

CHAPTER-3

Review of Literature

In any scientific investigation and research, a comprehensive review of literature is very essential. Its main function, apart from determining the work done before concerning the problem area i.e. area of investigation, it provides an insight into the methods and procedures and create a basis for interpretation of findings. As direct reference of all the items is not in abundance, certain specific reference along with some indirect references has been incorporated in this chapter for the purpose of meaningful use. In the present study, review of literature has been summarized among following heads.

- a) Community perception on climate change
- b) Climate change effects on agriculture
- c) Climate change effects on human health
- d) Climate change effects on biodiversity
- e) Climate change effects on water resources

- f) Climate change effects on migration
- g) Climate change effects on food security and livelihood
- h) Adaptation and mitigation strategies.

Community perception on climate change

Wozniak, G. D. (1984) found the adoption of interrelated innovations: A human capital approach in *Review of Economics and Statistics* 66 (LXVI): 70–79. Agricultural extension enhances the efficiency of making adoption decisions. In the world of less than- perfect information, the introduction of new technologies creates a demand for information useful in deciding on adopting new technologies.

Scott, M. S., Rosenberg, N.J., Edmonds, J. A., Cushman, R. M. (1990) reported in *Consequences of climate change for human environment*, *Clim Res.* 1:63-79. And their studies focusing on the socioeconomic aspects of climatic change are sparse and have almost exclusively restricted their analysis to the impact of environmental modifications on agricultural production.

Factors affecting peanut producer adoption of integrated pest management published in *Review of agricultural economics* (1991) by **McNamara et al.** He concluded that the occupation of the farmer is an indication of the total amount of time available for farming activities. Off-farm employment may present a constraint to adoption of technology because it competes for on-farm managerial time.

Lutz et al. and Shultz et al. (1994) published their report “The Costs and Benefits of Soil Conservation: The Farmer's Viewpoint” in the World Bank

Research Observer 9: 273–295. Agroforestry and Soil Conservation: Adoption and Profitability in El Salvador. Agroforestry Today 9: 16–17. 1994 that the land tenure can contribute to adaptation, because landowners tend to adopt new technologies more frequently than tenants, an argument that has justified numerous efforts to reduce 21 tenure insecurity.

Adesina,-A-A and Forson,-J-B (1995), published their research on Farmers' perceptions and adoption of new agricultural technology: Evidence from analysis in Burkina Faso and Guinea, West Africa. Agricultural Economics 13:1–9. This review contains many sources of information available to farmers; agricultural extension is the most important for analyzing the adoption decision and based on the innovation-diffusion literature.

Houston, J. R (1996) reported in International tourism and U.S. beaches. Shore and Beach 64:27-35. in 1996 that the readers are interested in the science behind climate change, climate change assessments, general circulation models and other impacts are directed towards the National Assessment Synthesis Team Overview.

User-Friendly Handbook for Mixed Method valuations. National Science Foundation. Division of research, development and communication published a research in (**Frechtling, J. and Sharp, L., 1997**). In that research the interviewers seek to encourage free and open responses, and there may be a trade-off between comprehensive coverage of topics and in-depth exploration of a more limited set of questions. In-depth interviews also encourage capturing of respondents 'perceptions in their own words, a very desirable strategy in qualitative data collection.

Rebetcz,-M (2000), reported the “Public expectations as an element of human perceptions of climate change, climatic change” in , Springer, Netherlands, Vol. 32, p. 495-509 about the human expectations regarding weather and climate sometimes lead to perceptions of climate change which are not supported by observational evidences.

Bryant et al. (2000), found such varied responses, even within the same geographic area, are partly related to the variety of agricultural systems involved and the different market systems in which farmers operate reported in Adaptation in Canadian agriculture to climatic variability and change. *Climatic Change* 45:181–201.

Vedwan,-N; Rhoades,-R-E (2001) reported the “Climate change in the western Himalayas of India : A study of local perceptions and response”. In order to understand how human beings would respond to climate change, it is essential to study people's perceptions of climate and the environment in general. Overall, of course the climate is described as being much warmer, but people's perception of temperature changes should not simply described as an increase or a decrease in annual temperatures. They are mainly related to change distributions.

Adger et al. (2003) found the adaptation to climate change in the developing. It has been argued that the world's climate is changing and will continue to change at rates unprecedented in human history, and that all societies need to enhance their adaptive capacity to face both present and future challenges of climate change.

