LIVING WITH INSECURITY: A CRITICAL EXAMINATION OF THE ENVIRONMENTAL PROBLEMS LINKED WITH SOCIAL PROBLEMS IN RURAL WEST BENGAL, INDIA

MANORANJAN GHOSH [*], SOMNATH GHOSAL[**]

Key-words: Environmental insecurity, Scarcity of resources, Social problems, Rural lives, West Bengal.

Abstract. Environmental insecurity is considered as one of the threats to human development, or human well-being. It has been noticed that rural social problems are closely related to environmental degradation, hazards, and scarcity of resources (supply-induced, demand-induced, structure-induced) of a particular region. India has been listed amongst the most vulnerable countries in terms of environmental degradation and climate change risk. The Indian state of West Bengal is the second highest densely populated state where 68.13% of the population live in rural areas and people have been facing with serious environment-driven problems. The aim of this article is to establish the link between environmental problems and rural social problems in West Bengal. The nature of social problems related to environmental depletion/ degradation/ hazards has been critically explained; for example, in the last 15 years, rural West Bengal has witnessed 18 major social problems linked to environmental issues. The study has been divided into two parts. The first part discusses the geographical pattern of environmental problems linking it with social problems according to agro-ecological zones. The second part focusses on the environmental scarcity of resources linking it with social problems. In rural West Bengal, the high population growth led to the scarcity of several resources, such as soil, water, forest, which affect the lives of the people. Out of the total geographical area of the state, fallow land increased from 0.5% in 1985–86 to 6.6% in 2010–2011. The increasing trend of fallow land leads to scarcity of land which has fueled rural farmer's distress.

1. INTRODUCTION

Environmental adversity is considered one of the hindering variables, which threatens the human development of a region. Environmental problems, in general, affect the overall safety of human well-being (Wenger and Rogger, 2004). It is assumed that these problems actually started in the wake of the industrial revolution in Europe, having now spread all over the world (Marsh and Grossa, 1995; Mgbemene, Nnaji and Nwozor, 2016; Settles, 1996). A research published by the United Nations Interagency Framework Team for Preventive Action (2012), entitled *From Conflict to Peacebuilding: The Role of Natural Resources and the Environment*, highlighted that 40% of the rural civil conflict, unrest, and violence during the last 60 years was related to the degradation of the natural environment and the scarcity of resources. It has also shown that these social conflicts have been fueled by the other existing factors, such as ethnic group, caste[1], economic inequality, regional disparity, the political issue, etc. Due to overall environmental degradation, developing countries are facing more serious challenges in the social, economic, and ecological domains than the developed countries (Marsh and Grossa, 1995; Nath and Behera, 2011; Shrestha *et al.*, 2015; Turral, 2011; UNFCCC, 2007). India is listed among the most vulnerable countries, being threatened by of droughts, floods, and environmental hazards due to climate change (World Bank, 2008; Brien *et al.*, 2004; Donaldson and Greenstone, 2014; Maiti *et al.*, 2017). In their study, Dasgupta *et al.* (2013) investigated the spatio-temporal and

[*] Doctoral Fellow (UGC-JRF), ghoshmanoranjan.99@gmail.com.

[**] Assistant Professor, Rural Development Centre, Indian Institute of Technology Kharagpur, Kharagpur – 712302, India, somnath@iitkgp.ac.in.

[1] 'The caste system' in Indian society is the division of people into groups that are hierarchically related to social status, Ancient texts (Manusmriti) talk about four castes–priests, warriors, merchants, and servants, but government censuses and anthropological surveys have identified hundreds in India.

socio-economic impacts of climate change on the food grain production of the major agriculture-developed states in India. They found that with a temperature change of 2º Celsius, the food grain production is going to be affected mostly in states like West Bengal, Andhra Pradesh followed by Uttar Pradesh, and Punjab by 2030. Rice production will fall rapidly compared to wheat, and coarse cereals. Their prediction shows that by 2050, foodgrain production will decrease by 14.20% in West Bengal.

India is the world's second populous country and has an emerging economy. However, due to the high population pressure and booming economy, the physical environment receives less consideration in terms of the country's planning and policy agenda (Banerjee and Ghosh, 2010). The rural people depend for their livelihoods on existing natural (environmental) resources available in surrounding areas (Scoones, 2009). Therefore, there has been a close link between environmental problems and rural socio-economic lives in any particular geographical area. Environmental degradation leads to the natural scarcity of resources, which creates rural conflicts and unrest in relation to population size and growth of the population in any region (Panda *et al.*, 2013). One of the vivid studies on environmental scarcity of resources and violence by Schnurr and Swatuk (2010) mentioned that the scarcity of natural resources alongside with multiple intermediate factors (existing economic disparity, inequality, within the region and community), although of variable intensity, are directly, or indirectly, responsible for social frictions. Scholars also suggested that stakeholders from different sectors of society, such as landless, small, medium, large farmer, marginal worker, and local leader along with unequal access and control of environmental resources accelerate the social problem in terms of allocation of any natural resource(Panda *et al.*, 2013). Mona Chettri (2017) pointed out that in the Sikkim and Darjeeling Himalayan region the mountain ecosystem is changing because of changes in the rainfall pattern, glacier lake out blast, and establishment of an excessive number of hydro-power generation dam; which is enhancing vulnerabilities, or environmental insecurity among the people of this region. Chettri (2017) also mentioned, the political and economic marginality, along with excessive natural-resources dependent livelihoods have been increasing the social hostility of the poor mountain communities. Lahiri-Dutt and Samanta (2013) reveal the insecurity and risk of the rural people who live in the island of the Damodar river in West Bengal due to flood and bank erosion. They also mentioned the complexity of rural livelihood in a difficult environment, for instance, some people prefer to live temporarily in a hostile river island for extra livelihood opportunities in terms of fishing and ferlitle agricultural land. All the above literature, elaborated within the national context has been showing the strong relationship between environmental and social problems.

