4. Literature Review

A number of studies have been conducted to assess vulnerability and adaptation measures in the lower Brahmaputra basin for extreme flood events (IPCC, 2007; UNEP, 1996, United State Country Study Programme, 1999 and Younus, 2010). The work of Singh et al. (2014) is based on construction of a matrix of weighted indices using data from a survey of 150 households spread over six different places on the banks of Brahmaputra in Assam such as Dhubri, Goalpara, Barpeta, Guawahati, Dibrugarh and Jorhat. They highlighted 26 issues as high vulnerability, 12 issues as medium vulnerability and 2 issues as low vulnerability. Adaptation assessment result showed 15 issues requiring urgent attention. The paper suggested various mitigation processes for the challenges faced by the people such as construction of embankments, and dams, construction of building on elevated area, flood plain zoning, and forecasting flood, etc. While analysing vulnerability they also presented a table showing how people adapted to flood by changing their land use pattern in some of the important districts in Assam during the period from 1950-51 to 2010-11 (Table 3).

Baruah and Goswami (2013) in their work have given an account of extent of river bank erosion in Assam and various reasons of its occurrence. According to them the Water Resources Department, Govt. of Assam has identified as many as 25 acute erosion affected reaches within the main stem river Brahmaputra in Assam. Since the last 100 years, the Brahmaputra shows a general trend of widening in the state. As a consequence, it has destroyed more and more of land and infrastructure including the old established system of flood embankments. The erosion rate is three times higher than the deposition over a period of 15 years. In addition, some long-term observations about width changes of the Brahmaputra are though available from different authors but are not comparable. Brahmaputra occupied around 4,000 km² in the 1920s and expanded to around 5,000 km² by the early 1970s. A major avulsion upstream of Dibrugarh added many hundred additional square kilometres to the area within the river banks during the 1990s. In the first decade of twenty first Century the Brahmaputra occupied about 6,000 km² (Govt. of Assam, 2008). The flood and erosion management measures started in Assam after the declaration of National Flood policy in 1954. Accordingly, a huge network of flood embankments were erected all over the state of Assam in the main stem river Brahmaputra, Barak and its tributaries as immediate and short-term measures under the "food for work" programme. Under this programme total lengths covered increased from 211 km in 1954 to 4465.19 km in 2006. These
measures included anti erosion and river training works that mostly comprise of bank revetments, construction of stone spurs, boulder deflectors, timber dampeners, pile screens, R.C.C. porcupines, leet fencing and other pro-siltation devices. In addition, the Water Resource Department also constructed 86 numbers of major sluices, 539 numbers of medium and minor sluices and about 855 km of drainage channels to provide adequate country side drainage and dewatering facilities. The emergency situations arising in flood seasons were mostly taken care of by some temporary measures like providing dowel bund with empty cement bags, back filling with bamboo support, A-type spurs, bamboo porcupines, breach closing works, bamboo cribs etc. All the above measures provided reasonable protection to about 16.50 lakh hectares of area which was almost 50 % of the total flood prone area of the state as assessed by the National Flood Commission (Rashtriya Barh Ayog), Govt. of India. In last few decades, it has extensively used chiselled and blasted boulder as one of the chief material for anti-erosion and river training works. Although, it is not very cost effective, material has been found to be very effective in these works.

The work of Das (2013) highlights the importance of water and its quality for various uses of water such as irrigation, drinking, industry, power generation, recreation, etc. Water is one of the important inputs for crop production when fertilizer is used. If it is polluted, it may be dangerous not only for plants, animals as well as for human being. Before using water for irrigation, its quality should be assessed so that it does not create any health hazard. If low quality of water is utilized for irrigation, soluble salts and /or other toxic elements like arsenic may accumulate in the soil thus deteriorating soil properties and crop quality. He opines that uses of surface water, particularly of Brahmaputra, are being gradually constrained due to increasing pollution in the form of urban and industrial wastes. His scientific findings based on various tests reveal that Brahmaputra water cannot be used for any domestic purposes without treatment.

A study was undertaken by Barman et al. (2013) on the land use and land cover of Majuli islands for the period from 1975 to 1988 and from 1998 to 2008 based on remote sensing data. The overall trend during a period of more than three decades revealed changes from fallow land to settlement, grass land, water body, and grassland to settlement, water body and plantation to settlement and fallow land. As the island was suffering predominantly from erosion, their analysis showed that the majority of the grassland and fallow land were eroded by Brahmaputra. Total grassland declined by 22.62 per cent, fallow land by 18.6 per cent, areas of plantation by
2.19 per cent and water bodies by 0.16 per cent. However, the area covered by human settlement was increased by 1.47 per cent due to population pressure.

Northwest Hydraulics Consultants (2006) undertook a study on River Brahmaputra with an objective to review flood and erosion management infrastructure in terms of how it was financed, operated, and maintained. Further it made an attempt to examine options for supporting improved flood and erosion management measures. The study while mentioning about abundant water resources of the North Eastern Region, pointed out that one-third of India’s runoff flowed from the Northeast through the Brahmaputra and the Barak and there existed a substantial unutilized groundwater resource. It was estimated to be about 60,000 megawatts of economically viable hydropower potential, of which only about 65 megawatts were developed or under construction. The study further mentioned that abundant water resources that imposed severe distress and costs on the region through frequent flooding needed to be managed.

Goyari (2005) made an attempt to examine the sustainability of agriculture in Assam in the face of damages caused by natural calamities like food. According to him frequent floods every year in the state have been destroying standing crops, creating waterlogging, soil erosion and affecting large crop areas and thus threatening the sustainability of the drive towards higher productivity and production of various crops in the state. Damages done to crops, cattle, houses and utilities alone between 1953 and 1995 was estimated at ₹4,400 crore with a peak of ₹664 crore in a single bad year as mentioned in the Shukla Commission Report (Govt. of India, 1997). The assessed flood-prone area in the state was estimated at 31.5 lakh hectares which was 92.6 per cent of the cultivated land as in 1992-93. Frequent floods in the state also caused reduction in productivity of crops leading to change in the cropping pattern from Kharif rice to summer rice and Rabi season crops. He mentioned that most flood control measures undertaken were of short-term nature; therefore, there was a need for concerted policy decisions on long-term basis by the government. The cooperation of the neighbouring countries was also of paramount importance.

The government has erected flood defences in some areas. Aaranyak, a locally based NGO, joined forces with the Kathmandu based International Centre for Integrated Mountain Development- the only transboundary organisation looking at development issues across the Hindu Kush-Himalayan region – to install a number of flood early warning devices along the Brahmaputra's banks.