here, the

Hooghly River flows along the western side of the block, as well as there are many creeks and mangroves also found in the block. The latitudinal extension of the block is from $21^{\circ} 50'15''$ N to $22^{\circ} 12'28''$ N and the longitudinal extension is from $88^{\circ} 7'26''$ E to $88^{\circ} 29'28''$ E and the total area is about 252.7 square kilometres as per the 2011 census. There are 11 gram-panchayats, 39 mouzas and 39 villages in the block. The total population of the block is 281963, population density is 1116 and the total male and female population are 144120 and 137843 respectively.

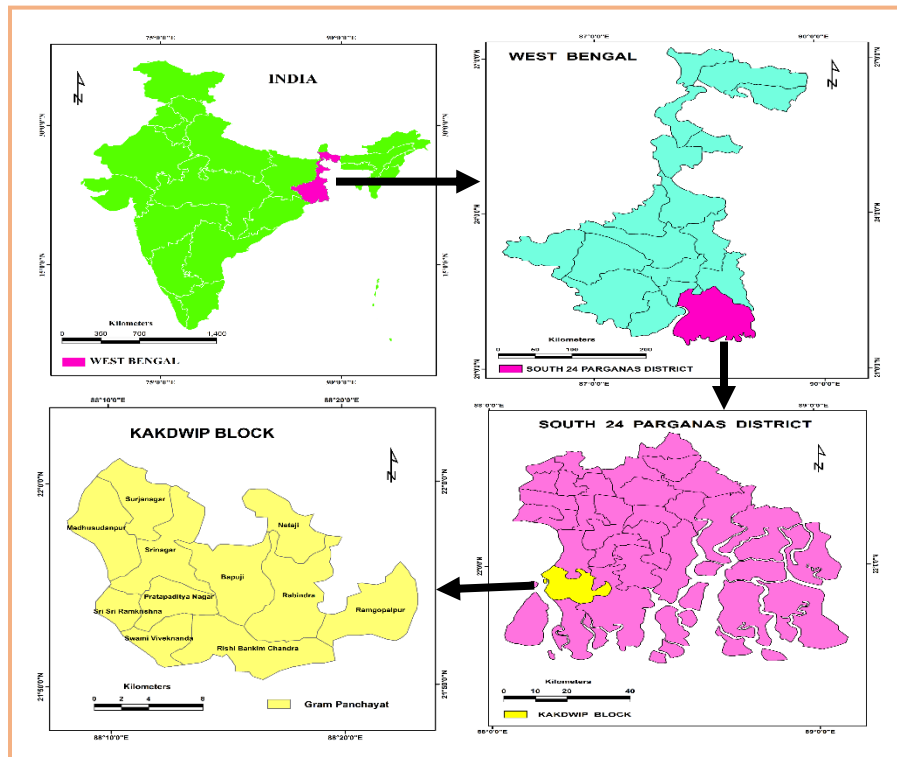


Figure 1. Figure 1. Location map of the study area

3.2 Data Collection

3.2.1 Primary Data Collection

Aged males and females have more ideas about climate change as they are more experienced persons. That is why they have been selected and some middle-aged male and female persons also have been selected in the survey to examine their perception of climate change and adaptation strategies in the Kakdwip block of South 24 Parganas district. A total of 110 questionnaire surveys were collected in the block, where 10 samples had been collected randomly from each of the 11-gram panchayats in the block. Out of 110 respondents, there were 65 farmers, 30 fishermen, 10 small businessmen and 5 daily laborers. As well as field observation and consultation with institutions personnel (BDO, gram panchayat's Pradhan and others) were also done.

3.2.2 Secondary Data Collection

Climatic data (rainfall and temperature) from 1989 to 2017 of Diamond Harbour weather station (nearest metrological station of Kakdwip Block) were collected from the Indian Metrological Department, Kolkata.

3.3 Data Analysis

Time series and trend analysis of rainfall and temperature were analyzed by using Microsoft Excel-2016. Statistical analyses such as descriptive analysis was used in questionnaire survey data analysis.

4. RESULT AND DISCURSION

The results of the study are mainly presented in two parts: the previous 30 years' trend of temperature and rainfall and community perceptions of climate change, its impact and local adaptation techniques to climate change.

