Climate Change & Environment Risks in Balasore District, Odisha : Issues for Capacity Building

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Abstract

The menace of climate change is haunting people all over the world. Both developed and developing countries are affected in the process. Balasore district of the state of Odisha is a fertile and productive area. Agriculture is the lifeline of the district. However, the danger of climate change is going to affect the lifeline of the district. The area no doubt is prone to multiple disasters like floods, cyclones etc. But the intensity and magnitude of the disaster is going to increase as a result of future climate change. The anthropogenic factor like environmental degradation due to felling of trees, deforestation which in turn is the result of steep increase in population, rapid urbanisation and industrialisation is a matter of serious concern. Added to this there is fear of desertification in the district. Not that the nature only is creating havoc and showing its fury but the ill planning of the authorities is also a contributing factor. A series of floods caused due to the faulty planning of NH-60 have proved this point beyond doubt. In such a scenario the disaster mitigation and adaptation strategies by the people at the grass roots, the governmental structure and the NGOs is highly essential. Their combined effort can provide a ray of hope in the midst of the gloom caused due to natural and human-induced disasters. The long term goal of sustainable development can also not be glossed over.

Keywords: *Adaptation, Bio-Shield, Capacity Building, Climate Change & Mitigation.*

Introduction

Climate change is a global phenomenon. It has been assuming menacing problem day by day. There is growing concern over the possible impacts of climate change internationally yet it has been a major concern especially for the developing countries which suffer most of the natural disaster related-deaths occurring each year and also face much larger economic losses than the developed countries in terms of percentage of Gross National Product (GDP). According to an estimate during the

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period from 1950 to 2001 about 6 lakhs disaster-related deaths took place around the world, out of which 1 percent were in developed countries and 99 percent were in developing countries. But the situation was quite different before 1950 when 30 percent of the total deaths took place in developed countries and 70 percent were in developing countries (Ahmad, 2003). Developed countries which have modern early warning systems and effective mitigation programme are able to reduce the impact of natural hazards whereas the developing countries with less preparedness and inadequate mitigation efforts suffer more from natural hazards (Kumar, 2012). At global level, there has been considerable concern over mounting human deaths and economic losses caused by the occurrence of natural disasters and despite substantial scientific and material progress having been made. According to a survey, despite the development of science and technology, the frequency of disasters is increasing alarmingly. Since 1960, the people affected due to disasters are growing at the rate of 6 percent (Baksi, 2008). The situation will be exacerbated due to climate change in future. Climate change too will disproportionately affect the developing countries and poor persons in all countries. It has been projected in a report called 'Global Natural Disaster Occurrence & Impact-1998-2008' in the database of Centre for Research on Epidemiology of Disaster (CRED-EM-DAT) that by the year 2015, an average over 375 million people per year are likely to be affected by climate-related disasters. This is over 50 percent more than the average number of people who have been affected during the last decade (CRED, Undated). Another research finding predicts that by the year 2025, about 80 percent of the world population will live in developing countries and up to 60 percent of them will be highly vulnerable to floods, severe storms and earthquakes (Cunny, 1994). The case is more frightening in case of India in general and Odisha in particular. The state of Odisha is vulnerable to multiple disasters. The sub-tropical littoral location makes the state susceptible to tropical cyclones, storm surges and tsunami. The river system with heavy load of silt having very little carrying capacity results in frequent floods. The large part of the state comes under earthquake Zone-II. However, the Brahmani-Mahanadi graven and their deltaic areas fall under earthquake Zone-III. This area covers 43 out of 103 Urban Local Bodies (ULBs) of the state (OSDMA, Undated). The western part of the state is prone to drought and sometimes the erratic behaviour of monsoon causes drought situation in the eastern part also. It has been noticed that the state of Odisha has been experiencing frequent disasters with varying magnitudes in the recent years (Behera et. al. 2002). The tornado of 1998, super cyclone of 1999, widespread drought during 2000, recurring floods in 2001, 2005, 2007 and 2008, the cyclone 'Phailin' and devastating flood in its aftermath in 2013 have taken a heavy toll of lives, stanched away livelihoods, rendered many homeless and damaged infrastructures.

