CLIMATE CHANAGE TRIGGERED SECURITY THREATS: A STUDY ON FOOD AND WATER SECURITY IN SRILANKA

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MASTER OF PHILOSOPHY

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DECLARATION

I declare that the dissertation entitled "Climate Change Triggered Security Threats: A Study on Food and Water Security in SriLanka" submitted by me in the partial fulfillment of the requirements for the award of Master of Philosophy is my bona fide work. This has been done under the guidance and supervision of Prof. Mahendra P. Lama. The dissertation has not been submitted for the award of an M. Phil. degree in this university or any other university.

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We recommend that this dissertation be placed before the examiners for evaluation.

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LIST OF ABBREVIATIONS

ADB	-	Asian Development Bank
AOSIS	-	Association of Small Island Developing States
AR	-	Assessment Report
B.C	-	Before Christ
CBF	-	Cultural-Based Fisheries
CCD	-	Coastal Conservation Department
CDM	-	Clean Development Mechanism
CEPOM	-	Committee on Environmental Policy and Management
CO	-	Carbon Dioxide
COP	-	Conference of Parties
CPR	-	Common Property Resource
CSA	-	Climate Smart Agriculture
DIC	-	Developing Island Countries
DMC	-	Disaster Management Centre
DS	-	Divisional Secretariats
EIA	-	Environmental Impact Assessment
EPL	-	Environmental Protection License
EL NINO/ENSO	-	Southern Oscillation
FAO	-	Food and Agricultural Organisation

FIM	-	First Inter-Monsoon Season
FO	-	Farmer's Organisation
FSB	-	Food Security Bank
FSR	-	Food Security Reserves
GDP	-	Gross Domestic Product
GEF	-	Global Environment Facility
GFSI	-	Global Food Security Index
GHG	-	Greenhouse Gases
GHI	-	Global Hunger Index
GN	-	Grama Niladhari
GNI	-	Gross National Income
GNP	-	Gross National Product
HFA	-	Hyogo Framework Action
HG	-	Home Gardens
HIV/AIDS	-	Human Immunodeficiency Virus Infection and Acquired Immune Deficiency Syndrome
ICZM	-	Integrated Coastal Zone Management
IDS	-	Island Developing States
IMF	-	International Monetary Fund
IPCC	-	Intergovernmental Panel on Climate Change
ISACPA-	-	Independent South Asian Commission on Poverty Alleviation

JICA -	-	Japan International Cooperation Agency
LDC	-	Least Developed Countries
LTTE	-	Liberation Tigers of Tamil Elam
MDM	-	Millennium Development Goals
MHG	-	Multi-layered Home Garden
MOF	-	Ministry of Fisheries
MSL	-	Mean Sea-Level
NAP	-	National Adaptation Plan
NCB	-	Non-Climatic- Brown
NCCAS	-	The National Climate Change Adaptation Strategy
NCRE	-	Non Conventional Renewable Energy
NDE	-	National Designated Entity
NGOs	-	Non Governmental Organisations
NIVs	-	New and Improved Verities
NWSDB	-	National Water Supply and Drainage Board
PPP	-	Purchasing Power Parity
PTF	-	Presidential Task Force
RBE	-	Reddish-Brown Earths
REDD	-	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, and the Role of Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks in -Developing Countries

RYL	-	Red-Yellow Latosols
SAARC	-	South Asian Association for Regional Cooperation
SACEP	-	South Asia Cooperative Environmental Programme
SAWTEE	-	South Asia Watch on Trade, Economics and Environemnt
SLNF	-	SriLanka Nature Forum
SPFS	-	Special Programme for Food Security
SPOCC	-	South Pacific Organizations Coordinating Committee
SPREP	-	South Pacific Regional Environmental Programme
SWM	-	South West Monsoon
UNDESA	-	United Nations Department of Economic and Social Affairs
UNDP	-	United Nations Development Programme
UNFCCC	-	United Nations Framework Convention on Climate Change
UNMDG	-	United Nations Millennium Development Goals
UNO	-	United Nations Organisation
UNOHRLLS	-	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States
UNP	-	United National Party
UN	-	United Nations
WB	-	World Bank
WFP	-	World Food Programme
WTO	-	World Trade Organisation

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CHAPTER 1

INTRODUCTION

A couple of years have passed with outrageous events engendered by climate change that drove the global community to find an immediate solution to deal with it. No other issue has received such ample attention globally and lead to tremendous debates and discussions at international security framework like climate change has. The global community has witnessed enormous dangerous impacts due to the changes over the earth periphery far exceeding scientific predictions. Beyond the environmental security standpoint, climate change should assume more importance in the political, economic, social and cultural spheres of each society. At this juncture, small island developing countries will be the most who suffer due to their geographical limitation to cope with this phenomenon. Therefore unanimous and holistic actions are mandatory to address exacerbated events of climate change. Climate change opened a new wave of dilemma regarding the scope and ability of old structures and institutions of statehood to handle its worsening events at international security framework.

1.1 Security: Traditional Vs Non- Traditional

The notion of National Security conventionally refers to the means to protect territory and sovereignty of a state from external threats emanating from outside of its borders such as war (military) and aggression. In this backdrop, national security primarily concerns the use of military defense to handle threats on territorial integrity, autonomy, and political order, especially from foreign states. It is, therefore, security in two ways "Security, in an objective sense, measures the 'absence of threats' to acquired values, in a subjective sense and the 'absence of fear' that such values will be attacked" (Wolfers 1962:149-150). At this juncture, security itself has become controversial and now passing through the prism of arguments and counter arguments related to its defined hitherto theoretical grounds due to the flourishing of various non-state actors by the twenty and early twenty-first century like globalisation, environmental degradation, climate change and natural hazards, epidemics, transnational crimes etc. The vulnerability caused by non-traditional security threats has the potential to weaken territorial structures and

institutions, especially in small states within the international system. For Buzan he identified vulnerabilities are economic and ecological verities that have become integral components of security definition. From the inclusive definition of security, it is necessary to elasticise to include newer and complex security concepts.

The end of the Cold War earmarked the emergence of a new wave of security studies and a new era of political environment that opened theoretical evolution by incorporating with the emergence of security threats and factors other than military in a pragmatic sense. The threat perspective of national security has given priority into two ways direct organized violence from other states or coercion from others by the means of strengthening their military and ways like economic blockades. The characteristics of threat perspectives have been changed tremendously when the security realm has occupied by newer issues which are specifically related to humanity. This has drastically made changes on the rigidness of orthodox conventional perspective of security concept thereby it underwent a radical-redefinition. Therefore the referent object of national security has shifted from state to individual and people.