4.1 Previous Thirty Years Trend of Temperature and Rainfall

Figure-2 shows the thirty years trend of average temperature in the Kakdwip block of the Indian Sundarban region. The maximum average annual temperature in the period of 30 years (1988-2017) was recorded as 27.9° C in the year 2016 and the minimum average annual temperature of 26.3° C was recorded in the year 1992. The average annual temperature has been calculated as 27° C. The years showing less than the average annual temperature were 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2003 and 2011. On the other hand, the years showing more than the average annual temperature were 2002, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2012, 2014, 2015, 2016 and 2017. Although, figure 2 represents the overall increasing trend of average annual temperature in the time period of 1988 to 2017 in the Kakdwip block of South 24 Parganas.

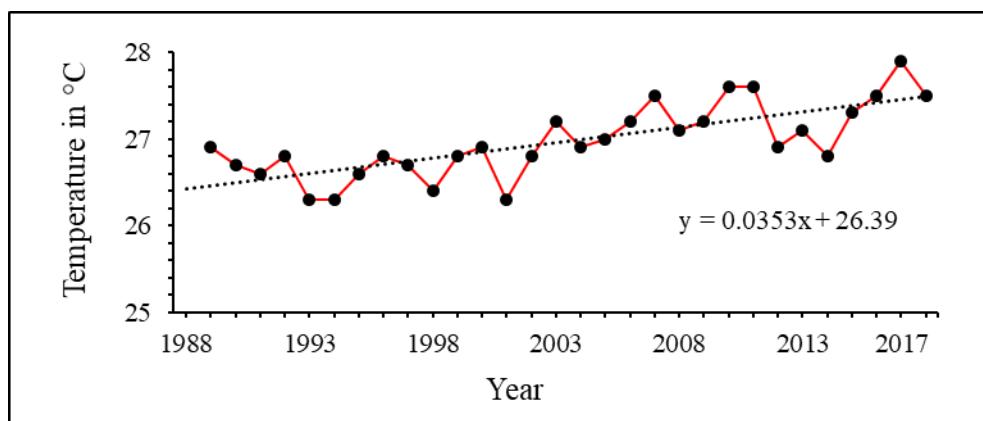


Figure 2. The average annual tempura trend in Kakdwip block (1988 to 2017)

Figure-3 shows the thirty years trend of annual rainfall in the Kakdwip block of the Indian Sundarban region. The maximum precipitation in the 30 years period was recorded as 243 cm in the year 2013 and the minimum precipitation of 130 cm was recorded in the year 1996. The

average annual rainfall of the study area has been calculated as 172.7 cm. The annual rainfall trend and variability have been shown in figure 3, which represents the irregular pattern of total annual rainfall. The trend of total annual departure from the computed value of average annual rainfall reveals that the years showing annual departure less than the average rainfall were 1988, 1989, 1991, 1992, 1994, 1996, 1997, 2000, 2001, 2008, 2009, 2010, 2012 and 2014. Especially in the years 1992, 1996, 2001 and 2010, the annual rainfall dropped to less than 140 cm. The years showing annual departure more than the average annual rainfall were 1990, 1993, 1995, 1998, 1999, 2002, 2003, 2004, 2005, 2006, 2007, 2011, 2013, 2015, 2016 and 2017. Moreover, a higher amount of annual rainfall was found in the years 1995 (217 cm), 2002 (229 cm), 2004 (203 cm), 2005 (213 cm) and 2013 (243 cm). In the years when the annual rainfall was less than the average rainfall, groundwater recharge was also decreased. But overall, figure 3 represents the annual rainfall increase trend in the time period of 1988 to 2017.