Adaptation to climate change requires that farmers first notice that the climate has changed, and then identify useful adaptations and implement them as discussed in

The perception of and adaptation to climate change in Africa. CEEPA Discussion Paper No. 10. Centre for Environmental Economics and Policy in Africa, University of Pretoria, South Africa (**Maddison,-D, 2006**).

Belliveau et al. (2006) reported the Farm-level adaptation to multiple risks: Climate change and other concerns in Occasional paper No. 27. Canada: University Of Guelph. Nevertheless, empirical assessment of actual adaptive behaviour is advocated, even though such behaviour is place-specific and time-specific and more likely represents a response to inter-periodic climatic variability, as well as to multiple non-climatic risks and opportunities.

Government of India published the National Action Plan on Climate change, Prime Ministers council on climate change, (**30th June, 2008**) NAPC. This study is a small step towards gaining a better understanding of climate change impacts and challenges corresponding to the core objective of National Mission on Strategic Knowledge for Climate Change which is the 8th mission of the National Action Plan on Climate Change.

Haas,-P-M, Barrett,-S, Okereke et al. and Vandenberg,-M-P; Cohen,-M-A (2009) found that climate change, being a key governance issue in recent years, appears to have predominantly focused on the development of global climate change regime agreements, the UNFCCC and the Kyoto Protocol, and their implementation.

Climate Change Governance. World Bank Policy Research Working Paper 4941. Washington, DC: World Bank (**Meadowcroft,-J, 2009**)

published a few studies that have examined the role national governments can play in putting in place institutions, policies, plans and measures to promote mitigation of, and adaptation to climate change and these have mostly addressed environmental governance of climate change in developed countries.

Climate Change Governance. World Bank Policy Research Working Paper 4941. Washington, DC: World Bank (**Meadowcroft,-J, 2009**). This author further argues that climate change governance requires governments to take an active role in bringing about shifts in interest and perceptions so that stable societal majorities in favor of deploying an active mitigation and adaptation policy regime can be maintained.

Nzeadibe,-T-C; and Ajaero,-C-K (2010) reported the “A economic characteristics and quality of life expectations in rural communities of Enugu State, Nigeria”. *Applied Research in Quality of Life*. 5 (4) 353-371. DOI: 10.1007/s11482-010-9096-4. Awareness and perceptions of a problem such as climate change shapes action or inaction on the problem.

Managing Climate Change - A Critical Governance Issue for Africa reported (2010) by **African Development Bank** that climate change has thus become the most important topical development policy and global governance issue in the 21st century.

Introduction to Geography (7th edition.) New York: McGraw-Hill. Assessment of socio-economic characteristics and quality of life expectations in rural communities of Enugu State, Nigeria reported (**Getis**

et al., Nzeadibe,-T-C and Ajaero,-C-K, 2010) that the perception is arguably related to awareness level and availability of information on a phenomenon. The spatial behavior and behavioral responses of individuals and communities are often framed around their perceptions of problems.

Climate Change Effects on Agriculture

In the **Second Assessment Report of IPCC (1996)**, it describes the climate change impact on global agricultural production focusing on serious consequences of large differences at local and regional scales. Many of the world's poorest people – particularly those living in subtropical and tropical areas – are most at risk of increased hunger.

Agricultural impacts in Egypt, **Strzepek and Smith, (1996)** figured out the adaptations in water resources (major river diversion schemes), irrigation (improved water delivery systems), agriculture (altered crop varieties and crop management), and coastal protection against sea-level rise were all tested. They achieve a modest 7–8% increase in agricultural sector performance compared to no adaptation, but together would be extremely expensive to implement.

OECD, (2002), published the Climate change: India's perceptions, positions, policies and possibilities. It has been projected that under the scenario of a 2.5 °C to 4.9 °C temperature rise in India, rice yields will drop by 32 %-40 % and wheat yields by 41 %-52 %.

Olesen, J.E. et. al (2006), reported that the uncertainties in projected impacts of climate change on European agriculture and terrestrial ecosystems. He described about frequent extreme climate events during

specific crop development stages, together with higher rainfall intensity and longer dry spells, may impact negatively on crop yields. Provides various models based on regional climate.