The movement for the reconceptualisation of traditional security was initially pioneered by Barry Buzan, Ole Waever and Jaap de Wilde of the Copenhagen school. The necessity for broadening of security was the main concern for Buzan when he recognised the far reaching impact of newer threats which is mushrooming and spreading beyond the borders. Therefore he elaborated the notion of national security concept into three major dimensions as individual, state, and international system. In which he again elaborated major security areas that need to address under the banner of national security such as political, economic, social, and environment through his work '*Peoples, State and Fear: An Agenda for International Security Studies Post Cold War Era'* (Buzan 1983: 120-124). Later on his work "*Security: A New Framework for Analysis*" he further emphasised the inter-relationship between military security and non-traditional security concepts as environmental security for the sustainability of planetary bio-sphere and other major security concerns like political security for the organizational stability of the state, economic security for access to resources, financial security and societal security.

He again added that these security concepts cannot operate in isolation (Buzan 1998:433).

The realism always is sensitive to impending war and this perception owes to the importance given to sovereignty of the state. Thereby it could undermine the non-conventional perceptions of political community. In the present context conflict for quest for power takes place within the state rather than from outside the border and of course, realism and its means and methods are incapable to address human security threats. Because the conventional notion of security is narrow and depends on the sovereignty principles of state (Walker1990: 07). From the non-traditionalist discourse Ullman dealt with comprehensive and drastic conceptualisation of security. By evaluating the notion of security he emphasised that the threats emanating from out of border are less dangerous than the threats emanating from within the country. He defines national security on the grounds of the scope and drastic impacts of threats. His view point identifies two ways that threaten national security 1) threatens the life of the inhabitants of a state by degrading the quality of life for a brief span of time or 2) significantly narrows down the policy choices of government or other governmental, non- governmental and private entities within a state. By arguing that the disruptions to the first category ranges from either external war or rebellions within the state like blockades, or natural calamities like catastrophic floods, massive or pervasive droughts, and decimating epidemics. On the other hand, the second category illustrates the degradation of the quality of human life predominantly during the war. Even if the war may not happen, the society has to undergo a situation with all its vigour. Furthermore, there are vast differences between the threats to 'national security' posed by nuclear weapons and those posed by catastrophic natural disasters'. The reasons that threats such as nuclear ones emanate from the human mind, and human minds can be negotiated with and such incidents can be remedied and the costs met. On the other hand, he exemplifies natural hazards like earthquake and floods have no mind of their own thus it cannot be deterred or the cost cut (Ullman 1983: 133- 138).

Individual security became the major object of international security framework at the end of the Cold War in 1989 and it has gained its full figure in 1994 as common security

or human security. Rothschild has identified four Redefinition of security from the conventional view point is a turning point in international politics it has been divided into four major segments:

- Security of nations to Security of individuals and communities; extended downwards from nations to individual.
- Security of nation to security of international or supranational physical environment; extends upward looking from nation to the bio-sphere. It set sort of entities whose security is to be ensured
- Concept of Security extended horizontally;
- Political responsibility for ensuring security; as enjoying all these rights (Rothschild 1995: 53-54).

However human security does not totally replacing the state centred security with the security of people rather it tries to mutually interlink. The proponents of human security concept underscored that the security of state from the foreign countries remains the same because it is the necessary condition for the security of its people, though the larger paradigm of national security upholds state would be the single referent object is not sufficient and meaningless to admit at the present context.

1.2 The Environmental Security Discourse

Among the new approaches, 'Environmental Security' is another security discipline that arose in international relations by the seventies. As a discipline environmental security approach is diverse in its character. The environmental discourse has come into its robust era while the conventional security paradigm seems too narrow. It was a great requirement that emerged from different areas of security studies in global politics during the nineties. While seeing environmental protection as an urgent need and to cope with its possible impacts, certain strategic political initiatives were set forth by several summits, meetings, agreements and contracts internationally. In the field of geopolitics the term environmental security deals with the status of high politics. In 1977 Lester Brown argued that "environmental issues have become matters of national security". Brown's insights received a more elaborate theorization in the work of Ullman, who in 1983 identified a list of environmental problems, including earthquakes, conflicts over

resources and territory, population growth and resource scarcity and stood for the redefinition of national security.

Likewise Myers argued that without environmental security all other forms of security become worthless…in short, Myers argued that "environmental security is our ultimate security" (Myers 1993a quoted in Buzan et al 1998: 71). But elevation of environmental security to the same status of state security has been criticised by several scholars like Deudney and Marc Levy. Tremendous explanations are aligned with the evolution of ecological concerns in the political arena. The green revolution in political ecology came in to the frame through the publication of '*Silent Spring'* by Rachel Carson in 1962 (Hough 2014: 6). A major milestone in the pathways of the growth of environmentalism in the international political was marked by "Biosphere Conference" which was the first intergovernmental meeting of UNESCO in 1968(ibid: 8) and the idea improved the understanding of complex environmental problems. Subsequently environmental discourse has gained momentum in international political realm since the United Nations Conference on Human Environment at Stockholm in 1972 (Buzan et al 1998:72).

Realists often considered that the issue of environmental security belongs to the category of low politics rather than high politics of security (Trombetta 2009: 132). They were of the opinion that including environmental security issues in the larger spectrum of security concept would undermine the actual meaning and theoretical hegemony of conventional security. But she argued that environmental degradation will most likely lead to conflicts and economic wreckage, this would be a serious threat to the peaceful existence of elements of state (Trombetta 2009: 166) whereas Deudney strongly opposed the move of connecting environmental degradation and national security. His foremost argument is that both environment and violence are entirely different though they could both destroy human wellbeing. However all possible threats on life and property are not the direct threats to the national security. He opines that newly emerging human security issues which degrade the quality of life such as epidemics, floods and droughts are just a threat which cannot be considered parallel to national security (Deudney 1990: 461-463). The traditionalists strongly believed that the inclusion of environmental security into the

classical national security paradigm would degrade the conceptual legacy of international security. .

1.2 Human Security, Climate Change and Securitization

Human Security the term coined by Human Development report of 1994 intrinsically upholds people centred security in contrary to conventional security view. The report argues that the traditional view of security is no longer concerned about the security of ordinary people rather its concerns were about war and territorial integrity from nuclear threats. The concept of human security on the other hand is more reliable to the global community to deal with their security matters rather than the narrow state centric view embodied in the national security context. Human security concerned about protecting individuals from all possible chronic threats as dangerous diseases, hunger, and repression and it also ensures protection from sudden harmful events and hazards. Individual or personal security is the foremost focal point of human security while national security believes on the fact that the people are safe when the state is safe from external aggression (UNDP 1994: 22).