Environmental insecurity and its impact on rural people, especially, the weaker and marginalised sections of society is an important topic of discussion these days. The term 'insecurity' has a deep connotation, widely used in different disciplines by the different research communities. Assessment of absolute insecurity is literally difficult, because it is the outcome of complex bio-physical, socio-economic as well as the psychological factors of people of the particular region. For instance, environmental changes are creating more inconvenience in high-density tropical countries (Kozak and Hajjar, 2012; Rasaily, 2013; Saikia, 2014; Saikia, 2011). Scholars argue that environmental insecurity is complex, dynamic and context-specific, being conceptualised by the interaction process between society and nature (Leary and Kulkarni, 2007; Panda *et al.*, 2013). For example, during 2005, an heat anomaly wave set in just before the early monsoon, led to loss of life and crop in a major part of West Bengal (State Development Report, 2010). The destructive flood in the northern part of West Bengal (2017) damaged 12,937.71 km^2 of cropped area, which was a huge loss for the rural economy and for livelihoods. Rural people in the developing countries face more serious social, economic, and ecological challenges because of overall environmental degradation (Gautam and Andersen, 2016; Panda *et al.*, 2013; You and Zhang, 2017). Due to climate change, India was listed among the most risk prone countries, facing tremendous drought, flood, and agricultural threats (Asian Development Bank, 2017; Brien *et al.*, 2004; Maiti *et al.*, 2017). This climate-induced environmental insecurity led to huge social problems both in rural and urban livelihoods. However, the rural regions suffer far more than the urban areas. Hence, it is arguable that the geographical patterns of environmental problems

decide that where, how and who are in trouble due to the specific environmental problems, such as forest resource degradation, scarcity of natural resources, or climate change, cyclones, river bank erosion, water stress that follow a particular regional pattern. The main objectives of this paper are to establish the link between the environmental and social problems in rural West Bengal. Where and how environmental problems have created social problems and their specific geographical pattern.

The paper sections are: first section deals with the study area i.e. location, demographic changes, farm and non-farm employment, economic status based on the analysis of census data and the existing literatures. The second section of the research frames the details of the methodological issues where we explain two different ways of research. In the third section, results and major findings are discussed. According to our methodology, the geographical visualisation of environmental insecurities, hazards, and social problems in rural West Bengal are explained rigorously, providing information according to the agro-ecological zone and secondary statistics over the period. Here, the mapping of the environmental scarcity of resources and social problems in rural West Bengal are explored. The fifth section concludes this article, where the present situation of rural West Bengal regarding environmental problems linked with social problems is elaborated. Sustainable policy solutions considering are also highlighted.

2. STUDY-AREA: RURAL WEST BENGAL

The state of West Bengal which expands from the Himalaya region in the north to the Bay of Bengal in the south covers an area of 88,752 km^2 with the rich mountain as well as coastal mangrove biodiversities, and is home to a population of almost 92 million (Census of India, 2011). The population of West Bengal doubled between 1971 and 2011. It is also the fourth most densely (1,028 persons/km^2, while the national average is 368 persons/km^2) populated state of the country, where the average monthly per capita expenditure of rural people was of 562 Indian rupees and 28.4% of rural population was below the poverty line (Chaudhuri and Gupta, 2009). Table 1 shows the percentage of rural population which is still high in West Bengal. At the same time, the rural workforce participation rate (main and marginal workers) has remained low over the time, which supports the reality that rural environmental resources have a tremendous effect on daily rural lives and livelihood. High population growth within the state and high immigration from neighbouring states, as well as neighbouring countries like Bangladesh, Nepal, and Bhutan to West Bengal (Debnath and Ray, 2017; Kumar, 2009; Sharma and Bhushan, 2014), have been exploiting the natural resources rapidly, thus accelerating social hostility. In West Bengal, the majority farmers are small and marginal, and according to the Census of India (2011), the share of the non-farm worker has declined and agricultural labour has increased in newly identified census town[2] (Guin and Das, 2015). During 2011–2012, in West Bengal, around 64.4% rural households did not cultivate any land and around 24% rural households cultivated less than 0.40 hectare land (Government of West Bengal, 2015).

Table 1

Population Scenario in Rural West Bengal

Year	1971	1981	1991	2001	2011
Total population (in million)	44312.017	54580.65	68077.97	80221.3	91347.736
% of rural population	75.25	73.53	72.52	72.03	68.13
Rural workforce participation	27.2	30.3	33.2	37.9	38.7
Rural sex ratio	942	947	940	950	953

Source: Census of India, 2011; West Bengal State Development Report, 2007.

[2] According to the Census of India, census town is the category of human settlement which fulfill the following criteria: (1) the place of more than 5,000 people and population of 400 per sq^2, 75% of the male population engaged in non-primary economic activities

It is very important to critically analyse the relationships between environmental problems and associated social problems, conflicts, and disputes. How and why rural socio-economic problems are closely linked to the exploitation of the rural natural resource bases are discussed herein. Here, West Bengal has been taken as a case-study. It is because, 68.13 percent of the state's population lives in rural areas, and their economic activities depend mostly on natural resources. At the same time, the state's agricultural production (the backbone of the state rural economy) highly depends on monsoon rainfall (Hoda *et al.*, 2010); Environment Justice Atlas report (2018) mentioned that the state of West Bengal ranks first among all the Indian states in terms of socio-economic conflicts.

3. METHODOLOGY AND DATA SOURCES

In order to critically examine and build a link between the environmental problems and the social problems in rural West Bengal, the entire analysis has been divided into two parts. The first part has been designed as a geographical visualisation of environmental insecurities, hazard events and their consequences on rural socio-economic lives in terms of different agro-ecological zones. In the second part, a consequence of the environmental scarcity of resources, such as supply-induced, demand-induced and structure-induced scarcity has been analysed. Environmental scarcity of resources has lead to social friction alongside existing socio-economic disparities. Secondary data from the Census of India, government, and non-government published reports, articles, documentaries, etc. have been referred to for critically analyzing the above-mentioned issues.