Nelson. G.C. (2009) published “Agriculture and Climate Change: An Agenda for Negotiation in Copenhagen” which describes about relation between climate change and agriculture with adapting scenarios against brunt of climate change. Also focuses on crop and livestock research, including biotechnology, to help overcome stresses related to climate change such as heat, drought, and novel pathogens.

Alliance of the CGIAR Centres (December, 2009), published a report in “Climate, agriculture and food security: A strategy for change”, that the climate is changing, and agricultural systems must also change if we are to avoid catastrophe. Farming, fishing and forest communities will need to adapt their livelihood systems, while mitigation efforts must address both the contribution of agriculture to the climate change problem, and the great potential of different resource management practices in reducing greenhouse gases in the atmosphere.

Ahmad Jamil et. al. (June, 2011) reported that Agriculture is the backbone of Indian economy. Directly or indirectly 55% of the country’s population depends on the climate sensitive sector agriculture. The agricultural sector is a driving force in the gas emissions and land use effects that causes climate change. The projected climate change under various scenarios is likely to have implications on food production, water supply, biodiversity and livelihoods in Impact of Climate Change on Agriculture and Food

Security in India (Int. Jr. of Argil. Env. and Biotech. Vol. 4, No. 2: 129-137)

Asha latha K. V., Gopinath Munisamy, Bhat A. R. S. (August, 2011) found the Impact of Climate Change on Rainfed Agriculture in India: A Case Study of Dharwad and published in International Journal of Environmental Science and Development.

Dev S.Mahendra (August, 2011) from Indira Gandhi Institute of Development Research, Mumbai, show the relationship of climate change, rural livelihoods and agriculture (focus on Food Security) in Asia-Pacific Region. Climate change is a major challenge for agriculture, food security and rural livelihoods for billions of people including the poor in the Asia-Pacific region.

Swaminathan M S et. Al (2012) published a report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2012. He represent that food insecurity and climate change are, more than ever, the two major global challenges humanity is facing, and climate change is increasingly perceived as one of the greatest challenges for food security. Food production has to be insulated to the extent possible from climate change impacts, since agriculture constitutes the major source of livelihood in rural areas in most of the developing countries. Sub-Saharan Africa and South Asia are amongst the most vulnerable regions to changes in temperature and precipitation. These are also regions with the highest malnutrition burden.

Gupta Shreekant, Sen Partha and Shrinivisan Suchita (2012), from Centre for Development Economics, Department of Economics, Delhi

School of Economics show that the impact of climate change on Indian economy: Evidence from Food Grain yield. This paper estimate a crop-specific agricultural production function with exogenous climate variables, namely, precipitation and temperature and control for key inputs such as irrigation, fertilizer and labor.

The Institute for Social and Economic Change, Bangalore (**Ninan K N Bedamatta Satyasiba, 2012**) published a report on “Climate Change, Agriculture, Poverty and Livelihoods: A Status Report”. This paper assesses the impact of climate change on Indian agriculture covering a cross section of crops, seasons and regions based on existing literature. The study notes that the impact of climate change will vary across crops, regions and climate change scenarios.

From ICAR Research Complex for Eastern Region, ICAR Patna **Abdul Vahab Abdul Haris et al. (January, 2013)**, published a research article on impact of climate change on wheat and winter maize over a sub-humid climatic environment. The present study deals with the impact of climate change on winter wheat and maize using the Info crop model. Simulation studies were performed for different time periods using HADCM3 factors at four centres located in three different agro ecological zones, with prevalent management practices.

Swaminathan M S et. al. (2013) from National Institute of Advanced Studies reported that India has undergone a series of ups and downs in agricultural production with the climatic conditions playing havoc in the years of abnormality. We faced many droughts in 18th and 19th centuries without much knows how to counterfeit their impacts. Currently, agro-

ecosystems are facing the problems of overexploitation of natural resources, decline in soil fertility, ground water level and agricultural productivity. Hence, ensuring sustainable food security is the need of the hour.

Saina Christopher Kipkoech et. al. (2013), found that Climate change is possibly the most significant environmental challenge of our time and poses serious threats to sustainable development in the world and more so in most developing nations. There is a direct link between climatic changes and global food insecurity more so in developing countries where climate change compounded with poverty has exacerbated the impacts. In order to address the challenges posed by climate change Climate Change and Food Security and published in NCDHR Climate Change.