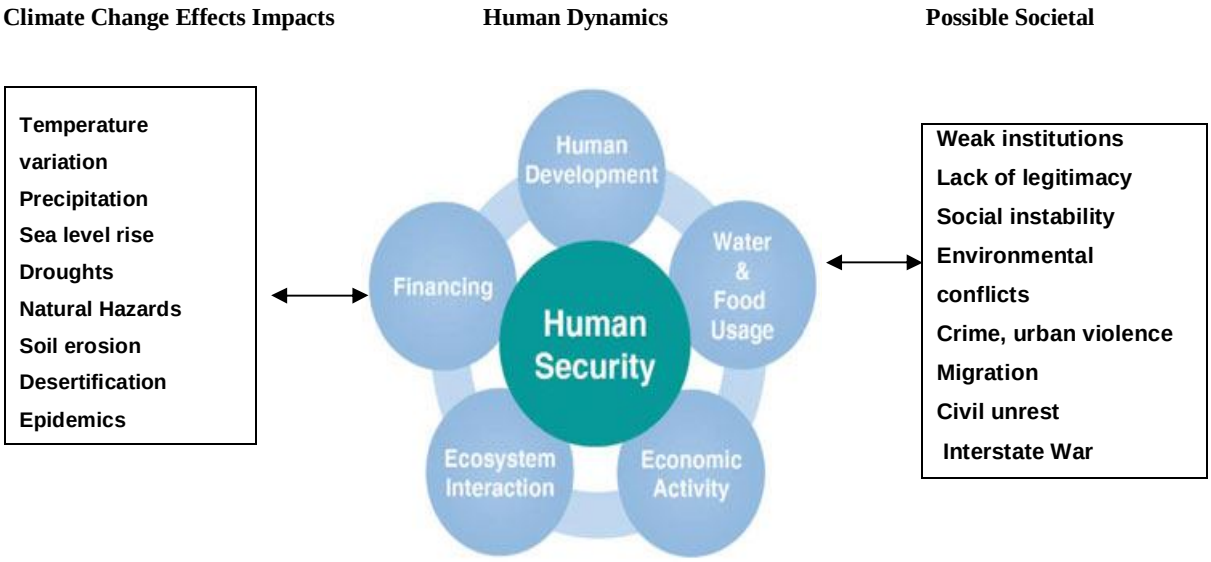
The human security approach could reinterpret realist perspective of threats horizontally by viewing individual security as the crucial part in the present security realm. It is due to this that Kofi Annan remarked that "Human security can no longer be understood in purely military terms. Rather, it must encompass economic development, social justice, environmental protection, democratization, disarmament, and respect for human rights and the rule of law". Furthermore, he envisioned security of future generation, along with freedom from fear and freedom from want. It is important to consider the fact that violent conflict that is a threat to human insecurity could be caused by climate change too (Barnett: 2006). For instance Darfur[1] had gone into a serious conflict in the year of 2007 as a result of environmental degradation posed by climate change, especially less rainfall for a long time. The climate change factors by themselves does not cause violent

[1]Darfur is located in Chad, African region resulted into serious tensions among farmers and dwellers due to decreases in rainfall at 30% for forty years and the issue had been recognised by United Nations Environment Programme in 2007 (Brown 2007: 1143).

conflict, but rather the effect of the changes play a role important in generating violent conflict. The former UN General Secretary Kofi Annan defines human security as:

> "Human security, in its broadest sense, embraces far more than the absence of violent conflict. It encompasses human rights, good governance, access to education and healthcare and ensuring that each individual has opportunities and choices to fulfil his or her potential. Every step in this direction is also a steep towards reducing poverty, achieving economic growth and preventing conflict. Freedom from want, freedom from fear, and freedom of future generations to inherit a healthy natural environment- these are the interrelated building blocks of human- and therefore national-security"[2].

Figure: 1.1 Dynamics of Climate Stress, Human Security and Societal Implications



Source: Adapted from Scheffran & Battaglini (2011:29)

Interlinking human security and climate change has become contested. There are two major factors which supports the inter connectivity of these as the environmental changes has already framed as an issue of peoples life, dignity and values apart from science. Because it remains inevitable to identifying local, regional and global environmental

[2]UN Secretary General Addresses at International Workshop on Human Security in Mongolia, *Press Release SG/SM/7382*, [Online: web] Accessed on 20 July 2017 URL: http://www.un.org/press/en/2000/20000508.sgsm7382.doc.html

changes as biodiversity loss, land degradation, etc has putting impact on biophysical systems which are directly related to human survival like agriculture, coastal zone, and water resources. The second reason has identified that there is a tendency to downplay the catastrophic events and issues of development, social justice into the aggregated notion of welfare. The real treating issues have been absolutely sidelining. At this backdrop, the securitization of environmental changes has become prominent and prioritizing the rights and needs of individual or community in contrast to state sponsored securitization (R. Matthew et al 2010: 15-17).

The human security concept has identified seven fundamental areas which need securitisation as economic security; freedom from poverty, food security; healthy accessibility of food, environmental security; protection from dangerous events, degradation of resources, personal security; physical safety from violence, Community security; protection from discrimination, and political security; enjoyment of political rights (Paris 2001: 91). In which food security is one of the major area which may be able to undermine all the other security areas. As of now environmental degradation and natural disasters and conflicts are recognised as the hurdle to ensure food security to the people. For instance the drought years in Africa witnessed famine and civil conflicts (Human Security Now 2003: 14). The water is another human centred issue which has become another important human security issue especially under the present climate change scenario.

1.3 CONCEPTS OF FOOD AND WATER SECURITY

Food and Water are two basic and fundamental ingredients for human survival. People cannot live without these as they are interconnected and there are no alternatives for these valuable resources. Food security is in generally described under three essential elements, namely: (1) availability of food, i.e. the amount and the quality of food available globally, nationally and locally and which can be affected temporarily or long- term by many factors including climate, disasters, war, civil unrest, population, agricultural practices, environment, social status, trade etc. (2) Accessibility of food, i.e. whether households have the purchasing power or other entitlements to buy food, which can have an effect on the person's ability to access and afford sufficient food and or associated with age, social

status, gender, income, geographic location and the ethnicity etc.., and (3) utilization of food, which is at the household level, sufficient and varied food that provides nutrition and boosts immunity.