4.2

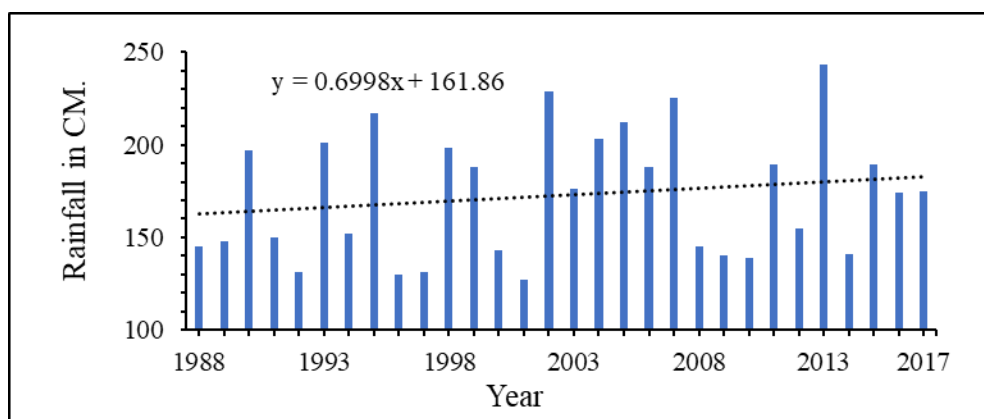


Figure 3. The annual rainfall of Kakdwip block, from 1988 to 2017

Characteristics of Respondents

Out of 110 survey respondents, 68% were male and 32% were female (Table 1). It was examined that 40.9% of the respondents were in the age group between 40 to 50 years, followed by 34.5% are in the age group of 51 to 60 years and 24.5% of the respondents were in the age group of more than 60 years. 44.5% of the respondents had no formal education and 23.6% had only primary education. Two-third of the respondents (59%) were cultivators and 27% were engaged in fishing. The majority of household (60%) monthly income was less than Rs 5,000, followed by 26% of the respondents were having monthly family income between Rs 5,000 to Rs 10,000 and only 14% of the respondents were having monthly family income above Rs 10,000. Primary survey results also showed that 63.6% of the respondent’s houses were kacha and 22.7% were semi pucca and only 13.6% were pucca.

Table 1: Socio-economic profile of respondents (n=110)

Household characteristics of respondents	Total No.	Percentage (%)
1. Gender		
Male	75	68
Female	35	32

2. Age (years)		
40-50	45	41.0
50-60	38	34.5
More than 60	27	24.5
3. Education Qualification		
No	49	44.5
Class IV	26	23.6
Class VIII	15	13.6
Class X	15	13.6
Class XII	2	1.8
B.A/ B.Sc.	3	2.7
4. Occupational structure		
Cultivation	65	59
Fishing	30	27
Small Business	10	9
Daily labor	5	5
5. Monthly family income		
Less than Rs. 5000	66	60
Rs. 5000 - 10000	29	26
More than 10000	15	14
6. House type		
Kacha	70	63.6
Semi-pucca	15	13.6
Pucca	25	22.7
Source: Primary survey		

4.3 Community Perception about Climate Change

In this part, the study discusses about local people's knowledge about climate change, source of information on climate change, causes of climate change and changing climatic elements.

4.3.1 Knowledge of Climate Change

The result obtains from the field survey revealed that out of 110 respondents, 40% of respondents heard about climate change, but 60% are unaware of climate change and they are not familiar with the term climate change (Table 2).

Table 2. People's perception of climate change

Already aware of climate change	Number of respondents	Percentage (%)
1. Yes	44	40.0
2. No	66	60.0
Total	110	100.0
Source: Field survey		

4.3.2 Source of Knowledge on Climate Change

The people (44) who indicated that they have heard climate change are further asked to describe the source of knowledge on climate change. The major source of knowledge is television and books and journals followed by friends, newspapers, school and radio. 29.5% of the 44 respondents who said that they have heard climate change from television, 22.7% respondents obtain their knowledge from books and journals, 20.5% is indicated that they have known about climate change from their friends, 13.6% of respondents said that they have acquired their knowledge about climate change from the newspaper. The rest of 9.1% and 4.5% of respondents know about climate change from their school and radio (Table 3).

Table 3. Respondents' (who are climate aware) source of knowledge on climate change

Source of knowledge	Number of respondents	Percentage (%)
1. Radio	2	04.5
2. Tv	13	29.5
3. Newspaper	6	13.6
4. School	4	09.1
5. Books and journals	10	22.7
6. Friends	9	20.5
Total	44	100.0

Source: Field survey

4.3.3 People's Perception about the Causes of Climate Change

Respondents were also asked about the causes of climate change. 75% of the total 44 respondents, who believe that anthropogenic activities are the main causes of climate change. There are various anthropogenic activities like overpopulation, air pollution, overcropping, deforestation, overgrazing, land degradation etc. Only 4.5% of respondents have believed that the natural process is the main cause of climate change and 20.5% of respondents think that both of the causes are responsible for climate change (Table 4).