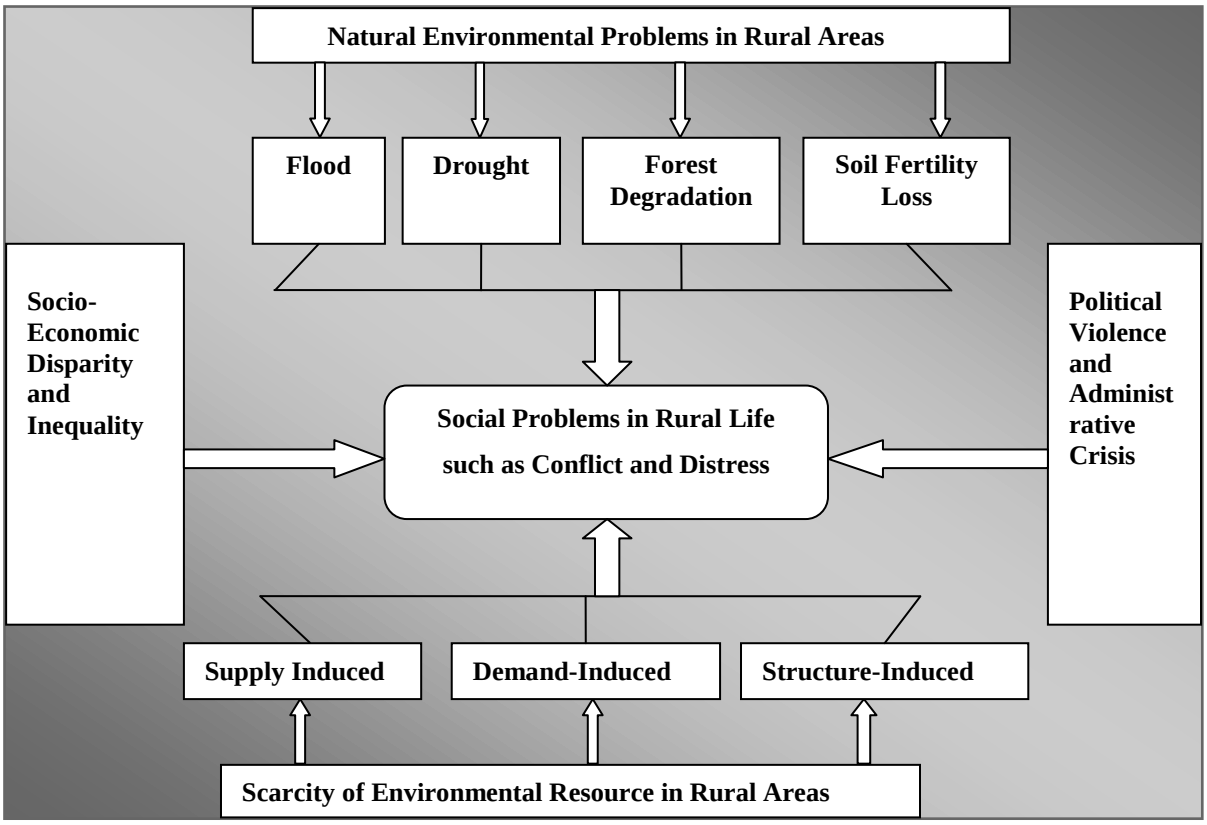

Fig. 1 – Relation between Social Problems and Environmental Problems.
Source: Design by the researcher based on the literature review.

4. GEOGRAPHICAL VISUALISATION OF ENVIRONMENTAL INSECURITIES, HAZARD EVENTS, AND SOCIAL PROBLEMS IN RURAL WEST BENGAL

In this article, region-specific problem are analysed with relation to rural social lives. Figure 2 shows the relative spatial pattern of vulnerability intensity in the state of West Bengal. The map is based on the integration of hazard distributions like flood, wind and cyclone, landslide, water stress, which fall into the category of environmental problems. It shows that maximum areas have a very high to medium vulnerable rating.