The fundamental understanding of food security concept arises from the definition of Food and Agricultural Organisation on global food security – "Food security is a situation that exists when all people at all times have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2001). This definition provides clarity about food security. The physical and mental health of an individual is deep-rooted in the grounds of his consumption of nutritious food. But to acquire sufficient basic food for a person's dietary needs has not yet become possible widely. The fundamental idea of this definition outlines three main components which simplify the actual meaning of food security as food availability, food accessibility, and food utilization. The availability food refers the reserved physical presence of food for consumption; accessibility refers to the socio-economic circumstances that support attaining sufficient food at any required time. The utilization of food determines the way household receives and absorbs the nutritious content from the food which they have access to.

Food security has to be the prime goal of every society and nation due to it being a fundamental requirement of life sustenance. The concept of food security arose as a response to a series of starvation and poverty in past times. Food for all people at all time is a status that cannot be maintained by many of the regions in the world as some are yet insufficient to provide their population with nutritious food such as Africa and South Asia. This was one of the main reasons behind the great coming together of regions for the first World Food Summit in 1974, a landmark in the history of food security. This summit defined food security as "availability of all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" (UN 1975).This is considered to be the first-ever definition of food security.

The concept of food security kept being reaffirmed several times after 1974 by various summits and conferences according to the changing perception of food as an indicator of

a sustainable life of the people. Food and Agricultural Organization itself contributed different dimensions of food security by recognising the necessity to broaden the concept time in time to adjust with the rising demand for food and increasing scarcity of the flow of its production, distribution, and utilization. This led to many definitions which are seen in the policy arena. In 1996 FAO reconceptualised the notion and has become widely accepted as "Food security exists when all people, at all times, have physical and economic access to sufficient food to meet their dietary needs and food preferences for an active and healthy life". (FAO: 1996).

Hunger arises in the interstices of the strands of greater productivity, growing population, economic specialization and surplus appropriation, and uneven unfolding and interaction over time, against a background of natural variation in the resources and hazards affecting food production (Milliman and W. Kates 1990:10). In the historical times, hunger or food crises were common everywhere and had been influenced by human and natural environments. Food crises, then as now, arose from a sharp reduction not of produced food, but of available food. Food crises originated from distinct factors as physical surrounding, the climate, agricultural technology and maladministration. Adding to those are trade and transport, disruption of the physical movement of necessary foods due to the occurrence of war, conflict, piracy, and recently natural calamities (Milliman and W. Kates 1990:126). These different circumstances are spread in an uneven manner and have different impacts according to areas. Climatic variations are shockingly on a rise in the present situation. The Food and Agriculture organization in its recent study identified that climate change became a major threat to the ambition of ending hunger, achieving food security and improving nutritious food availability in the global scenario. Satisfying the growing number of the population would require at least a 60 percent food production increase in the coming decades[3].

The combination of limited resources and population increase is considered to be the main cause of tremendous expansion in the demand for food, and thereby over-exploitation of land for agricultural production is increasing. The unprecedented

[3] FAO (2016), *Climate change and food security: risks and responses*., [Online: web] Accessed on 15 January 2017 URL: http://www.fao.org/3/a-i5188e.pdf

demographic increase is overwhelmingly located in the developing countries where birth rates are highest and population age structures are youngest. In fact 95% of the 2.603 billion increments which the United Nations projects for the period 1990- 2020 is expected to occur in the developing countries. (Tim Dyson1996:11).It is important to ensure food availability for all and to guarantee that people would able to attain their food through adequate physical, social, cultural and economic conditions for an active and healthy life. Occurrences like natural disasters, economic collapse or lack of economic development are the root causes of food scarcity in many cases (Mukherjee 2012:4).

Food security and livelihood security is a combination of several factors that are mutually interconnected. For a country, its topography, geographical patterns, climatic conditions and variations, agro-ecological patterns, population, infrastructure, economic facilities, and water requirements are main players in the fulfillment of food security goal. All these factors may not be favorable at a given time in a given place. The food security has been divided into three major segments as Food availability, accessibility, and utilization. The proper functioning of these parameters will guarantee the food security of a nation. This is the stability of food in both national and household level. But it can be affected by natural and socio- economic factors, conflicts, disease and other factors that are particular to certain countries.

1.4 The concept of Water Security:

Water is the greatest gift of nature to the world and a renewable resource which is abundantly available and had been utilized in the past decades without any restrictions or considerations. But today the resource has been encircled within the sphere of “security”, because it becomes a thread of many security issues. Water can play a vital role in the poverty equations through its various impacts on food associated factors. The availability of fresh water resources in the future is in a twist because the quest for development and people's demands on the high intensity of lifestyle has been affected the purity of water resources in multiple ways. The ministerial Declarations of the Second World Water Forum (WWF) in Hague in 2000 had fist introduced the concept of ‘water security’ found that it would be the serious concern of this century, and it also bring threats on other

several security concepts as; societal security for meeting basic needs, food security, environmental security, political security on the issue of sharing water, human and gender security, economic security in terms of valuating water.

The securitization of water has a recent origin and is a complex concept derived from environmental security aspects of the twenty-first century. The issue of water is highly sensitive in nature and has different diversifications and impacts in different parts of the world. In some places, water resources are dwindling and people are unable to accesses enough water for their needs and in some other places water becomes an issue of hostility between countries and even between states within the countries and at times, it becomes an issue leading to even war. Grey et al defines "Water Security" to be "the availability of an acceptable quantity of water –related risks to people, environments and economies", (Grey and Sadoff 2007: 545-548).

Climate changes in the recent periods highly exacerbate the security perspective of water. The greenhouse effects triggered climate changes will exacerbate effects on fresh water availability and water quality. The changes occur in precipitation patterns will affect fresh water runoff, and flood risk in low lands also and frequent drought. Therefore "Achieving water security for the sustainable production of food and rural livelihoods while maintaining or improving the quality and biodiversity of the natural resources and ecosystems is one of the key challenges of the early 21st century".

1.5 Evidences of Climate Change and its Impacts on South Asia

Climate change seems to be a draconian problem facing humankind today. Scientific studies estimate that the climate change impacts would exert an extra stress over the already existing vulnerabilities of many developing countries in the world. In account of this, various climatic events have become a routine occurrence in South Asian region and it has become highly prone to severe effects that could unravel its economic and social stability. South Asian region has a geographic diversity comprising of rich arable land, forests, oceans and mountains which are vulnerable to various natural calamities. Having two island states and numerous mini scattered islands, coastal shoreline states, land locked hills and spatial plane countries are in one or another way the region is

jeopardised with climate change triggered natural hazards as flood, cyclone, earthquakes, and tsunami.