Methodology

Empirical method has been adopted to collect data from the people subjected to some of the earlier major disasters in the district. At first the existing literature was perused to enhance knowledge about disasters and their management. The Census of India, documents available with NABARD, OSDMA and Emergency Office, Balasore were also referred for better understanding of socio-economic condition of people, frequency and intensity of disasters, and mitigating measures undertaken by the government to deal with disasters. Primary data were collected from different stakeholders in the process of disaster management. For this purpose two systematic schedules were prepared, one for the victims of disasters, people's representatives & social workers and the other for government officials. The data were collected directly from the respondents by interviewing them at their door step with the help of the schedule. Some qualitative data were also collected through Participatory Rural Appraisal (PRA) and Non-participant Observation method. A group of more than 20 people of a tribal village in Chanua panchyat of Balasore Sadar block (sample block) was united and some discussion on disasters affecting them, along with the causes, their suffering and remedies to avoid such mishaps took place. Similarly, the Non-participant Observation method was adopted during the devastating flood in the aftermath of the cyclone 'Phailin' in October, 2013. Here, the researchers (performing the role of social workers) took active part in relief and rescue operation in the worst affected areas of Balasore Sadar block with the rescue team of Fire Department.

To understand the impact of disaster on various strata of society and to get information about the role of district administration in disaster management for the said Doctoral Research, the sample for the study has been designed. It is a multi-staged sample design which covers five levels namely district, block, panchyat, village and household. Firstly, the district of Balasore has been selected as the study area which is a disaster-prone district of Odisha. The district has a total number of 12 blocks and out of these 3 blocks namely Jaleswar, Balasore Sadar and Nilgiri have been selected purposively (considering their disaster proneness as per the records available with the Emergency Office, Balasore District and their location). In the next stage 3 panchyats of each block and a total of 9 panchyats have been selected purposively. Then 3 villages of each panchyat and in the process a total of 27 villages have been selected purposively for the study. From these 27 sample villages 189 households have been selected. Here proper attention has been given for adequate representation of the scheduled caste, scheduled tribe and women, as per the social group composition in the district according to Census-2011.

The Scenario in Odisha

The unique geo-physical location and climatic condition of the Indian sub-continent makes her more vulnerable to natural hazards. Natural disasters occur here with amazing frequency.

Floods, droughts, cyclones, earthquakes, landslides, avalanches etc. have been occurring in one or another part of India throughout the year. As far as natural disasters are concerned, the country's disaster problem is much diversified. While the Himalayan region is susceptible to natural hazards like earthquake, landslide and avalanches, the plain region has been affected frequently by flood every year. The desert region is affected by drought and famine and the coastal zone is prone to cyclone, windstorms and tsunami (Satendra & Sharma, 2004).

The state of Odisha which is situated in the coastal zone is prone to variety of disasters. The geographical peculiarities of the state have made her continuous victim of natural hazards. Floods, droughts and cyclones have been regular features in the history of Odisha. Climatically Odisha falls under a tropical climatic zone. The south-west monsoon and the retreating northeast monsoon predominantly determine the climatic condition. Sometimes the irregular or erratic behaviour of monsoon causes either excessive rainfall as a result massive floods leading in the state or less rainfall causes droughts in the region. The delayed monsoon which forecasts consolatory rain to the northern part of Odisha is primarily cyclonic in character. There are two cyclonic peaks in their occurrence; one during May-July, the approach time of monsoon to Odisha and the other during October-November, the period during the retreating of monsoon. In later period (October-November) maximum cyclones hit Odisha. The State Disaster Management Authority has identified 240 km coastal belt including Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Puri, Khurda and Ganjam-as cyclonic hazard-prone districts. The coastal districts of Odisha have been hit by 11 severe cyclonic and 55 cyclonic storms in the last 120 years with maximum storm surges height varying between 2.3 to 5.5 meters (Khanna, 2005). Besides the western districts are droughts prone. During the summer the Mercury rises to 45°C and even higher which causes acute shortage of water in those areas (Special Relief Commissioner, 2007). Disasters are occurring more frequently in Odisha with higher intensity and causing immense loss of life, assets and livelihood. According an estimate of Inter Agency Group (IAG), Odisha since 1965 till 2003, the state has experienced flood for 17 years, droughts for 19 years and cyclone for 7 years. The same study of Inter Agency Group revealed that during the 1970s the estimated value of property loss was around Rs 105 cr. which has increased to nearly 7 times in 1980s and more than 10 times in the 1990s (IAG,