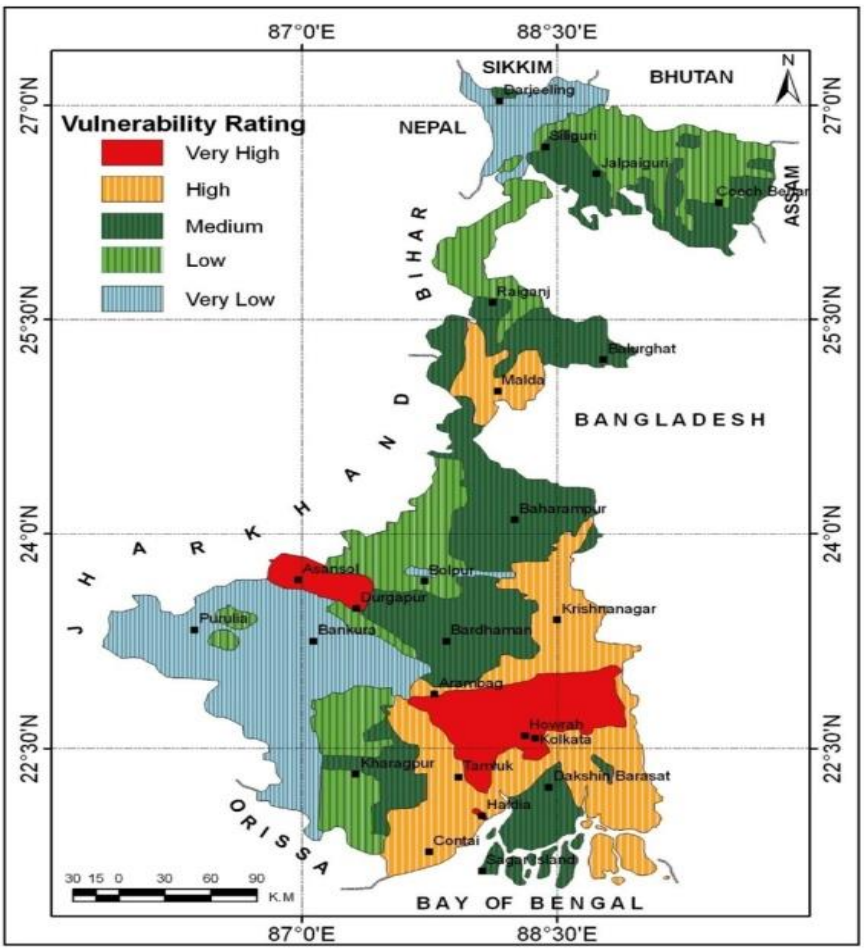

Fig. 2 – Composite Environmental Vulnerability Map of West Bengal

Source: Nath *et al.*, 2008, computed from the integration of hazard distributions – earthquake, flood, wind and cyclone, landslide, water stress.

On the other hand, West Bengal is divided in six agro-ecological zones namely, the Northern Hilly Zone (2.8% of the state's geographical area), the Terai-Teesta Alluvial Zone (14%), the Gangetic Alluvial Zone (19.7%), the Vindhya Alluvial Zone (14.4%), the Undulating Red and Lateritic Zone (32%), and the Coastal Saline Zone (17.1%). Each zone shows a significant diversity in terms of natural resources, diverse ecosystems, geological, soil, and climatic characteristics, as well as cultural diversities (Government of West Bengal, 2017). The agro-ecological region clearly reflects the nature of human and natural environment interactions in rural areas. Agriculture and the natural resource-based workforce is the basic form of rural economy (Scoones, 2009; Whitby and Willis, 2017). As mentioned above, the

state of West Bengal is divided in six agro-ecological zones. The state is also divided in the fifteen-livelihood zones as per Food and Agriculture Organization of the United Nations. These livelihood zones are outlined on the basis of multiple factors, such as climate, population, agriculture, poverty, and water-related issues based on block-level data (Prasari and Nations, 2011). As already mentioned in the methodology section, for the purpose of the geographical visualisation of environmental insecurities, hazards in rural West Bengal, have critically superimposed the agro-ecological zones on the livelihood zones (Table 2).

Table 2

Visualization of the Environment, Economy and Associate Problems in West Bengal

Livelihood zones	Agro-Ecological zone	Districts fallen under each zone	Major problems
Hilly-Terai Rain-fed Grain Crops-Fruit-Vegetables- Spices zone.	Northern Hilly Zone	Darjeeling	Massive landslide in the rainy season and forest degradation.
Terai-Grain crops-Fiber-Vegetables-Livestock zone.	Terai-Teesta Alluvial Zone	Jalpaiguri	Flood and river bank erosion and forest degradation.
Terai-Grain crops-Fiber-Tobacco-Vegetables-Livestock zone.		Cooch Bihar	Poor soil condition, acidity, wasteland.
Barind Rain-fed- Grain crops-Pine apple-Fiber zone.	Gangetic Alluvial Zone.	Uttar and Dakshin Dinajpur,	Occasional drought and flood and soil erosion.
Barind-Rice-Horticulture-based livelihood zone.		Maldah	Chronic erosion, River Ganga floods.
Gangetic Alluvial &Barind- Rice-Sericulture zone.		Maldah, Murshidabad	Arsenic contamination of the groundwater, thunderstorm,
Ruhr and Alluvial-Grain crops-Poultry-Livestock Zone		Birbhum, Bardhman	Gully erosion, flood, salinity.
Ruhr and Alluvial-Grain-crops-Fishery-Poultry-Livestock-Cottage Industry zone.		Nadia, Hugli, Haora, Bankura, North 24 Parganas.	Occasional drought, water contamination.
Ruhr and Alluvial-Grain crops-Livestock zone.	Vindhya Alluvial Zone	Purulia, Bankura, West Midnapur.	Forest degradation, water stress.
Eastern Plateau & Alluvial-Grain crops-Livestock zone.	Undulating Red and Lateritic Zone.	Purulia	Chronic drought, heavy water crisis, Badland.
Coastal and Alluvial-Grain crops-Fishery-Floriculture-Vegetables-Livestock zone.	Coastal Saline Zone.	Kolkata, Nadia, Haora, North and South 24 Parganas.	Decline in surface and groundwater,
Coastal-Grain crops-Horticulture-Livestock-Fishery zone.		South 24 Parganas	Salinity, Land erosion.
Coastal-Grain crops-Fishery-Livestock-Bund Horticulture zone.		South 24 Parganas, East Midnapur.	Salinity, Land erosion, flood
Coastal-Small Scale Single crop (Grain/Horticulture)-Capture Fishery-Livestock zone.		South 24 Parganas	Riverbank erosion, a tropical cyclone.

Source: Prepared by the researcher by combining information from 'Livelihood Zones in West Bengal: A Scenario for AWM interventions', FAO, 2013. 'Environmental and Social Safeguards, Planning in Panchayati Raj Institutions: Capacity Assessment and Management Plans' (CNTR/ MSPWB/ SRD/ GMC/ 2009/ 3325).World Bank, DFID, UK-India, 2010.

The major environmental problems of each of the six agro-ecological zones linked with rural livelihoods and social problems are as follows:

1. Northern Hill Zone: In terms of the agro-ecological nature of West Bengal, the Northern Hill Zone is predominantly rural and part of the Himalayan ecosystem (Prasari, 2011). Rural livelihoods of this zone depend on subsistence agriculture, forestry, livestock, and plantation activities. The hilly topography made the rural life extremely hard. Large numbers of people are engaged in agricultural activities, but most of them are marginal farmers (District Statistical Handbook, 2011). The major

environmental problems are the poorly developed soil, and fluvial erosion, which is dominant over the whole district (Starkel et al., 2008). Landslide and the soil erosion rate is very high in this region due to the fragile geological structure. The Northern Hill zone and Terai-Tessta alluvial zone are the upper and lower part of the Teesta River basin, (the most vulnerable river in Himalaya). Landslide in the upper portion and devastating flood in the lower part are common phenomena (Pal *et al.*, 2016). The frequencies of landslide are a matter of concern for the rural people of the Northern Hills. It damages the agricultural practices, forestland, and other property, or the financial base of the rural economy. Table 3 illustrates the details of affected people, road, village, etc. over the time.