Agriculture occupies a major chunk in the economic sectors of a majority of its middle and low income countries and a plays a significant role for generation of national income. At present, increasing population, degradation of resources, endless famine and food security troubles, and inappropriate capacity to mitigate such events, are considered to be the leading problems in South Asia. Implications of climate change seriously threaten food security of South Asian countries particularly India, Pakistan, Bangladesh, Maldives, and Sri Lanka. According to the FAO (2009) report about 456 million people in South Asia are undernourished. Serious climate changes including the rapid increase of temperature, unpredictability in seasonal changes, storms, floods induced by high rainfall, droughts, and changing rainfall patterns are the challenges which South Asia faces today.

The Stern Review on climate change prediction for 2020 states that Climate change threatens the basic elements of life for people around the world access to water, food, production, health, and use of land and the environment(. This prediction about the economic costs of climate change, talks about the present situation of South Asian countries. Food and water are the two major components that come under threat according to the review. Glacier melting and frequent occurrences of flood curtails the availability of ground water especially in the Indian subcontinent. Declining crop yields are another serious problem that can pull down the economic development and food and health security of millions of people residing in this region.

The common challenges confronting the South Asian states have to be understood from human security perspective and the governments have to be sensitised to the issues of poverty, food scarcity, non-availability of drinking water, housing and shelter and energy, ethnic marginalisation (Rahman 2000: 16). Out of which issues food scarcity and non-availability of drinking water are extremely severe due to climate changes.

Aforesaid climate change or climate variability is a major factor can undermine the ability of a nation to feed their population with sufficient or quality food grains. Studies over a period unanimously found that climatic variability has been an unavoidable

challenge which prevails in the present century where many of the developing and underdeveloped countries struggle for poverty eradication and healthy life for its citizens. In this backdrop, South Asian region is not spared from the glaring problems of poverty and famine. Though out of the countries of South Asia Sri Lanka has fared better in efforts to fulfil food security in the recent periods. But the situation is not safe due to the changing pattern of diet of people and their dependency on imported foods for daily life requirement, growing tendency of climatic challenges in multiple ways, low level of agricultural performance, and household food insecurity in rural areas.

The factors include the sensitivity of resources such as yields, freshwater, soils, reefs and fisheries to sudden and incremental changes in climate, the degree to which households and communities rely on these resources to meet their needs and values, and the capacity of social systems to adapt to changes in the temporal distribution and abundance of these resources so that households' and communities' needs and values can continue to be satisfied (Barnett: 2006).

This study is undertaken to build up a case for this broad conceptualization of human security within climate change. Human security demonstrates variety of threats that are more transparent to evaluate within the security realm. Border disputes, migration, social stress, and humanitarian crises, resource shortages being the anticipated consequences. The present study has focused on island country SriLanka which is especially sensitive to all the identified climate change impacts in South Asia. In accordance with the human security concept threats such as food security and environmental security issues like water degradation, sea level rise, floods, and drought are the major issues the SriLanka is confronting today.

Objectives of Study

i. To examine the scope of how environmental and human security could fit in the larger dynamics of national security
ii. To assess the effectiveness of human security approach to study various dimensions of climate change impact
iii. To elucidate how the problems of island nations are peculiar in the context of climate change impact
iv. To assess the issue confronted by SriLanka in terms of understanding and managing the impact of climate change
v. To examine the state of food and water security in SriLanka
vi. To assess how climate change impacts food and water security in Sri Lanka and what the implications are
vii. To examine the state of preparedness in Sri Lanka in making people secure both in terms of food and water in the of backdrop of climate change impact

Hypotheses

i. Climate change impact could dislocate the entire political economy of Island nation SriLanka if food and water security are not managed effectively.
ii. Regional arrangements and mechanisms to deal with climate change impact could make inter-dependence between South Asian countries much wider and deeper.
iii. Unless Sri Lanka's mitigation and adaptation policies vis-a-vis climate change are not totally made people centric, the cost of climate change impact could be very high.

Methodology

The study was analytical and empirical in nature and it used both primary and secondary sources of documents from the Government agencies, press releases, and international organisation's reports. The secondary source of data includes books, newspaper reports,

journal articles etc. This case study uses deductive reasoning method to analyse and interpret the existing data to prove the proposed hypotheses. The multi-disciplinary nature of this study covers economic, political and scientific aspects of climate change and its impacts.

Chapter -1 Introduction

The chapter analyses and interprets various impacts and challenges the developing island states are facing in the present climate change regime. Compared to countries in the mainland continent, island states are highly vulnerable to climate change impacts. The study has found that the role of developing island states in the international political regime is increasing vigorously and it could result into a new bargaining alliance in the international political regime. Furthermore the socio-economic and political impacts of the island state due to climate change shows that their future will be uncertain.

Chapter- II Island States and Climate Change: Impacts and Responses

Food and Water security are the prime areas which this study has focussed on and it found that Climate change has posed a real time threat to food and water sector in Sri Lanka. The chapter analyses the climatic variations and it impacts on food and water availability systems in SriLanka and how it undermines their economic development and political stability. The inter linkages between water availability for food production is a serious concern for the self- sufficiency of the nation.

Chapter III- Food and Water Security Sri Lankan Experience

Food and Water security are the prime area which this study was focussed on and it found that Climate change has posed a real time threat to food and water sector in SriLanka. The chapter could analyse the climatic variations and it impacts on their food and water availability systems in SriLanka and how it undermines their economic development and political stability. The inter linkages between water availability for food production is the serious concern for the self- sufficiency of the nation.

Chapter IV- SriLanka Adaptation Policies: Progress and Future Perspectives

This chapter deals with the Sri Lankan Government's capacity to deal with the climate change challenges. The chapter concentrates on the role of international community and their support to SriLanka to make the nation resilient to the frequent climate change events like floods and drought, and the efforts which have already have been taken to deal with such climatic threats. In addition to this the chapter tried to find the environmental policy initiative made by government and the role of multiple actors includes non-state actors, international agencies in mitigating and adaption process. Finally chapter discusses the major findings on the analysed issues regarding changing nature of climate change in island states and SriLanka and more precisely the economic and political condition of SriLanka.