2003). According to the Annual Report-2002 of the Special Relief Commissioner, Dept. of Revenue & Disaster Management, Odisha the amount of loss due to these disasters is mounting in the recent years. Disasters have become a critical problem for the poor people of Odisha. More than 80 percent of the geographical area and nearly 90 percent of the poor people in Odisha are vulnerable to one or more disasters with more than 66 percent of the population living below poverty line. Hence the coping mechanism of the state and its people is constantly under severe strain (Special Relief Commissioner, 2002). The records available with Odisha State Disaster Management Authority (OSDMA) indicate that the state of Odisha has a long history of devastating cyclone (Table 1). During the last century around 1000 cyclonic disturbances occurred in the Bay of Bengal, out of these 500 were depressions and over 400 were either cyclonic storms or severe cyclonic storms. Out of 205 cyclonic disturbances, whose records are well documented, 55 affected the coast zone of Tamil Nadu, 59 crossed the coastal areas of Andhra Pradesh, 58 hit the coast of Odisha and 33 struck the coast of West Bengal (Selvam, 2012).

Table 1: History of cyclones in Odisha

Sl. No.	Date & Year	Category of Cyclone	Landfall	Human Casualty
1	31st October, 1831	Very severe cyclonic storm	Balasore coast	50,000
2	18th July, 1872	Cyclonic strom	Balasore	21
3	22nd September, 1885	Super cyclone	False Point, Odisha	5,000
4	8-11 October, 1967	Very severe cyclonic storm	Between Puri & Paradeep, Odisha	Not Available
5	26-30 October, 1971	Very severe cyclonic storm	Between Puri & Paradeep, Odisha	10,000
6	29th October, 1999	Super cyclone	Paradeep, Odisha	10,000 or more
7	13th October, 2013	Very severe cyclonic storm	Ganjam, Odisha	38 (21 in Phailin & 17 in flood)

(Source: osdma.org)

Natural Disasters in the District

The district of Balasore is the North-Eastern district of Odisha which is situated between 20.48°C and 21.59°C North latitude and between 86.16°C and 87.29°C East longitude. It is bounded by the Bay of Bengal in the east, Mayurbhanj district in the west, Medinipur (West Bengal) in the North and Bhadrak district in the South. It has a 82 km long stretch of coast line. The district headquarter is 208 km from the capital

of the state, Bhubaneswar. Total geographical area is 3634.0 sq km. As per the census of 2011, the population of the district is 2,317,419 and the density of population is 609 per sq km (Registrar General & Census Commissioner of India, 2011). The entire district is divided into 2 sub-divisions, 7 tahasils and 12 blocks. There are 289 panchyats and 2971 villages in this district. The entire district is covered with plain alluvial track.

Natural disasters have been regular features of the district of Balasore since time immemorial. It is one of the disaster-prone districts of Odisha. Being in the east-coast of Odisha, it is exposed to both hydrological as well as climate-related disasters like floods, tropical cyclones, tidal wave, tsunami etc. Some parts of the district are also exposed to drought. The district of Balasore is situated in the path of depressions of severe cyclonic storms which generally occur before the onset of monsoon and during the retreating of monsoon. The Super Cyclone of 1999 is an example of such mishap. Flood is also a regular feature of the district which visits the district 3 to 4 times in a year. It has also been vindicated from the records available with the Emergency Office, District Collectorate that among all the disasters which occur in the district, the river floods are often most frequent and devastating. The cause of such floods is mainly the precipitation pattern in the district. The average rainfall in the district is 1568.4 mm. But the rainfall during June to September constitutes around 75 percent of the total annual rainfall of the district (Balasore District Administration, 2008). As a result, there is very heavy discharge of flood water from the ever flowing rivers like the Subranarekha, Budhabalanga, Jalaka, Sono and Kanshabansha which flow through the district and make the district prone to hydrological disasters like floods. Creation of low pressure in the Bay of Bengal aggravates the situation further. Apart from these some other features such as, long stretch of coast line, high density of population, high population growth, environmental degradation etc. make the district more vulnerable to different types of disasters. Some of the major natural disasters are mentioned below for this purpose.

Table 2: Major Natural disasters in the district during 1998-2008.

Year	Category of disasters	Size of Population affected	No. of Human Casualty	No. of Casualty Cattle	No. of House damaged	Total damage Rs. lakh
1998	Tornado	3,000	21	30	507	371.77
1999	Super cyclone	12,55,086	62	38,778	82,443	11352.96
	Flood	4,90,562	1	No	1274	2607.72
2007	Flood	8,84,221	30	796	37,251	47353.78
2008	Flood	9,43,559	9	1	22,236	39085.26

District Disaster Data Sheet, Balasore, 1998-2008

Climate Change, Environmental Risk & Increasing Vulnerability

In the recent year it has been noticed that there is a growing share of devastation triggered by natural disasters around the world. These disasters are leaving greater impact on societies especially in developing countries. This change in climatic pattern due to global warming will further aggravate the situation and has serious consequences in future.