Table 4. People's (who are climate aware) perception about the causes of climate change

Cause of climate change	Number of respondents	Percentage (%)
1. Anthropogenic causes	33	75.0
2. Natural causes	2	4.5
3. Both	9	20.5
Total	44	100.0

Source: Field survey

4.3.4 People Perception about the Climatic Condition

Respondents were asked about the change in the atmospheric temperature. 85.5% of the total 110 respondents have replied that the temperature has increased over the last 30 years, while only 2.7% indicated that the temperature has decreased and 11.8% of respondents have not noticed any change in the atmospheric temperature (Table 5). It has been found that people have different opinions about changes in rainfall quantity. The majority of respondents (86.4%)

claimed that rainfall has decreased over the years, only 8.2% of people mentioned that rainfall has increased, and the rest 5.5% of respondents believed that there is no change in rainfall (Table 5). On the other hand, when the respondents were asked about the change in the duration of the summer period, 83.6% of 110 respondents said that the summer season duration has increased compared to the last few decades. However, 12.7% of respondents think that there is no change in the stability of the summer period and only 3.6% of respondents feel that the durability of the summer period has decreased (Table 5). People's perception of the durability of the winter period is far different from the stability of the summer period. Over 83% of the total respondents claimed that the time period of the winter season has decreased and only 6.4% of the respondents think that the durability of the winter period has increased and remains 10% of total respondents noticed that there is no change in the duration of the winter season (Table 5).

Table 5. People's perception of the climatic condition (n=110)

Climatic Measures	Response					
	Increase		Decrease		No change	
	No. of Respondents	No. in %	No. of Respondents	No. in %	No. of Respondents	No. in %
1. Temperature	94	85.50	3	2.70	13	11.80
2. Rainfall	9	8.20	95	86.40	6	5.50
3. Summer period	92	83.60	4	3.60	14	12.70
4. Winter period	7	6.40	92	83.60	11	10.00
5. Cyclone frequencies	68	61.80	33	30.00	9	8.20
6. Drought period	82	74.50	16	14.50	12	10.90
7. Hailstorm	40	36.40	65	59.10	5	4.50
8. Thunderstorm with lightning	86	78.20	22	20.00	2	1.80

Source: Field survey

In the Kakdwip block of Indian Sundarbans, 30% of the total 110 respondents indicated in their experience that the frequency of cyclone has decreased compared to the past three decades. Although 61.6% of the respondents mentioned that the frequency of cyclone has increased and only 8.2% of the participants believe that there is no change in the frequency of cyclone in this block (Table 5). The majority of the respondents (75.5%) noticed that the drought period has increased in the last thirty years. Furthermore, 14.5% of respondents reported that the drought period has decreased and according to 10.9% of respondents, there is no change in the drought period (Table 5). Survey respondents were also asked to report their perception of changing the behavior of thunderstorms with lightning and hailstorm. Over 78% of the respondents reported that thunderstorm with lightning has increased and 20% perceived that it has decreased. On the other hand, the majority of respondents (59.1%) perceived that hailstorm has decreased and 36.4% noticed that it has increased in the last thirty years (Table 5).

4.4 People’s Perception of Climate Change Impacts on Socio-Economy

Socio-economic activities are very much affected by climate change. The main economic activities of the study area are cultivation and fishing. The local people are aware of climate change’s impacts on their socio-economy.

4.4.1 Farmers’ Perception of the Climate Change Impacts on Agriculture

Cultivation is the main economic activity in the Kakdwip block. But it is being affected in many ways by climate change. Out of 110 respondents, there are a total of 65 farmers. The farmers have real-life experience about climate change's effects on agriculture. 93.8% of the total 65 respondents identified that crop diseases have increased and 90.8% said that invasive plant species have increased in the agricultural land. In addition, 84.6% of respondents stated that irrigation sources have decreased. Almost 77% of respondents mentioned that yield profit has decreased and 81.5% of respondents said crop cultivation cost has increased. Moreover, 81.5% of respondents identified that wasteland has increased which is creating obstacles in agriculture. Nearly 88% of respondents believe that the food crisis may happen in the near future.

Table 6. Farmers’ perception of climate change impact on agriculture (n=65)

Measures	Farmer’s response			
	Yes		No	
	No. of respondents	No. in %	No. of respondents	No. in %
1. Increase in crop cultivation cost compare to past	53	81.5	12	18.5
2. Increase diseases in agriculture crops compare to past	61	93.8	4	6.2
3. Invasive plant species increase in agriculture land	59	90.8	6	9.2
4. Irrigation sources are decreasing	55	84.6	10	15.4
5. Decrease in yield profit compare to past	50	76.9	15	23.1
6. Waste land is increasing	53	81.5	12	18.5
7. Food crisis can be in the future due to climate change	57	87.69	8	12.31
Source: Field survey				

4.4.2 Fishermen’s Perception of Climate Change Impacts on Fishing

Fishing is the second most important economic activity after cultivation in the Kakdwip block. Out of 110 respondents, there are a total of 30 fishermen. Increased climatic variability over the last 30 years has been noticed by the majority of fishermen and they have identified that due to climate change, fish species have been declining gradually. According to our field survey, 96.7% of the total of 30 fishermen said that fish species have decreased over the last thirty years (Table 7). Due to climate change, the number of fish species is not only declined but also fish production has decreased. 90% of fishermen respondents noticed that fish production has decreased compared to the previous three decades (Table 7).