Chapter V- Conclusion

This final chapter discussed the major findings on the analysed issues regarding changing nature of climate change in island states and SriLanka and more precisely the economic and political condition of SriLanka is harmonised with other chapters while making a logical flow**.**

CHAPTER II

ISLAND STATES AND CLIMATE CHNAGE: IMPACTS AND RESPONSES

2.1 Overview

The physical existence of a territory which is surrounded by water[4] is often considered as an island. Such lands are relatively small and are quite different from continents because of its geographic characteristics such as genesis, composition, and magnitude. There are plenty of beautiful islands inhabited by millions of population. The nature and survival of inhabitants have deep rooted relation with their environment and are highly dependent on surrounding seas and oceans. The geophysical features of such islands are found to be sensitive to external threats like Global Warming and Sea-Level-Rise and other accompanying challenges of climate change. Serious environmental degradation and depletion of resources have become a day to day event in most of the island states. Many studies and reports have found that island developing states are highly vulnerable and remain threatened by natural calamities. The driving factors vary from human and climate induced changes in the ecosystem. These concerns are adequately highlighted by these island states in many international negotiations. Despite the clear vulnerable situation of island states they have had not achieve significant remedy on their life sustaining threat. More precisely the fact is that island countries are inferior to the international economic viability thus keep away from justice. This chapter deals the likely impact of climate change on island developing states[5] and their responses at the regional and global level.

2.2. ORIGIN AND NATURE OF ISLAND STATES

The Oxford dictionary defines an Island as "a piece of land surrounded by water" and further elaborates as a land being detached or isolated by surrounded water. An island originates mainly in two three ways. "The formation of a piece of land detached from its

[4]'Continents' are also surrounded by water, not considered as islands because of their larger size and land mass. *National Geographic*, [Online: web] Accessed on 17 June 2017 URL: https://www.nationalgeographic.org/encyclopedia/island/

[5] The island developing states are scattered in the world with multiple geographic features, some are small islands, low lying coral reef atolls and some are archipelagos. This chapter largely focuses on small island developing states which are highly vulnerable.

mainland through sea erosion and it may be a mountain submerged under the Ocean". On the other hand, the evolution of island called as volcanic eruption that is "the creation of a land by the sea due to volcanic action and also a land mass that intensely makes by coral reefs" (A.J. J-Browne 1893: 189). Therefore an island is formed in the Ocean either directly by a volcanic eruption or by coral actions. There are two major class of islands viz., Continental Islands and Oceanic Islands. Charles Darwin viewed the islands from both geological and biological perspective. Wallace mentioned that the Islands originated through volcanic eruption or coralline origin. Such Islands are usually situated very far from continents and fragmented by deep sea like the Oceanic Islands of New Zealand and Seychelles. The other groups as Continental or Offshore islands are bodies of land are far away from the continent shelf. (Wallace 1892).

The low-lying atolls are too small and remote surrounded by the rings of coral reefs that enclose a lagoon[6]. The evolution of a coral atoll is quite a complex process and is inter-related with multiple factors. These include ecological condition of the continent, composition of the coral species, and local area and morphology. The theory developed by Charles Darwin on the formation and existence of atoll in his monograph '*The Voyage of the Beagle*' was the foremost step to the wider understanding of Coral islands. He believed that the atolls get formed when coral organism on the top of the sea grow and reach a point in sea level at latitudes that receive enough sunlight. Thereafter the coral will come up and the island sinks down to the sea. Then it creates a barrier reef that eventually creates atolls[7].

Studies over a period attribute the genesis of atolls to cool volcanic rock getting through the movement of tectonic plates away. However contradictory nature of theories regarding the formation of atolls are continue to exist, there is the assorted type of atolls

[6] A lagoon refers to be the shallow body of a water lies between the major zone of reef development and the shore stands to open a way to the larger water body.

[7] The C. Darwin's theory of formation have been criticised by several researchers thereafter by defining that Coral islands no longer keep pace on sea (Grigg 1982), and Darwin's theory did not explain the trajectories of how other volcanic Oceans forms, but at the same time subsidence is important as he developed, 'Coral Reefs and Sinking Islands: Revisiting Darwin's Other Theory', *Oceans at MIT*, [Online: web] Accessed on 17 June 2017 URL: http://oceans.mit.edu/news/featured-stories/coral-reefs-sinking-islands-incomplete-theory-charles-darwin

in which most extensive islands belong to Pacific Oceans and some are in the Indian Ocean. At present, the countries of Pacific islands like Kiribati and Tuvalu, Marshall Islands and Indian Ocean Islands like Maldives do come under the vulnerability zone. In contrast there is another view attributes that atoll formation also depends on local condition, morphology and anthropogenic influences like infrastructure (Schaeffer & Here 2010). The island developed countries have identified on the basis of certain characteristics they are possessing in contrary to the mainland's features are consists;

a) Smallness
b) Remoteness or Insularity
c) Limited Institutional Capacity
d) Narrow Domestic Resource base
e) Climate Change and Sea-Level Rise
f) Environmental Degradation and Natural Disasters

Because of their basic existing structures island countries has become peculiar to various vulnerabilities of climate change impacts. Briguglio identified such peculiar characteristics are the basic limitation to island countries in her collaborations with global economic discourse and cause to economic vulnerability, fragility and lack of resilience to overcome such disadvantages[8].

2.2.1 Relatively Small in Size

The prime characteristic of an island is considered as its smallness[9] in terms of its land mass, population, economy, and preferences etc. States are usually classified on the basis of multiple variables like area of land, population, Gross Domestic Product, Gross National product, and other related economic indicators[10] (Briguglio 1995: 1615,

[8] Briguglio, L (1995), "Small Island Developing States and Their Economic Vulnerabilities", *World Development*, 2(9):1615-1632

[9] There are exceptional cases to the fundamental characteristic of smaller islands as one finds islands much bigger in sizes like Greenland, Borneo, Sumatra, Hispaniola, Madagascar and Sri Lanka (Granger 1993:157-187 quoted in Wong et al).

[10] GDP or Per capita income do not determine the status of small island states as they reflect neither the compound relation between environmental, social and economic resources and issues, nor institutional weakness and structure existing in Small Island Developing States (Ghina, (2003) "Sustainable

Srinivasan1986: 205, Barnett and Campbell 2010: 156)) and military capabilities. However, in the case of island states three variables are mainly measuring the size and strength of the country as land area, population and Gross National Product because these countries are comparatively small. However smallness is a relative concept because some states are small in size but large in terms of either in population or income. This ecological uniqueness of island states as smallness is found to be the basic common limitation for their economic and political development and accessibility with the outer world. The definition of small states in the words of Rothstein as;

> " *A Small Power is a state which recognizes that it cannot obtain security primarily by use of its own capabilities, and that it must rely fundamentally on the aid of other states, institutions, processes, or developments to do so; the Small Power's belief in its inability to rely on its own means must also be recognized by the other states involved in international politics"*(Rthestein 1968:23 quoted in Keohane 1969:293).