Climate change & sea level rise

One of the most devastating consequences of climate change due to global warming is the possible rise in the sea level; a direct impact of global warming and climate change is the key factor threatening the coastal areas of the world (Jena & Mishra, 2011). It has been projected that along the Indian coast the sea level would rise by 39 to 57 cm by 2050 and 78 to 114 cm by 2100 (Unnikrishnan et. al., 2006). The economic impact of 1 meter of sea level rise on the coastal district like Balasore could be to the tune of Rs. 360 crore (Orissa Fact sheet, Undated). Further it has been estimated in a case study from Odisha & West Bengal that in the absence of protection or proper adaptation, a one meter rise in sea level will inundate an area of 170,000 hectare, predominantly prime agriculture land and displace 0.7 million people (Sahu, 2013). The consequences of global warming on the coastal zones are major concerns among scientists as the livelihood security of the coastal communities and ecological security of the coastal zone in India is already under stress due to high population density, rapid urbanisation, industrial development, high rate of coastal environmental degradation and frequent occurrence of natural disasters. The problem is going to be further aggravated by increase in sea level rise due to climate change (Selvam, 2012). As we all know that agriculture is the lifeline of the people of the district. Besides, the people of the district depend on fishery which makes important contribution to the local development as it provides huge employment and diverse livelihood in the coastal areas of the district. The rise in the sea level will endanger the coastal people and their livelihoods definitely.

Climate Change & Increasing Disaster Situation

The Risk of Flood in the District

Flood is one of the disasters which visit the district more frequently with devastating impact. Sometimes it occurs 3 to 4 times in a year and creates havoc. The year-wise data of disasters available with the Emergency Office, Balasore and Special Relief Commissioner, Dept. of Revenue and Disaster Management, Govt. of Odisha vindicate the fact. In a report called 'Climate Change & Orissa' (Orissa Fact sheet) experts predict that Odisha should prepare herself for more severe flooding in years

to come because of deforestation, faulty flood control planning and global climate change. The analysis of data available with Indian Meteorological Department shows that parts of Andhra Pradesh, Odisha, Chhattisgarh and Madhya Pradesh have been receiving heavy to very heavy rainfall over past 50 years. The district of Balasore is not free from it. The change in precipitation pattern, the immediate impact of climate change has already been felt in the district. Around 75 percent of the annual rainfalls occur between June to September and as a result there is heavy flow of flood water in the rivers which inundate 10 out of 12 blocks of the district. Anthropogenic factors like unsustainable development, increasing settlements in vulnerable areas, destruction of vegetation along the embankments, lifting of sand from the vulnerable pockets of the river (as the people of Jaleswar & Balasore Sadar blocks alleged during the field study) have been contributing a lot for the increasing flood fury in the district. The faulty construction technique of NH-60 from Balasore to Jaleswar is an example of unsustainable development. The National Highway Authority of India (NHAI) has not given adequate attention to the drainage of flood water though people had agitated for sufficient number of bridges and drains for the passage of flood water. In the course of assessment after the series of floods from 2005 to 2008, Water & Power Consultancy, India (WAPCO), a premier consultancy organisation of Ministry of Water Resource, Government of India has blamed the faulty design and lack of drainage system in NH-60 as the major cause for the increase in intensity of flood in the district (Statesman-India, 2008). During the post-Phailin food in October 2013, the same problem has been noticed by the researcher. Due to lack of free passage, the flood water of Budhabalanga River submerged the National Highway-60 at Phuladi, Balasore Sadar block and caused huge devastation in the lower areas like Buanal, Nagram, Parikhi, Odongi, Chanua panchyats of Balasore Sadar Block etc.

Similarly, in the recent years urban flooding has become a major concern for the people residing in Balasore town. The recent incidence of urban flooding has been noticed on 21 July, 2014 as heavy rainfall occurs in the peripheral areas of Balasore town on 20 July due to deep depression in the Bay of Bengal. It caused huge devastation in the areas like Motiganj Bazar, Sahadevkhunta, Gopal Gaon and many other areas. The people of these areas said that they didn't see such type of urban flooding before. The flood water entered into the shops and houses which are even in higher places. To the people of the areas inadequate drainage, encroachment of drainage system and filling up of wet lands are major reasons.