2. Terai-Teesta Alluvial Zone: This region is that part of sub-Himalayan West Bengal. The Terai-Teesta alluvial region has been divided by the major rivers like Mechi, Teesta, Torsha, Sankosh in three zones, (a) Terai (Mechi-Teesta) – 339.96km^2; (b) Western Duars (Teesta-Torsa) – 482.54 km^2; and (c) Eastern Duars (Torsa-Sankosh) – 1,005.85 km^2. Due to high river density, the region is highly flood-prone (Roy, 2011). At the same time, the entire region has high crop productions, mainly rice, jute, wheat, and corn. However, every year, devastating floods alongside with riverbank erosion damage the crops and others livestock resources. Table 3 shows the details about the '2017 Flood' and its consequences on rural lives in this zone. Apart from the above environmental problems, there is even more severe degradation forest, which affects the livelihood of forest dwellers. For example, 7,786 families, including a large number of indigenous people, live in the forest areas of this zone. These families are basically depended on forest resources for their livelihoods (Directorate of Forest, 2012).

3. Gangetic Alluvial Zone: This zone is the highly populated agro-ecological zone of West Bengal, which suffers greatly from riverbank erosion and frequent floods. Most of the farmers who live along the bank of the Ganga River, are becoming landless because of river bank erosion. For example, in Maldha District, 12–31% of the farmers lost their land and in Murshidabad district, more than 10,000 people every year have to leave their homelands because erosion along the Ganga River. During 1985–94, 206.60 km^2 of land was lost and 79,190 households were displaced mainly due to erosion and floods (Rudra, 2010). Hence, one can easily conclude that the main challenges in the rural areas are continual erosion and floods of the Ganga River and its tributaries, which cause massive-scale distraction of land, livestock, crops, road networks and houses. Water-borne diseases, such as dysentery, are common phenomena in every rainy season. The region also faces a huge scarcity of drinking-water and irrigation in non-monsoon seasons (Prasari, 2011). These kind of adverse environmental problems are pushing rural lives into greater distress, especially, amongst the poor and marginal people of society.

4. Vindhya Alluvial Zone: The district Purulia, Burdwan, and Bankura came under this Vindhya Alluvial Zone. Agriculture is one of the most important economic activities, facing huge water scarcity in this region, for example 60% of the community development blocks[3] of this region are underwater distress (National Disaster Risk Reduction, 2011). Due to over-exploitation of the groundwater in Burdwan District, the soil becomes saline; consequently, crop production is reduced. The rural food security and economic life of the marginalized group of people have been influenced by the fluctuation of the crop production. The increasing soil degradation and associated food insecurity increases the social-economic problems.

5. Undulating Red and Lateritic Zone: the whole south-western part of the state, including the districts of Puriliya and West Midnapur, come under this agro-climatic zone. One of the major environmental problems of this region is severe drought on the surface, and groundwater scarcity. About 60% of the surface water and 28% of the groundwater of the state exist in the northern part of

[3] Community Development Block is the second bottom hierarchy in the administrative structure of West Bengal, India, it deals with the rural development of the country.

the state (Government of West Bengal, 2012), Whereas, 82% of the West Bengal's total population live in the southern part. However, the southern part shares only 40% of the state's total surface water. Therefore, the people of this region face a huge drinking-water crisis, agricultural practices being also affected. Especially, in summer, the entire region suffers massive water scarcity. This adverse environmental condition further enhances rural people's problems.

6. Coastal Saline Zone: Cropland erosion or net land loss and increasing salinity of the soil by tidal saline water are the biggest problem in the coastal area of West Bengal. This region is part of the world's largest Ganga-Brahmaputra active delta system. Due to global sea-level changes[4] land loss rate (2.85 km^2 per year) has doubled in the entire region compared to the previous century. The most vulnerable inhabited places are Sagar, Ghoramara, Jambudip, Namkhana, Mousumi, Dhanchi, and Bhagdhani, where millions of people struggle for their daily livelihood (Ghosh, 2012). A study conducted by the European Commission of Humanitarian Aid and the University of Calcutta (2010) revealed that after the cyclone 'Aila' in 2009, the soil salinity of this region goes beyond the standard limit of agricultural production (1.5 m soil depth), even depth salinity continued to two or three years after the cyclone. 'Aila' cyclone-induced environmental problems caused huge socio-economic problems among agriculture-dependent people. The land cover and land-use pattern also changed considerably, for example, agricultural land fell from 2,149 km^2 in 2001 to 1,691 km^2 in 2009, and the swamp area increased from 14,847 km^2 in 2001 to 20,410 km^2 in 2009 (Hazra *et al.*, 2010). The region is cyclone-prone and Table 3 shows the impact of the 2002 cyclone.

After discussing the major environmental problems of each agro-ecological region of West Bengal, it is clear that rural people continue to face water scarcity, forest resource depletion, river bank erosion, floods, and landslides in the different geographical regions. Each particular environmental problem creates unique socio-economic problems. Table 3 shows the different kinds of environmental hazards and their impact throughout the state at different times. Therefore, it is possible to justify the idea that rural social problems are closely related to its environment. This situation is further underlined by the scarcity of resources and the demographic change in the next section.