Table 7. Fishermen’s perception of climate change impacts on fishing (n=30)

Measures	Farmer’s response			
	Yes		No	
	No. of respondents	No. in %	No. of respondents	No. in %
1. Fish species in river are declining	29	96.7	1	3.3
2. Fish production is declining	27	90.0	3	10.0
Source: Field survey				

4.4.3 People’s Perception of Climate Change Impacts on Other Socio-Economic Measures

The different aspects of human life have been affected by climate change. 80% of 110 respondents stated that their occupational activities have been affected by changing climatic conditions. Nearly 90% and 94.5% of 110 respondents remarked that uncomfortable weather conditions and health diseases have increased. Irregular rainfall creates water penetration problems in the soil, which reduces the height of the groundwater table. When respondents were asked about groundwater table and groundwater quality, 84.5% and 82.6% of the respondents noticed that the groundwater table has decreased and groundwater quality has declined due to less rainfall compared to the past thirty years.

Table 8. People’s perception of climate change impact on other socio-economic measures (n=110)

Measures	Farmer’s response			
	Yes		No	
	No. of Respondents	No. in %	No. of Respondents	No. in %
1. Occupation is being affected by climate change	88	80.0	22	20.0
2. Discomfort is increasing due to climate change	98	89.1	12	10.9
3. Health diseases are increased due to climate change	104	94.5	6	5.5
4. Groundwater table is decreasing	93	84.5	17	15.5
5. Groundwater quality is changing	92	83.6	18	16.4
Source: Field survey				

4.5 People’s Perception about Adaptation Strategies to Climate Change

Adapting to changing climatic conditions is a very important aspect, which requires various adaptation techniques. The local people of the Kakdwip block have taken some local adaptation techniques in this regard.

4.5.1 Farmers’ Perception of Adaptation Strategies to Climate Change

The farmers have been practicing various indigenous coping strategies to adapt to climate change. Even 30 years ago, they believed that disaster occurs by nature; that’s why they have nothing to do regarding climate change to reduce the risk of disaster. Presently, they are learning

more about crop cultivation from the Block Development Officer and gram panchayat. They are taking some adaptation measures such as using high yielding seed, crop rotation, protect soil moisture, cultivating drought-resistant crop and crop insurance by 84.3%, 30%, 18.6%, 38.6%, and 66.7% of the total 65 respondents respectively (Table 9).

Table 9. Farmers' perception of adaptation measures to climate change (n=65)

Adaptation measures by farmers	Response			
	Yes		No	
	No. of respondents	No. in %	No. of respondents	No. in %
1. Using high yielding seeds	59	84.3	11	15.7
2. Rotate the crops on cultivation land	21	30.0	49	70.0
3. Protect soil moisture of cultivation land	13	18.6	57	81.4
4. Cultivating drought resistant crop	27	38.6	43	61.4
5. Crop insurance	46	66.7	23	33.3

Source: Field survey

4.5.2 People's Perception of Adaptation Strategies to Climate Change

The local people of Kakdwip block have been practicing various coping strategies to adapt to climate change. They are taking some adaptation strategies such as homestead gardening, rainwater harvesting, rearing poultry and rearing livestock, reducing water misuse, and disposing of waste properly by 74.5%, 89.9%, 62.7%, 33.6%, 98.2% and 87.3% of the total 110 respondents respectively (Table 10).

The community people of the Kakdwip block have been also practicing some other coping strategies to adapt to climate change like using LED bulbs (84.5%), prefer walking or cycling to go a short distance (89.1%), following urgent warning about disasters (88.2), using cyclone shelter during cyclone (37.3%) and participate in tree plantation program (68.2%) as shown in table 10.