Thornton Philip and Lipper Leslie (April, 2014), reported in IFPRI Discussion Paper- 01340, that How Does Climate change Alter Agricultural Strategies to Support Food Security? And also show the negative effects of climate change are projected to affect the populations with the least capacity to adjust, but with the greatest need for improved agricultural performance to achieve food security and reduce poverty. The purpose of the paper is to identify how climate change affects how we should approach the process of transforming agricultural systems (including crops, livestock, fisheries and forestry) to support global food security and poverty reduction in a sustainable way.

Impact of Climate Change on Vegetable Cultivation – published in “A Review International Journal of Agriculture, Environment & Biotechnology Citation: IJAEB:” 7(1): 145-155, DOI 10.5958/j.2230-732X.7.1.020 (**Ayyogari Kondinya et. al., March, 2014**) that under changing climatic

situations crop failures, shortage of yields, reduction in quality and increasing pest and disease problems are common and they render the vegetable cultivation unprofitable. As many physiological processes and enzymatic activities are temperature dependent, they are going to be largely effected. These affects of climate change also influence the pest and disease occurrences, host-pathogen interactions, distribution and ecology of insects, time of appearance, migration to new places and their overwintering capacity, there by becoming major setback to vegetable cultivation.

Tata Institute of Social Sciences published a Review of Agrarian Studies on Climate Change and Food Production Systems (**Kanitkar Tejal, 2014**) and show the impact of climate change has been classified in the report under three main categories: (i) the impact on natural (and managed) resources and their uses, (ii) the impact on human settlements, industry, and infrastructure, and (iii) the impact on human health, well-being, and security. The first section discusses the impact of climate change on water systems and resources, coastal and ocean systems, and food production systems.

Climate Change Effects on Human Health

Maheshwari S, Basavaraj (2007) reported the Global Warming: Impact on Global Health and on the Indian Health Scenario in Particular, IPCC-Climate Change and Human Health - Risk and Responses in Chapter-153 and show that GTIndia is home to a third of the world's poor, and climate change will hit this section of society the hardest. Set to be the most populous nation in the world by 2045, the economic, social and ecological

price of climate change will be massive. With changes in key climate variables, namely temperature, precipitation and humidity, crucial sectors like agriculture and rural development are likely to be affected in a major way.

University of Adelaide, et al. (2009) reported that Climate change and Migration in Asia & Pacific Climate change, migration. Asia and the Pacific, Asian Development Bank. Linking climate change and migration, migration in Asia and the Pacific, identifying Hot Spots of climate change impact potential impact of climate change on migration patterns policy considerations and recommendations.

Neelam Sachan and V.P.Singh (2010) published a review Article and show the effects of climatic changes on the prevalence of Zoonotic diseases. Global warming, zoonotic diseases, avian influenza, swine flue, Japanese encephalitis, nipah virus, rabies, leptospirosis.

In a review Article by **Poonam K. Singh & Ramesh C. Dhiman (June, 2012)** reported that the climate change and human health: Indian context. Chikungunya; climate change; dengue; human health; Japanese encephalitis, malaria; vector-borne diseases

In a review Article, **V. Ramana Dhara, Paul J. Schramm & George Luber (August, 2012)** reported the climate change & infectious diseases in India: Implications for health care providers. Developing nations with limited resources are expected to face a host of health effects due to climate change, including vector-borne and water-borne diseases such as malaria, cholera, and dengue.

In the National Institute of Malaria Research (ICMR) Seminar, **Ramesh C Dhiman (2014)** presented the climate change and vector borne disease, Evidence of climate change Impact of health and VBDs, temperature thresholds for transmission, projected impact on Transmission Windows of Malaria and Dengue using PRECIS model by 2030, emerging chikungunya and Kala-azar need detailed studies.

Climate Change Effects on Biodiversity

Houston, J. R. (1996), reported in International tourism and U.S. beaches. Shore and Beach 64:27-35. That the readers interested in the science behind climate change, climate change assessments, general circulation models and other impacts are directed towards the National Assessment Synthesis Team Overview.

Saxena K. G. Et. Al. found that climate change, biodiversity and livelihoods in Indian Himalaya, while unprecedented rate of global warming in recent times is conclusively established, scientific capacity to predict future climate scenarios is limited, with projected warming rates reported in the range of 1.0 to 5.8 oc on a global scale (**IPCC, 2001**) and 0.4 to 2.0oc in India (**Hingane et al., 1985; Parish and Funnell, 1999**) largely because of an upward trend in maximum temperature (**Rupa Kumar et al., 1994**). **Kavi Kumar and Parikh (2001)** considered likely warming by 2 0C in temperature together with a 7% increase in precipitation as the 'best guess'.