The Risk of Cyclone in the District

The district has been facing the fury of cyclone at regular intervals. The details have been given above. Further the change in climatic pattern due to global warming is

likely to alter normal weather and climatic patterns including change in frequency and intensity of violent storms. According to Orissa Factsheet of Global Environmental Negotiation, there is a possible increase in cyclone intensity of 10 to 20 percent against a rise in sea surface temperature of 2 to 4°C. Another recent simulation study shows that there is an increase in occurrence of cyclones in the Bay of Bengal in the increased Green House Gas scenario, particularly in the post-monsoon season. The same study also indicated that wind speeds associated with cyclones will also reach maximum level due to climate change (Unnikrishnan *et. al.*, 2006). The hypothesis is that warming ocean water would feed more energy into high magnitude storms such as cyclones and hurricanes causing a significant increase in their frequency & intensity (Jena & Mishra, 2011). Hence, the coastal areas will experience inundation, storm flooding and it will accelerate the coastal erosion, intrusion of sea water into fresh ground water, encroachment of tidal (saline) water into river system and farm land. The people of Chanua and Parikhi panchyats (during the field study) expressed the possibility of the encroachment of saline water into their farm land and fresh water bodies in the absence of proper measures along the coast of the Bay of Bengal.

The Fury of Tsunami in the District

Another disaster which may affect the coast of Balasore district is Tsunami. The Odisha State Disaster Management Authority has predicted the areas which may face the possible threat of Tsunami in future (Table 3).

Table 3: Blocks of Balasore facing Tsunami threat

Sl. No.	Name of Block	No. of Panchyats	No. of Villages	Size of population to be affected
1	Bhogorai	7	16	17,272
2	Baliapal	9	9	30,553
3	Remuna	3	6	6,708
4	Balasore Sadar	17	51	49,564
5	Bahanaga	5	19	17,439

(Source: Osdma Press Release, 2009)

Population Pressure and Increasing Environmental risk

It has been observed that the coastal zones around the world are densely populated due to fertile soils, livelihood facilities such as development of fishing and shipping industries. The same is the case with Balasore district. It is densely populated. As per the Census of India-2001, the density of population was 532 per sq km. which

was almost double that of Odisha (286 per sq km). But as per the Census of 2011, the density of population has increased tremendously and it is now 609 per sq km. During the same period the growth rate of population in the district is high (14.47%) as against (13.97%) for the state (NABARD, 2011; & Registrar General & Census Commissioner of India, 2011).

The population of the district goes on increasing. The district is grappling with more number of disasters year after year. But the adaptive capacity of the people hasn't developed. Rather due to increase in population, they are building residence on/near the embankment which is vulnerable to flood. For example people are residing on the embankment of the Subarnarekha river at Gurudaspur village, Srirampur Panchyat, Jaleswar Block (Study Area). In the recent years there is increase in habitations along the coast of Balasore district. This is mainly due to illegal settlement of Bangladeshi migrants and internal migration of people (fisherman) in search of livelihood. This has posed serious threat to the coastal forests along Balasore coast. Mangrove forest, which once dominated has depleted due to over-harvesting, fresh water diversion, urban growth pressures, charcoal and timber industries and mounting pollution. Rapid depletion of mangrove forest has made Odisha coast more vulnerable to cyclones (OSDMA, 2014).

Climate change & its impact on agriculture

The Inter Governmental Panel on Climate Change (IPCC) has released its Fifth Assessment Report called 'Climate Change 2014: Impacts, Adaptation & Vulnerability' on 31st March, 2014 at Yokoham, Japan. In this report the IPCC has come out with a number of warnings about climate's vagaries which we are likely to be faced in the coming year. One such major consequence is its impact on food security especially in tropical and temperate regions. The report highlights that climate change without adaptation will have negative impact on agriculture production, mainly the production of three major crops such as wheat, rice and maize (IPCC, 2014). Many climatologists predict a significant warning in the coming decades due to rising carbon dioxide and other Green House gases in atmosphere. The changes in temperature, solar radiation and precipitation due to this will have negative impact on crop production and livestock farming. It has also an economic impact on agriculture including changes in farm profitability (Khan *et. al.*, 2009). If this is the future dismal picture, then the district of Balasore will face serious consequences. One such consequence is the negative impact on agro-productivity. Agriculture is the lifeline of the district. It generates employment for a major portion of the population. As projected the coastal zone of the district will face setback in agriculture due to

inundation and salinisation and the other parts will face the same setback due to water erosion caused by anthropogenic factor like deforestation.