Table 10. People's perception of adaptation strategies to climate change (n=110)

Adaptation measures by local people	Response			
	Yes		No	
	No. of respondents	No. in %	No. of respondents	No. in %
1. Homestead gardening	82	74.5	28	25.5
2. Rainwater harvesting	98	89.9	11	10.1
3. Rearing poultry in house	69	62.7	41	37.3
4. Rearing livestock in house	37	33.6	73	66.4
5. Reducing water misuse	108	98.2	2	1.80
6. Disposing waste	96	87.3	14	12.7
7. Using LED bulbs to save energy	93	84.5	17	15.5
8. Prefer walking or cycling to go nearest distance	98	89.1	12	10.9
9. Following urgent warning about disaster	97	88.2	13	11.8
10. Using cyclone shelter during the cyclone	41	37.3	69	62.7
11. Participate in tree plantation program	75	68.2	35	31.8

Source: Field survey

4.5.3 People's Perception of the Government Initiatives for Clime Change

A responsible government must provide some infrastructure to the common people. The present study tries to give an overall picture of the people's perception and knowledge of the government's benevolence. Above 95% of the total respondents are aware of the government's involvement in riverbank erosion management, drinking water supply, tree plantation programs, and improvement of the education system. Nearly 85% of people are aware of the government initiative on health facilities and construction of cyclone shelter, 77.3% are consent government provide early warning or alert before any natural hazards. Irrigation management and environmental awareness are also an important part of the government's responsibility, but local people don't have sufficient knowledge about these measures taken by the government. 35% and 42.7% of the total respondents noticed that the government has taken steps for irrigation management and environmental awareness programs (Table 11).

Table 11. People's response to Government initiatives for climate change (n=110)

Initiatives taken by Government	People's response			
	Yes		No	
	No. of respondents	No. in %	No. of respondents	No. in %
1. Irrigation management	25	35.0	46	64.8
2. River bank erosion management	108	98.2	2	1.8
3. Drinking water supply	106	96.4	4	3.6
4. Tree plantation program	107	97.3	3	2.7
5. Education system improvement	106	96.4	4	3.6
6. Construction of houses	80	72.7	30	27.3
7. Transportation system improvement	106	96.4	4	3.6
8. Health facilities	96	87.3	14	12.7
9. Construction of cyclone shelter	98	89.1	12	10.9
10. Environmental awareness program	47	42.7	63	57.3
11. Provide early warning	85	77.3	25	22.7

Source: Field survey

5. CONCLUSION

The study sought to find out the details of community perception on climate change and adaptation strategies in the Kakdwip block of the Indian Sundarbans region. Due to poor formal knowledge, their knowledge level about climate change is low, although they have adequate real-life experience on climate change. The local community people have a clear idea of the change in temperature, rainfall, the shift in summer and winter periods of the last three decades. They also perceived that the negative effects of climatic variability on the environment, the economy as well as their livelihood. The majority of the respondents identified that cyclone frequency, drought period, thunderstorm and lightning have increased compared to the past thirty years.

They are also aware of increasing health diseases, uncomfortable weather, and decreasing groundwater table. Moreover, most farmer participants noticed that cultivation cost, diseases in crops, invasive species and wasteland have increased but yielding profit has decreased, which could create a food crisis in the near future. The results highlight that the farmers are following their traditional techniques to adapt to the changing climatic conditions such as cultivating drought-resistant crops, protect soil moisture, rotation of crops and crop insurance. Furthermore, the local community people have also taken traditional measures such as rainwater harvesting, reducing water misuse, livestock rearing and poultry, homestead gardening etc. Although the government has taken various measures towards climate change, more effective steps need to be followed to implement appropriate adaptation strategies for climate change in this region.

6. RECOMMENDATIONS

From the questionnaire survey, personal observation and the whole study, the following recommendations are suggested-

- 1) The government should take necessary measures for the local community people of Kakdwip block to make them aware of climate change.
- 2) All the identified indigenous traditional adaptation strategies and techniques should be established all over the block.
- 3) Improvement of irrigation facilities and excavation and renovation of ponds, canals, and water reservoirs are much needed in the area.
- 4) All farmers should be encouraged to avail of crop insurance.
- 5) The government should arrange hand-to-hand training programs for local people in pisciculture, in order to create additional employment by using the ponds here.
- 6) The government should actively participate in the hazards alarming system – by providing early warning of hazards that can save lives and properties.
- 7) Local people need to use cyclone shelters more actively during severe cyclones.
- 8) Above all, the local governing body as well as clubs, NGO, educated persons need to extend their helping hand to local people to make them more aware of climate change.

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