Biodiversity and Climate Change, Convention on Biological Diversity (**Djoghla Ahmed, 2007**) published this brochure captures the most

emblematic impact of climate change and consequent biodiversity loss in the whole of Africa – the melting of the Mount Kilimanjaro glaciers on the border of Tanzania and Kenya.

Reid Hannah and Swiderska Krystyna (February, 2008) from International Institute for Environment and Development Biodiversity, climate change and poverty: exploring the links, biodiversity is key to how well people can adapt to climate change, how effectively landscapes absorb and store carbon, and how effective vegetation and ecosystems are in reducing the adverse impacts of climate change.

In, from Biodiversity and Climate Change: Achieving the 2020 Targets, **Secretariat of the Convention on Biological Diversity (May, 2010)** published this edition of the Convention on Biological Diversity's Technical Series was prepared to accompany posters presented at SBSTTA-14. They contain a wide range of case studies and best practices illustrating how climate change adaptation and mitigation measures, and biodiversity conservation and sustainable use can be mutually supportive.

Indian J.Sci.Res.2(4): 137-139 by **Sharma Kumar Dushyant, Mishra J. K. (2011)**, found the impacts of Environmental Changes on Biodiversity. This article depicts the pictures of climate change effects on biodiversity and the adaptive capacity of our natural ecosystem against these gradual changes of climate.

Sharma Umendra (May, 2011), in National Conference on Forest Biodiversity Earth's Living Treasure reported the effect of global warming on Biodiversity in India, biodiversity: what is it, where is it, and why is it important? Global warming effects on biodiversity and animals.

Sharma Kumar Dushyant, Mishra J. K. (2011), reported on Indian J.Sci.Res.2(4): 137-139 that the impacts of environmental changes on biodiversity. This article depicts the pictures of climate change effects on biodiversity and the adaptive capacity of our natural ecosystem against these gradual changes of climate.

Rathore Aparna and Jasrai T. Yogesh (March, 2013), published a report in International Journal of Scientific and Research Publications and showed the biodiversity conservation will lead to strengthening of ecosystem resilience and will improve the ability of ecosystem to provide important services during increasing climate pressures. This review basically focuses on the importance of biodiversity, the consequences faced by the plants, animals, humans and ecosystem owing to the global warming and climate change and the possible mitigation and adaptation strategies in terms of biodiversity conservation which can protect the planet from the consequences of climate change.

Climate Change Effects On Water Resources

From Swedish Water House (SWH) **Wilk, J. and Wittgren, (2009)**, reported the adapting water management to climate change, adapting water management to climate change, water resources in a changing climate, adaptation and vulnerability to climate change, adaptation strategies in practice.

A Survey report on climate change vulnerabilities, Aquaculture practices and cropping pattern in Sagar and Basanti block in Indian Sundarban published by **B K Chand, R K Trivedi, S K Dubey, M M Beg (2012)**, on

Aquaculture in changing climate of Sundarban, uniqueness of Sundarban ecosystem & its contribution to aquaculture, Shrimp farming status in Sundarban region, major threats associated with aquaculture & fishery of Sundarban.

Aditi Mukherji (2012), reported about the agricultural Groundwater use in West Bengal. Research results make it easier for farmers to access water in West Bengal. She described the crucial situation of water scarcity in West Bengal. The rising cost of cultivation, largely as a result of high irrigation costs and non-remunerative crop prices, are at the heart of low profitability from agriculture. High irrigation costs are, in turn, a direct result of farmers' dependence on expensive diesel for pumping groundwater and high electricity tariff rates in the state. In the meanwhile, the state is home to 214 lakhs of poor people, i.e., 28.5% of the population of the state is below the poverty line. Of these, 84% of poor people live in villages. According to the National Sample Survey (NSS) 61st round (2004-2005), 10.6% of rural households in Paschim Banga are reported as not having enough food every day during some months of the year.

From International Research Journal of Environment **Sciences Kumar Manoj and Padhy Pratap Kumar (January, 2013)** reported the Climate Change, Water Resources and Food Production: Some Highlights from India's Standpoint. They showed there that India is expected to become water stressed country by the years 2020-2025 with per capita water availability falling to 1341 m³/person/year by 2025.