Danger of Desertification in the District

Another serious consequence of climate change that is being realised in Odisha is desertification. It is a process of productivity loss of lands. When severe, it leads to permanent damages to land. It has been projected in a report of Water Initiative Odisha (WIO) that the whole state will turn to a mass of barren and desert like land in another 150 years. The same report of WIO claimed that within the period of 13 years i.e. from 1991-92 to 2004-05, severely degraded land in the state has increased by 136 percent, barren land has increased by 69 percent and land converted to non-agriculture uses has increased by 34 percent. This is about 7 percent of Orissa's total geographical area. By 2004-05, as high as 17.5 percent of Orissa has turned barren or unsuitable for agriculture. WIO has reached this conclusion using state data on lands (WIO Report, 2006). Similarly the change in precipitation pattern is a major concern for the people of Odisha. It has been observed that the annual rainfall in coastal districts like Balasore, Puri, Ganjam etc. has increased while the annual rainfall in western districts has decreased drastically. The coastal districts are moving towards desertification due to soil erosion and water logging. The anthropogenic factor like deforestation due to industrial explosion and steep increase in population has further been aggravating the situation. It has also been revealed in this report that soil erosion due to deforestation is serious in 52 percent of total geographical area of Odisha and the district of Balasore is not free from it.

An article 'Orissa among five states showing signs of Desertification' published in Maharashtra Times dt.19.12.2009 has been mentioned that Odisha comes next to Rajasthan, Jammu & Kashmir, Gujurat and Maharastra having high proportion of land undergoing degradation. The same article it has also revealed that Odisha has about 54,69,336 ha of degraded land, more than that of geographically bigger states like Andhra Pradesh, Uttar Pradesh, Madhya Pradesh and Karnataka. Odisha's degradable land mass constitutes 5.18 percent of the total geographical area of India. In Odisha erosion by water is the most pronounced processes of land degradation and desertification. Erosion by water is witnessed in 32,06,507 ha of land of the state which ranks close to the state like Rajasthan (India: Desertification, 2009). Similarly more land mass in Odisha has been getting water logged than any other state in the country. The anthropogenic factors such as deforestation caused by industrial explosion and population growth, blockage of natural drainage system, filling up of wetlands etc. make the situation more panicy in the district.

The Risk of Drought in the District

Sometimes the district faces drought or drought-like situation. The drought in 2002 can be cited here in which out of 289 panchyats, 258 were affected. The District Disaster Data Sheet, 2002 reveals that the district has a crop area of 5,34,911 acres or 2,13,964 ha. The crop area affected by the drought constituted 4,87,695 acres which was around 91.17 percent of the total farm land of the district. According to the Agriculture Department, Govt. of Odisha and the District Administration, the erratic behaviour of monsoon (late arrival or weak monsoon) was the main reason for such drought in the absence of adequate irrigation facility in the district (District Disaster Data Sheet, 2002).

Results

The above discussion vindicates the susceptibility of the district to multiple disasters. The anthropogenic factors like rapid growth of population, unsustainable developments etc. pose serious threat of environmental degradation. The rapid growth of population in the district is the major cause for fast disappearance of the forests including the coastal forests. The agriculture which is the lifeline of the district is likely to receive major setback due to erratic behaviour of monsoon consequent upon climate change. Similarly, the fishery sector which generates employment opportunities next to agriculture is likely to be affected by it. In other words climate change due to global warming is likely to aggravate the disaster situation in the district. More number of people of the district will fall victims to multiple disasters in the absence of adaptation techniques and capacity building devices. Hence capacity building in the district is the crying need of the hour since it is found that capacity to reduce risk is relatively weaker in poorer countries (Shaw & Krishnamurthy, 2009).

Issues for Capacity Building Suggestions

In a poor and disaster-prone country like India, the role of capacity building is very crucial in reducing the risk of disasters. As it is well said disaster doesn't occur itself, it occurs when a hazard hits a vulnerable group or community or society. Vulnerability reflects the incapability or weakness of the community which transforms the hazard to a disaster.

According to Wikipedia, the term 'Capacity Building' was used for the first time in the lexicon of International Development in 1940s. The Capacity Development is a conceptual approach to development that focuses on understanding the problems of inhabitants, nature of government, international organisation and non-governmental organisations for realising their developmental goals while enhancing the abilities that will allow them to achieve measureable and sustainable development. The

delegates to the symposium, 'A Strategy for Water Sector Capacity Building' which was organised by UNDP and International Institute for Hydraulic and Environmental Engineering at Delft, Netherland in the year 1991 defined 'Capacity Building' "as the creation of an enabling environment with appropriate policy and legal framework, institutional development including community participation (of woman in particular), and human resources development and strengthening of management system."