Table 3

Records of Disaster or Environmental Problem and Impact on Rural Life

Disaster or Environmental Trouble	Year	Impact on Rural Resources or Description of the Social Problem
Landslide	1968	667 people dead; NH-31 the lifeline of Darjeeling was destroyed.
	2008	16,674 people in five blocks were affected, approximately 3,174 houses were damaged.
	2009	145,758 people and 26,595 houses in 555 villages in eight blocks of Darjeeling were affected.
	2015	38 dead and 23 missing. A large number of rural settlements were disconnected by destroyed roads.
Flood	2007	134 rural people dead, millions of people were marooned in 3,000 villages in the coastal area of West Bengal.
	2017	Destructive flood in north Bengal. 12,937.71 sq.km cropped area was damaged. Total 44, 21,996 people affected. Number of human lives lost – 32 (drowning – 30, snake bite – 2). Number of houses damaged – Fully (59,288) Partly (141,606).
Cyclone	2002	Nine fishing trawlers sank offshore the Bay of Bengal. 78 death and most of the agricultural land destroyed in Sundarban areas.

Source: Tabulated by the researcher combining data from the Dartmouth Flood Observatory, Hanover, USA, Indian Meteorological Department, New Delhi, West Bengal State Inter-Agency Group, 2017 and National Disaster Risk Reduction Portal, India (2017).

[4] Tide gauge data at the Diamond Harbour port indicate a sea level rise of 5.7 mm compared to the previous century, which can be credited to subsidence in the region (Indian Network for Climate Change Assessment, 2010).

5. MAPPING THE ENVIRONMENTAL SCARCITY OF RESOURCES AND SOCIAL PROBLEMS IN RURAL WEST BENGAL

There is a considerable amount of researches, conducted at different regional scales, investigating the close relationships between environmental scarcity of resources and an increase in rural socio-economic problems (Homer-Dixon, 1999b; Ide, 2015; Panda *et al.*, 2013; Schnurr and Swatuk, 2010). In the developing countries, the rural problem is occasionally due to environmental scarcity of resources. A significant study by B. Daley (2013) entitled *Resource Scarcity and Environment: Review of Evidence and Research Gap Analysis* argued that Neo-Malthusian[5] scrutiny regarding resource scarcity and social problems confirm that environmental resources have a limit to service the human population. If the limit is crossed, the result will be poverty and overall vulnerability. Daley (2013) also highlighted that in the developing countries, high population growth led scarcity of several resources such as soil, water, forest, etc. affecting rural lives, and environmental scarcity of resources contributed to raising regional as well as global vulnerability, such as poverty conflicts and social hazards. Environmental scarcity of resource in a country or society makes people struggle to meet their basic needs for water, land, forest, being unable to withstand environmental tensions (Barbier, 2012; United Nations Interagency Framework Team for Preventive Action, 2012). Scarcity is generally of three types: supply-induced scarcity, demand-induced scarcity, structure-induced scarcity (Homer-Dixon, 1999). Supply induced scarcity is one of the important causes of environmental degradation of resources. It emerges when a major part of the natural resources are degrading due to deforestation, groundwater depletion, water pollution, soil erosion, etc. Table 4 shows the changing scenario of environmental resources of West Bengal. Out of the total geographical area of West Bengal, 13.5% is forest area. Current fallow land of the state increased from 0.5% in 1985–1986 to 6.6% in 2010–2011. There is also an about 2% decline in the net sown area. Within the same time, the state became the second largest densely populated (1,028 / km^2 exceeding than national average of 382 / km^2.) state of the country. If we look at the per capita net sown area, it appears to have significantly fallen from 1.31 ha to 0.08 ha (Table 4). The State Directorate of Forest (2012) reported that 2995.3 ha of the state soil is under salinity and water logging. This evidence shows a scenario of growing natural degradation of resources. Therefore, the ability of the land and soil to meet the demand of rural agricultural production is reduced. Apart from the above supply-induced scarcity, demand and structure-induced resource scarcity are also governing the social problem scenario in rural West Bengal. For example, the farmer's distress depends on the control of and ownership of land and water resources. As the small and marginal farmers have little land, they cannot cope with the shocks of an extreme environmental problem, such as flood and drought. In West Bengal, 97% of farmer suicide cases happen in the marginal and small landholding household (Manjunatha and Ramappa, 2017). This supports the idea that structure-induced resource (land) scarcity is linked with social problems. There is a continuous decline of the per capita net sown area due to population pressure (Table 4).

In addition, India is a country foremost in conflict, friction, vulnerabilities, which arise from a depleted environment, such as water scarcity, the building of water-dams, forest resource rights, land degradation, mining, nuclear power, etc. (India Spend[6], 2010). West Bengal ranks first amongst all the Indian states in terms of the number of socio-environmental conflicts[7]. Table 5 depicts a clear picture of the nature and place of social friction, or problem-related environmental issue. In West Bengal, hardly any sophisticated study has been conducted on the 'rural socio-environmental conflict issue', but the number of such problems increases almost regularly every year. For example, in the last fifteen

[5] The Neo-Malthusian doctrine argues that 'ecological scarcity' or 'environmental resource scarcity' as a measure of natural organic tolerance; disproportionally related to food production and consumption of resources (Koula Mellos,1988).

[6] India spend is Indian's first data journalism initiative and web portal. It collects data from the economic, environment, and political field.

[7] Environmental Justice Atlas: a web portal. For more information www.ejolt.org

years, West Bengal has witnessed 18 major social problems related to the environment (Environmental Justice Atlas, 2017).

Table 4

Changing the land-use pattern of West Bengal[8] (Area in thous. sq.km)

Land-use category	1985–86		1995–96		2008–09		2009–10		2010–11	
	Area	%	Area	%	Area	%	Area	%	Area	%
Forest land	11.86	11.4	11.96	13.8	11.74	13.5	11.74	13.5	11.74	13.5
Current fallow land	0.65	0.5	2.2	2.5	2.87	3.3	3.23	3.7	5.74	6.6
Area not available for cultivation	1,730	19.6	1,642	18.9	1,793	20.6	1,820	21.0	1,840	21.2
Net sown area	52.63	59.5	54.62	62.8	52.94	61.0	52.56	60.5	49.91	57.5
Per capita net sown area(hectare/per head of rural population)	0.131		0.110		0.091		N.A		0.080	

Source: Tabulated by the researcher, Data Combined from the Department of Agriculture, Bureau of Applied Economy and Statistics, Govt. of West Bengal, 1985–2011.