It is not worthy to generalize the peculiar characteristics of small island countries in terms of their security standards in international politics. Security of small island states has become the major concern for international security frameworks as currently. For instance the island country Tuvalu in the Pacific Ocean uphold by their national leaders as the national icon of all island societies to Global Warming" (Connell & Corbett 2016: 594-595) emphasising the vulnerable face of small states under climate security threat.

2.2.2 Remoteness or Insularity

Most of the islands are geographically separated or isolated from the mainland and it is encircled with either sandbar or coral reefs. This physical separation or remoteness of a land by the encircled water bodies or mountains or desert is often referred as insularity (Pungetti 2012: 51). The isolated island communities are inflexible and constrained to maintain their relationship with the people, services and lifestyles prevails in the outer

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Development in Small Island Developing States: the case of the Maldives", *Environment, Development and Sustainability*, 5: 143)

world. In addition to this, in accessibility to the recent scientific and technological developments, economic diversification and communication and information systems have found to be the non-ecological factors that make islands insularity much deeper and wider. This characteristic has made serious barricades over their economic integration with continents. This is much visible in the bilateral trade of Caribbean island states with its largest partner United States; having average distance of 2850 km, similarly the Pacific Island countries is mostly incorporated for trade and commercial purposes with Australia, its neighbouring developed partner is situated about 3690 Km away from them. Therefore the transportation and other infrastructural facilities are critical for Pacific and Caribbean's (Borgatti 2008; 487). Island developing states occupy strategic position in the oceans where power politics of big countries are also located.

2.2.3 Limited Institutional Capacity

Institutional capacity determines the system of governance, to regulate and enforce rule and laws in the internal and external affairs of the state. For island countries also foreign trade requires political openness of their territory. This may expose their political systems to outside world. There are violent conflicts in some of the small island countries like Fiji, Maldives, and Solomon Islands etc. This is where the importance of good governance and political stability play a critical role. On the other hand climate change impact could undermine weak institutions thereby the level of vulnerabilities will likely increase. (Farrugia 2007: 64). For instance Caribbean region has a weak institution since long ago which result into capital constrains and debt. The Caribbean island states therefore facing during the time of environmental shocks the countries are affecting extra burden or higher costs. The Hurricanes Katrina and Ivan affected in New Orleans and Caribbean island of Grenada and cased to damage of 200% of its GDP, in contrast the Ivan did not touch the national income of New Orleans. Furthermore even after the four years the government could not overcome this gravest effect (J. Brown 2010: 58).

2.2.4 Narrow Resource Base

The domestic resource base of islands is another crucial element in terms of vulnerability. Because of less availability of land and both life sustaining and economic resources like

food grains, fresh water, energy, and also the human resources and technological developments respectively have a direct and indirect impact on its development Some island states are largely dependent on international trade for their all economic activities hence they are gaining fewer benefits. More precisely suffers due to uneasiness to diversify its small economies with more at the present liberal globalised economy (Connell & Corbett 2016: 585).

The decades long colonial dictatorship in many islands economies are caused to shrink production into a single commodity like coffee, banana, coconut, sugarcane etc. This made the island states inferior and less competitive in the arena international trade. The islands have high level of openness to agricultural trade and food imports have been quite high. . Diversification of produces became a serious issue also because of poor mobilisation capital/ finance in its domestic markets. Small Island states are dependent on foreign countries for oil and fuels.. However, small islands have a good economic prosperity than the land locked or least developed small countries in the world. On the other hand islands like Honk Kong, Japan and Singapore[11] are small but it cannot be categorised small economy (ibid 2016: 585).[12] Despite the fact, the island states in the recent decade has shown a progressive step to integrated into world economic primarily through utilising the Exclusive Economic Zones (EEZ) along with international tourism the globalisation and integration (Barnett & Adger 2003: 329).

2.2.5. Environmental Degradation and Natural Disasters

Environment is the precious wealth of human life on the earth. It comprises natural biotic and a biotic species, living organisms as humans, animals, plants, and freshwater. The degradation of such resources would result into multidimensional and multifaceted impact on island states as geography, location, and the landmass are peculiar to islands

[11] Singapore is a Small Island Developing Country even though it considered as the first developed city state among the developing countries.

[12] Singapore has high income status , Trinidad and Tobago are high income developing country with GDP per capita US$ 15,500 [Online: web] Accessed on 20 June 2017 URL: http://www.un.org/en/development/desa/policy/wesp/wesp_current/2012country_class.pdf , Therefore "smallness is neither a necessary nor a sufficient condition for slow economic development" (Srinivasan 1986: 207)

tropical challenges. Small island developing States have valuable resources, including oceans, coastal environments, biodiversity. Natural hazards are the most dangerous face of climate change that could devastate or destabilise an entire small island states. “Island biota is generally at a higher risk of extinction and that island extinctions are two three orders of magnitude higher than continental rates for birds and mammals. Extinction risk is strongly associated with limited geographic distribution at a variety of scales” (Taylor & Kumar 2016: 2015). Moreover the islands have very limited capacity to adapt changing environmental fertility.