Climate Change Effects On Migration

The Intergovernmental Panel on Climate Change (IPCC, 1990) noted that the greatest single impact of climate change could be on human migration—with millions of people displaced by shoreline erosion, coastal flooding and agricultural disruption. Since then various analysts have tried to put numbers on future flows of climate migrants (sometimes called “climate refugees”)—the most widely repeated prediction being 200 million by 2050.

IOM migration research series (**Brown Oli, 2008**) found the Migration and climate change, a growing crisis 200 million climate migrants by 2050? A complex, unpredictable relationship refugee or migrant?

Dobernig-Pinto Ilse (2008) published his Migration Research Series No. 31 on Migration and Climate Change (ISSN 1607-338X International Organization for Migration (IOM)).

Kolmannskog Vikram (2009), published a research paper on climate change, disaster, displacement and migration: Initial evidence from Africa. Although there is not a mono-causal relation between climate change, disasters, displacement and migration, the existence of a clear link between the phenomena is increasingly recognized.

University of Adelaide, et al (2009), reported that Climate change, migration. Asia and the Pacific, Asian Development Bank. Linking climate change and migration, migration in Asia and the Pacific, identifying Hot Spots of climate change impact potential impact of climate change on migration patterns policy considerations and recommendations

Werz Michael and Conley Laura (January, 2011), published a report on climate change, migration, and conflict addressing complex crisis scenarios in the 21st century. This report is the first in a series of papers from the Centre for American progress that will examine the nexus of climate change, migration, and conflict and its implications.

Newland Kathleen (September, 2011), found the climate Change and Migration Dynamics. Climate-related mechanism of displacement (sea level rise, higher temperature, disruption of water cycle, severe storm), vulnerability, resilience and adaptation

Flautre H el ene and Lambert Jean (May, 2013) found refugees and migrant due to climate change. Which Factors, who's affected, which movements happens due to climate change. Climate change and environmental degradation have had a significant impact on population movements worldwide – and this is still to increase.

The Green | EFA; In European Parliament, (Flautre H el ene et. al. May, 2013) reported that as CO2 emissions continue to rise, is the EU prepared to provide answers to the complex issues emerging around this process, both within and outside of its borders? How many people are being forced to move due to climate change? How many will be in the future? How should the international community respond to this challenge? What role should the EU play? And should people displaced for reasons related to climate change be granted a specific legal status?

Assessing the Impact of Climate Change on Migration and Conflict, **The World Bank (Raleigh Clionadh et. al., 2013)** claimed and roundly concluded that large scale community relocation due to either chronic or

sudden onset hazards is and continues to be an unlikely response. It proposes an alternate framework through which to examine the likely consequences of increased hazards.

Flautre Hélène, Lambert Jean, (2013), reported in *Climate change, Refugees and Migration* that Which Factors, who's affected, which movements. Climate change and environmental degradation have had a significant impact on population movements worldwide – and this is still to increase.

Community Perception on Climate Change, Food Security and Livelihood

Saxena K. G. et. al. reported about the climate change, biodiversity and livelihoods in Indian Himalaya. While unprecedented rate of global warming in recent times is conclusively established, scientific capacity to predict future climate scenarios is limited, with projected warming rates reported in the range of 1.0 to 5.8 oC on a global scale (**IPCC, 2001**) and 0.4 to 2.0oC in India (**Hingane et al., 1985; Parish and Funnell, 1999**) largely because of an upward trend in maximum temperature (**Rupa Kumar et al., 1994**). **Kavi Kumar and Parikh (2001)** considered likely warming by 2 °C in temperature together with a 7% increase in precipitation as the 'best guess'

Learning to Mitigate and Adapt to Climate Change: UNESCO and Climate Change Education, UNESCO International Seminar on Climate Change **Education (July, 2009)**, showed that education has a central role to play in understanding, mitigating and adapting to the changing climate.

While education at all levels and in both formal and informal settings is needed, instilling climate change awareness and understanding at a young age is ultimately the best way to change behaviours and attitudes. What children learn today will shape tomorrow's World.

Climate, agriculture and food security: A strategy for change Alliance of the CGIAR Centres (December, 2009), reported that the climate is changing, and agricultural systems must also change if we are to avoid catastrophe. Farming, fishing and forest communities will need to adapt their livelihood systems, while mitigation efforts must address both the contribution of agriculture to the climate change problem, and the great potential of different resource management practices in reducing greenhouse gases in the atmosphere.