Table 5

Rural Social Problems or Friction Related to Environmental issues in West Bengal

Problem and Places	**Nature of the Problems or Friction**
Forest rights conflict in Jalpaiguri forest division.	Forest dwellers are struggling for traditional settlement rights related to the Forest Rights Act. They are protesting for the decentralisation of forest management and equitable land rights.
Fertileland-related dispute in Singure and Nandigram.	Frequently, people protest against the TATA Motors Company for establishing the motor industry in the fertile lands of the region. Rural livelihood crisis was the major issue in this dispute because the farmers argue that fertile land here provides them with modest livelihoods. The quality of soil was at the core of this socio-political turbulence.
Katwa thermal-power project dispute in Katwa, Burdwan District, 2014.	The farmers of Srikhana Village in Katwa, West Bengal are reluctant to give away the rich multi-cropped land to the thermal power-producing agency. Ninety percent of the farmers belong to the marginal category of this region. This means that losing the land will push them further into livelihood insecurity. Besides, major environmental issues related to the dispute were soil and surface water contamination, and crop damage.
West Bengal anti-eucalyptus movement in Midnapur, 2007.	In 2007, an anti-eucalyptus movement arose in the Khonkashuli Village, Midnapur District. The Lodha community cut down 6,600 eucalyptus trees planted by the Forest Department of West Bengal. "Eucalyptus does not give us food" was the main theme of the rural people's protest. They claimed return of their land. Loss of the vegetation cover and food insecurity was the driving force of the anti-eucalyptus movement.
Sahara[9] eco-tourism conflict in Sundarban, 2003 onwards.	Sundarban is the world largest mangrove forest. The Saraha India eco-tourism project bans the local people from collecting fish, non-timber forest products from the creek of the delta. This created huge social conflicts alongside some environmental issues that the physical change of the island will degrade and distort the rich biodiversity and hydro-geology.
Deocha-Pachami-Dewanganj-Harinsingha mining conflict in Birbhum District, ongoing from 2014.	This coal field was discovered to be the largest coal reserves in West Bengal. The social problems that stemmed here were due to various reasons, such as loss of the indigenous knowledge system, settlement displacement, biodiversity loss, pollution and geohazard. Indigenous people do not agree to give the land to the mining agency.
Nayachar chemical hub conflict in Sundarban, 2005.	Nayachar chemical hub located in the coastal regulation zone of Sundarban is not environmentally legalised. The main environmental problems will be air pollution, oil spill into the sea, and chemical pollution. They fear that the island's ecology and the local resource-base will be destroyed. There are growing social distress and problems because of these perceptions.

Sources: Listed by the researcher from the Environmental Justice Atlas web portal, 2017.

[8] Excluding of Kolkata Metropolitan District.

[9] Sahara India Pariwar is an Indian business company. They want to develop a tourism hub in the fragile ecosystem of sunderban (part of the world largest delta). The proposed tourism area covers over 303.5 hectares, including the island Sagar, Kaikhali, Fraserganj, and Jharkhali.

6. CONCLUSIONS

This study reveals the very close relationship between environmental calamities and the scarcity of natural resource and rural social problems. In West Bengal, the high dependency of monsoon-based agricultural practices, based on the indigenous people forest resources, along with high population density and low per capita land are exceedingly affecting the livelihoods of rural people. As mentioned in Table 3, disasters entail environmental problems, such as cyclone, flood, landslides, and river-bank erosion, occasional droughts. These disasters or environmental problems are very much responsible for social problems in the rural life of the West Bengal people. However, the structure-induced factors, such as economic inequalities and disparities, which are very prominent in the state, are responsible for the overall socio-economic problems amongst the rural population. Therefore, there is a need for a holistic approach to mitigate the environmental problems, as well as to avoid the environmental scarcity of resources which create rural livelihood problems. Some significant measures taken by the United Nations (2012) to solve the above-mentioned problems are: reduction of competition over scarce natural resources, support for sustainable livelihoods practices, increase of the availability of scarce renewable resources, less waste, and improvement of resource governance and accountability. Above all, the creation of a region specific 'dispute resolution capacity framework' crucial to policy-making within the context of environment driven rural social problems.

REFERENCES

Banerjee, A., Ghosh, S. (2010), *The Creation of West Bengal's Forest Underclass: An Historical Institutional Analysis of Forest Rights Deprivations*. School of Environment & Development, University of Manchester.

Barbier, E.B. (2012), *Natural Capital, Ecological Scarcity and Rural Poverty*. The World Bank Research Group. Mexico City:

Brien, K. O., Leichenko, R., Kelkar, U., Venema, H., Aandahl, G., Tompkins, H., West, J. (2004), *Mapping vulnerability to multiple stressors: climate change and globalization in India*. Global Environmental Change, **14**, pp. 303–313.

Census of India (2011), *West Bengal Census Handbook*, Directorate of Census Operations, West Bengal, Kolkata.

Chaudhuri, S., Gupta, N. (2009), *Levels of Living and Poverty Patterns: a District-Wise Analysis for India*. Economic and Political Weekly, pp. 94–110.

Dasgupta, P., Bhattacharjee, D., Kumari, A. (2013), *Socio-economic analysis of climate change impacts on foodgrain production in Indian states*. Environmental Development, **8**, pp. 5–21.

Debnath, M., Ray, S. (2017), *Spatial Pattern and Distribution of Migration and Immigration in West Bengal from Neighbouring States and Countries: An Appraisal*. Khoj:An International Peer Reviewed Journal of Geography, **4**(*1*), p. 26.

Directorate of Forest (2012), *West Bengal State Forest Report (2011–12)*, Office of the Principal Chief Conservator of Forests, Kolkata.