Thus, the goal of 'Capacity Building' is to enhance the ability, to evaluate and address crucial questions as the people, organisations, societies and other stakeholders strengthen, adapt and maintain their abilities over time. Capacity Building has been recognised by Capacity Development Resource Centre as a prerequisite to development and could be addressed at individual or organisational levels.

Individual Capacity: It is the ability of individuals to learn, gain knowledge and skills which can be utilized when new challenges and opportunities arise.

Capacity building at individual level

Individual capacity building in the district is outmost need of the hour while the frequency and intensity of natural disasters has been increasing day by day and the economic loss due to natural disasters is also mounting. In this situation capacity building of individual is needed to enhance their coping capacity to withstand the shock of these disasters and to recover from the same (Gonsalvese & Mohan (ed.), 2012). It is a well known that socio-economic condition of a person determines the degree of vulnerability to disaster. Similarly the level of awareness and housing pattern also determines his extent of susceptibility to disasters. According to the Census of India, 2011 in the district of Balasore the people Below Poverty Line (BPL) constitute 73.72 percent of the total population. During the field study it has also been found that the houses are mainly made up of mud wall and straw roof or asbestos sheet. Similarly it has been found that construction norms were not followed during the construction in order to make these houses disaster-resistant. The people don't have knowledge about it or in some cases their economic conditions make them unable to bear the cost of building a disaster-resistant house. The level of awareness about disaster management at grass root level is also very low in the district. During the Doctoral Research it has been observed by the researchers that 181 (95.80%) out of 189 respondents of the study area (covering 27 sample villages of 9 panchyats in the district) don't have knowledge about what to do and what not to do during disasters and in the aftermath. Only 8 (4.20%) have knowledge about it. Hence economic upliftment of the people is the urgent need of the hour. Similarly steps should be

taken on urgent basis to increase the level of awareness among the people and also to encourage them to build disaster-resistant houses.

Climate change accelerated by global warming will have devastating impact on coastal habitations. The example of such consequences of climate change is rise in sea level, increase in frequency and intensity of cyclone and flood. The details of the possible devastation have already been discussed. In many studies the effectiveness of bio-shields including the mangrove, non-mangrove coastal forests have been proved mitigating natural hazards like tsunami, tropical cyclones and storm surges (Das & Vincent, 2008). The usefulness of Jhun (Casuarina) has also recently been proved protecting cash crops in coastal areas. The Institute of Forest Genetics & Tree Buildings, Coimbatore has implemented a pilot project on plantation of 'Casuarina', a natural wind breaker along the coast to protect banana farming in coastal area and it is a ray of hope for the banana growers that the Institute has successfully saved banana plant in Coimbatore by planting the tree (Bio-shield Protects, 2013). But unfortunately the coastal people of Balasore district are unaware of this usefulness of these forests. So they are cutting down these trees for fuel wood and construction of house. As a result the bio-shields are depleting fast along the coast of Balasore and the coastal areas are becoming vulnerable to disasters like tsunami, tropical cyclones, tidal wave etc. During field study it was found that almost all (42) respondents of Parikhi and Chanua panchyats (situated along the coast) of Balasore Sadar have no knowledge about the usefulness of these coastal forests. The undivided district of Balasore (Udaypur of Balasore district to Dhamara of Bhadrak district) has 88 km of coast line. Out of this, 17 km of coastline is under the control of Ministry of Defence, Government of India and remaining 71 km of coastline is under the control of Ministry of Forest and Ministry of Tourism, Government of Odisha. Earlier this area had 88.96 ha of Jhaun (Casuarina) forests. But these forests are disappearing rapidly due to illegal settlement of Bangladeshi migrants and for accommodating new farm land and prawn farming (The Status of Coastal Forest, 2009).

Organizational Capacity: It is about people working together for a common cause and includes institutional reforms necessary for synergising efforts.

Capacity building at organisation level

Capacity building at organisation and government level is similarly important in the present scenario. In many researches the pivotal role of the community as an important institution in the process of disaster management has been acknowledged. The community is also the first respondent to any disaster and it is the community which can help itself during the disasters and immediately after the disaster. It is

quite difficult for the outsiders to reach the disaster-affected area in time because of lack of knowledge about that area and communication as well as transportation problem. During the data collection it was found that not a single village out of 27 sample villages in study area had either Village Disaster Management Plan or Village Disaster Management committee.