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namely, precipitation and temperature and control for key inputs such as irrigation, fertilizer and labor.

Roy Narayan Tuhin published a paper in Economic Analysis of Producers' Perceptions about Impact of Climate Change on Fisheries in West Bengal, Agricultural Economics Research Review Vol. 25(No.1) pp 161-166 (**January-June, 2012**). It is generally recognized that those who are most vulnerable and marginalized would be most severely affected by the cumulative impacts of climate and other anthropogenic activities that degrade the natural resources. Climate change will result in a social change (**Sarkar and Padaria, 2010**). Fish farmers continue fishery as a livelihood opportunity and a way of life beside other economic activities like crop raising and livestock production (**Sigdel et al., 2011**).

Adaptation and Mitigation Strategies

Julie Arblaster et. al. (2007) reported the “Long-term Climate Change: Projections, Commitments and Irreversibility” in final draft of IPCC (Chapter 12). They reported the assessment report of long-term projections of climate change for the end of the 21st century and beyond, where the forced signal depends on the scenario and is typically larger than the internal variability of the climate system. Changes are expressed with respect to a baseline period of 1986–2005, unless otherwise stated.

Jeyalakshmi S. et. al (November, 2013), published the statistics Related to Climate Change – India from the Ministry of Statistics & Programme Implementation Realizing the importance and need for such an effort, the Central Statistics Office(CSO) of Ministry of Statistics and Programme

Implementation took initiatives in 2008 by way of discussing the subject in the 16th Conference of Central and State Statistical Organizations and subsequently organizing a seminar on ‘Climate Change – Data Availability and Requirements’ to discuss the subject with researchers, academicians, technocrats and officials from Ministries dealing with matters related to environment and climate.

Achala C. Abeysinghe et. al. reported in IPCC WGII AR5 Chapter 20, the “Climate-Resilient Pathways: Adaptation, Mitigation, and Sustainable Development” (31st March, 2014). They also reported that climate change poses a moderate threat to current sustainable development and a severe threat to future sustainable development. Some climate-related impacts on development are already being observed (e.g, changes in agriculture, and increases in coastal vulnerability). Added to other stresses such as poverty, inequality, or diseases, the effects of climate change will make sustainable development objectives such as food and livelihood security, poverty reduction, health, and access to clean water more difficult to achieve for many locations, systems, and affected populations.

Richard T. Corlett et. al. (March, 2014), published their studies in IPCC WGII AR5 Chapter 24 about observed climate changes and their impacts are still inadequate for many areas, particularly in North, Central and West Asia (*high confidence*). Improved projections for precipitation, and thus water supply, are most urgently needed. Interactions between climate change and the direct impacts of rising CO₂ on crops and natural ecosystems are also currently poorly understood. More research is needed on impacts, vulnerability and adaptation in urban settlements, especially

cities with populations under 500,000. More generally, there is a need to develop low-cost adaptation measures appropriate to the least developed parts of the region.

Agrawala et. al. published their report (**April, 2014**), in the technical summary of IPCC Working Group III – Mitigation of Climate Change that ‘Mitigation’, in the context of climate change, is a human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs). One of the central messages from Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC) is that the consequences of unchecked climate change for humans and natural ecosystems are already apparent and increasing. The most vulnerable systems are already experiencing adverse effects. Past emissions have already put the planet on a track for substantial further changes in climate, and while there are many uncertainties in factors such as the sensitivity of the climate system many scenarios lead to substantial climate impacts, including direct harms to human and ecological well-being that exceed the ability of those systems to adapt fully.

Helal Ahammad et. al. reported in IPCC Working Group III – Mitigation of Climate Change Chapter 11 “Agriculture, Forestry and Other Land Use (AFOLU)” about the opportunities for mitigation include supply-side and demand-side options. On the supply side, emissions from land-use change (LUC), land management and livestock management can be reduced, terrestrial carbon stocks can be increased by sequestration in soils and biomass, and emissions from energy production can be saved through the

substitution of fossil fuels by biomass (*robust evidence; high agreement*) .
On the demand side, GHG emissions could be mitigated by reducing losses and wastes of food, changes in diet and changes in wood consumption though quantitative estimates of the potential are few and highly uncertain.