Donaldson, D., Greenstone, M. (2014), *The Unequal Effects of Weather and Climate Change*: Evidence from Mortality in India.

Ghosh, A. (2012), *Living with changing climate: Impact, vulnerability and adaptation challenges in Indian Sundarbans*. Centre for Science and Environment, New Delhi.

Government of West Bengal (2012), *West Bengal State Action Plan on Climate Change*, Ministry of Forest, Environment and Climate Change, New Delhi.

Government of West Bengal (2015), *Database on Labour and Employment Statistics of West Bengal–2014*, Bureau Of Applied Economics And Statistics, Department Of Statistics And Programme Implementation, Kolkata.

Government of West Bengal (2017), *Environment and Social Systems Assessment Public Disclosure Authorized*, Institutional Strengthening Of Gram Panchayats Program II, (ISGPP–II), Kolkata.

Guin, D., Das, D. N. (2015), *New Census Towns in West Bengal "Census Activism" or Sectoral Diversification*. Economic and Political Weekly, **50**(*14*), pp. 68–72.

Hazra, S., Samanta, K., Mukhopadhyay, A., Akhand, A. (2010), *Temporal Change Detection Study of Sundarban*. School of Oceanographic Studies, Jadavpur University Kolkata.

Homer-Dixon, T.F. (1999a), *Environment, Scarcity, and Violence*. Princeton University Press. Retrieved from https://www.jstor.org/stable/j.ctt7pgg0.

Homer-Dixon, T.F. (1999b), *Environment, Scarcity, and Violence*. Princeton University Press.

Ide, T. (2015), *Why do conflicts over scarce renewable resources turn violent? A qualitative comparative analysis*. Global Environmental Change, **33**, pp. 61–70.

Kumar, C. (2009), *Migration and Refugee Issue between India and Bangladesh*. In Scholar's Voice: A new way of thinking, Vol. **1**, pp. 64–82.

Lahiri-Dutt, K., Samanta, G. (2013), *Dancing with the River: People and Life on the Chars of South Asia*. Yale University Press.

Maiti, S., Jha, S. K., Garai, S., Nag, A., Bera, A. K., Paul, V., Deb, S. M. (2017), *An assessment of social vulnerability to climate change among the districts of Arunachal Pradesh, India*. Ecological Indicators, **77**, pp. 105–113.

Manjunatha, A.V., Ramappa, K.B. (2017), *Farmer Suicides: An All India Study*, Institute of Economic Growth and Social Change, Bangaluru.

Marsh, W.M., Grossa, J. (1995), *Environmental Geography: Science, Land Use, and Earth Systems*. Wiley.

Mgbemene, C.A., Nnaji, C.C., and Nwozor, C. (2016), *Industrialization and its Backlash: Focus on Climate Change and its Consequences*. Journal of Environmental Science and Technology, **9**(*4*), pp. 301–316.

Nath, P.K., Behera, B. (2011), *A critical review of impact of and adaptation to climate change in developed and developing economies*. Environment, Development and Sustainability, **13**(*1*), pp. 141–162.

National Disaster Risk Reduction (2011), *West bengal State Disaster Risk Reduction Report.*

Pal, R., Biswas, S.S., Mondal, B., Pramanik, M.K. (2016), *Landslides and Floods in the Tista Basin (Darjeeling and Jalpaiguri Districts): Historical Evidence, Causes and Consequences*. J. Ind. Geophys. Union, **20**(*2*), pp. 66–72.

Panda, H., Panda, S. M., Lund, R. (2013), *Environmental Insecurity and Social Friction: Links in Rural Odisha*. International Journal of Rural Management, **9**(*1*), pp. 17–43.

Prasari, R. (2011), *Livelihood Zones in West Bengal: A scenario for AWM interventions*.

Roy, S. (2011), *Flood Hazards in Jalpaiguri District*. Unpublished Ph.D thesis, Department of Applied Geography, University of North Bengal, Siliguri.

Rudra, K. (2010), *The Encroaching Ganga and Social Conflicts: The Case of West Bengal*.

Schnurr, M. A., Swatuk, L. A. (2010), *Critical Environmental Security: Rethinking the Links Between Natural Resources and political Violence*. Dalhousie University.

Scoones, I. (2009), *Livelihoods perspectives and rural development*. Journal of Peasant Studies, **36**(*1*), pp. 171–196.

Settles, J.D. (1996), *The Impact of Colonialism on African Economic Developmen*t, University of Tennessee Honors Thesis Projects.

Sharma, R., Bhushan, A. (2014), *Illegal Immigration of Bangladeshis into India*. (National Security Challenges), Paper presented in the CS 04 session of 23rd WORLD Congress of IPSA, 19th to 24th July 2014, Montreal, Canada.

Shrestha, A.B., Agrawal, N.K., Alfthan, B., Bajracharya, S.R., Maréchal, J., Oort, B. van. (2015), *HKH Water Atlas*. ICIMOD, Nepal.

Starkel, L., Sarkar, S., Soja, R., Prokop, P. (2008), *Present-Day Evolution of the Sikkimese-Bhutanese Himalayan Piedmont*. Dział Wydawnictw, **51**/*55*, pp. 800–818.

The World Bank (2008), *Climate Change Impacts in Drought and Flood Affected Areas: Case Studies in India*.

Turral, H. (2011), *Climate Change, Water and Food Security*. Food and Agricultural organisation, Rome.

UNFCCC (2007), *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries*. United Nations Framework Convention on Climate Change, 68.

United Nations Interagency Framework Team for Preventive Action (2012), *Toolkit And Guidence for Preventing and Managing Land and Natural Resources Conflict*. Renewable Resources and Conflic, vol. **206**.

Wenger, R., Rogger, C., Dach, S. (2004), *Climate change and forest-based livelihoods.* InfoResources, Zolliofen.

Whitby, M., Willis, K. (2017), *Rural Resource Development: an Economic Approach*. Routledge.

Received May 29, 2018