There is also another reason for recognising the role of community capacity in managing the disasters effectively. It is often noticed many small disasters occur frequently but these are hardly reported. How they are manage these and with what resilience and capacities affected communities face disasters as observed by Ariyabandhu & Wickramsinghe, (2005). One such disaster situation which has been managed locally is noticed in Jaleswar and Nilagiri blocks. The elderly people of these blocks reveal the usefulness of a small well called 'Dug Well' which they dig in the corner of their farmlands. It helps them a lot to avoid the drought situation to a great extent in Khariff season while the monsoon is late and irregular. According to them these wells are also very useful in maintaining the underground water level in those areas. Hence, the policymakers must think about the revival of such indigenous knowledge which the communities have since time immemorial to tackle the disasters.

Similarly capacity building at government level is also important. During the field study it was observed that the Collector is not found to be assisted by adequate trained staff as far as disaster management is concerned. The contingency planning of the district administration is rescue- and relief- centric. The expenditure in mitigation activities is almost none. Disaster risk reduction measures are not implemented in the ongoing developmental works. The construction of NH-60 is an example of such type. As a result there is huge devastation in the district by the floods which visit the district 3 to 4 times in a year. As we all know, severe cyclones visit the district at regular intervals. But there is no early warning system yet in the district for cyclone forecasting. According to the officials of India Meteorological department, Bhubaneswar, the installation of 'Dopplar Radar' for this purpose is under construction. As said earlier the BPL families constitute 73.72 percent of the total population of the district and it is their poor economic condition which makes them more vulnerable to natural hazards. It has been vindicated in many researches that the poor suffernay more in nay disasters and they also need more time for recovery (Potenza, 2010). Hence, initiative must be taken at governmental level for the economic uplift of these people. The implementation of disaster mitigation measures in developmental projects must be made compulsory and there should be paradigm shift in the approach to manage disasters at district level. The appointment of 'Disaster Manager' at district and block level will further strengthen the initiative.

The destruction of Bio-shields is also a major concern at this time. People are cutting down the jhaun trees (Casuarinas), the natural wind breakers and destroying other non-mangrove due to ignorance. Hence, creating awareness at community level is the crying need of the hour. It can be done by creating awareness among the people by giving them training on disaster mitigation and telling them about the usefulness of the mangrove and non-mangrove forests during the past disasters especially during Tsunami, cyclone and wind storms. Similarly strong law must be enacted to protect these bio-shields.

Mitigation is a strategy to pursue action that reduces green house gas emission in such a way as to lessen the severity of climate change. But mitigation alone can't fully stop the effects of climate change. Hence, adaptation needs to be included in the development strategy. Adaptation is based on the expectances of the fact that climate change is happening and pursuing strategies to minimise its impact. However, region's ability to adapt depends on its state of development (Achrya, 2012). For example the farmers of Punjab can better cope with irregular rainfall than those of Odisha in general and Balasore district in particular who become vulnerable to vagaries of monsoon. In other words it is difficult to distinguish adaptation to climate change from the process of development itself.

Conclusion

A coastal district like Balasore in the state of Odisha is prone to multiple disasters. This vulnerability is likely to increase manifold due to climate change which has the potential to affect its lifeline i.e. agriculture through desertification. The floods, storms which frequent the district cause havoc and bring untold misery for the inhabitants. The floods which took place due to faulty planning of NH-60 is a glaring example. Due to anthropogenic factors like deforestation, destruction of bio-shields and filling up of wetlands which are results of rapid urbanisation, steep increase in population and industrialisation, the likely impact of climate change on the district is predicted to be severe. The inhabitants of the Balasore district especially the marginalised section and people staying in vulnerable areas may have to bear the brunt of these possible environmental risks and hazards. In the absence of adequate adaptation and mitigation strategies, the problem may intensify. In such a scenario the adaptation of 'Capacity Building' measures are highly essential to tackle the problem. The involvement of the people of the district especially at the grass root level, the non-governmental organisations and above all the district administration is imperative. The efforts of the state government and civil society is called for to cope with the likely impact of climate change in the near and distant future. Lastly, the

long-term goal of sustainable and balanced development is to be achieved to tackle properly the problem of climate change not only at Balasore but also in the entire country.

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