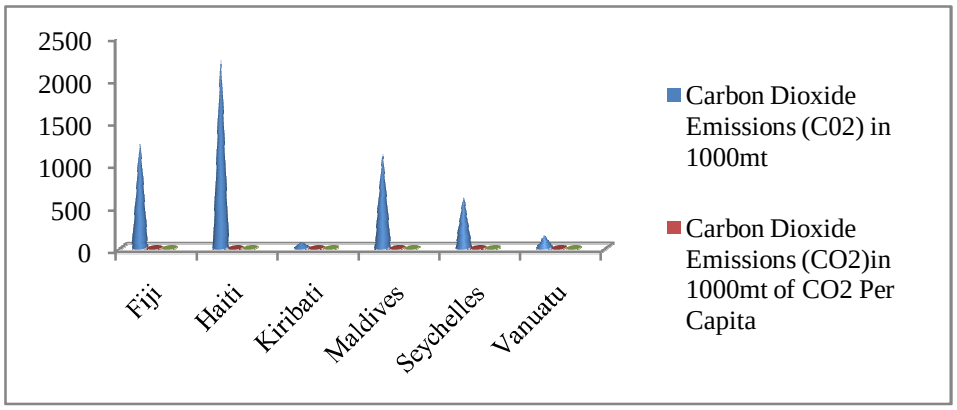
2.3 THREAT OF CHANGING CLIMATE

The climate condition of small island developing states is highly influenced by persisting changes occurring through ‘Global Warming’. This is an abnormal phenomenon that surge virtually the outcome of the combination of greenhouse gases as water vapour, Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulfur Dioxide (SO_2) and Chlorofluorocarbons concentrations in atmosphere, in addition to this deforestation and changing land use patterns are attribute to concentrate greenhouse gas emission at same level (Warric and Farmer 1989:5). This has been exacerbated by human activities (Anthropogenic) like deforestation and burning of fossil fuels (coal and oil) taken place in the industrial era lead produced more greenhouse gases (IPCC 2014:04). Simply put, the climate change as “any change in climate over time, whether due to natural variability or as a result of human activity” (IPCC, 2007: 871). Before the industrialisation period, there was no such evidence global emission or climate change (Goude 2006). As a consequence the global mean temperature has boosted up both in earth surface and atmosphere. Thereby the accelerated mean temperature went up by 0.6°C in the twenty first century. In contrast the projected increase of temperature would be at 1.4°C to 5.8°C at the end of twenty first Century (Pachauri 2006: 109). Likewise global climate change has exaggerated sharply and made changes on weather conditions (Barnett 2000: 195).

The larger context of human security the central issues with regards to island states become the vulnerability posed by climate change. “Vulnerability concerns the process by which individuals, societies and ecosystems are susceptible to harm as a result of climate change”(Adger 2010:276). Along with the vulnerability aspect of the climate

change human security tries to trigger out the justice and adaptive capability of individuals and societies from the all possible harmful threats. At this juncture it is often visible that the island countries are marginalised to the global political economy of climate change.

Figure: 2.1 The Most Threatened Island's Share of GHG Emissions in 2011



Source: UN Statistics, Department of Economic and Social Affairs[13]

Figure 2.1 shows total share of greenhouse gas emission produced by the most threatened islands from sea level rise. According to the UN estimates the CO_2 emission of Small Island from the year of 1990 to 2006 increased at an average annual rate of 2.3 percent. The emission rate was much higher in Trinidad and Tobago in 2006 (UNDESA 2010) but ten times lesser than the higher emitter countries like US, China, India etc.

2.3.1 Sea - Level – Rise and Vulnerabilities

In contrast to the mainland the consequence of Global Warming directly leads to the security issue of sea-level rise in island states. The threat perception posed by sea-level rise to low lying islands and coastal areas by the anthropogenic global warming has been found back in 1980s (Nicholls 2010: 18). There after the sea-surface has continues to rise in a rapid way. The changes occurring on glaciers, the Greenland ice sheet and Antarctic

[13] "Millennium Development Goals Indicators", United Nations Statistic Division, Department of Economic and Social Affairs, [Online: web] Accessed on 28 June 2017 URL: http://unstats.un.org/unsd/mdg/Data.aspx / https://mdgs.un.org/unsd/mdg/Data.aspx

ice sheet due to the global warming cased to thermal expansion on sea-surface and it has substantially increased the sea-level rise in the period between 1992 to 2011 (IPCC 2014: 42). The sea level rise fluctuated due to the typical changes that occurred in glacial and inter glacial chains for a thousand years back in Holocene (Mimura 2013: 281). This phenomenon will likely to increasing in the upcoming years in persistent with the hosting of greenhouse gases. Therefore the likelihood of the rise in sea-level would the most severe threat to Small Island developing states especially the low-lying coastal countries (Pachauri 2006: 109). Barnett and Adgar are defines the special case of atoll countries at this glance. They out lined that atolls are extremely small and isolated islet than with low income opportunities would be the supporting elements makes them highly vulnerable to climate change (Barnett & Adger 2009: 322).

Fifth Assessment Report of IPCC (2014) estimated that low level of warming of 1° to 2°C will threaten sensitive ecosystems of SIDS by undermining their marine ecology and coastal sustainability, and livelihood. The projected global mean temperature for 2081-2100 (base year of 1986-2005) for Northern Indian Ocean estimated 1.5°C is the highest rate among the regions while Northern tropical Pacific and Caribbean, West Indian Ocean is projected to have 1.4° C. Nevertheless climate change can posed higher elevation of fluctuations on sea level and ascribed to the sudden occurrence of cyclones, tide, waves, and tsunami. Therefore Global warming caused to Ocean gets hot and it would result into increase in sea-level through thermal expansion of sea water.

Along with the sea level rise the El Nino effects, tropical cyclones, trade winds and hurricanes are the intertwined catastrophic events in Islands and makes them vulnerable. There were five successive El Nino events between 1991 and 1995, and a severe El Nino again in 1997/8 with associated drought in the Marshall Islands. The effect of global warming on cyclone activity is also uncertain. Some research suggests that there is unlikely to be any change in the frequency of tropical cyclones, but they may be some 10-20% more intense, creating potentially catastrophic impacts from waves, storm surges and wind. For instance Guam a developing island in the western part of Micronesia in West Pacific Ocean experienced worst El Nino in 1983. The island did not face any ground of water shortage before experiencing El Nino effects. After the event the island

witnessed drying up of rivers and abandoned water storage due to drought and spread of grass fires[14].

Inundating a significant area of an island would be a serious threat to the island states. Particularly their low lying wet lands and coastal vegetations are the basic ecosystem that safeguards the bio-diversity. The low elevated Maldives with 188 inhabitant islands and 25 low lying coral atolls are gone to massive vulnerable effect highly vulnerable due to climate change and rising sea level. 80% of its total land area stand above less than 1 meter above sea line (UNESA 2010& IMF 2016). Many of its low lying coral atolls are already uninhabited due to floods 37 of its islands have submerged as consequences of continuous floods. The impacts such submergence, evacuation, salt water intrusion are likely to be shuffled with sea-level-rise.

A study has found that climate migration tendencies are high in Pacific Island Countries especially Tuvalu has no land above 2 meters of sea level. Thousands of population residing in such atolls and low-lying islands are compelled to evacuate people and relocate within their own limited land. The country has become totally affected be the coral depletion (income source), fresh water scarcity due to drought periods are pushed the densely population to resettle in neighboring destinations (Mortreux & Barnett 2009: 106). The similar incident has occurs in Kiribati is one of the most threatened island states lying on the middle of central Pacific Ocean. It is vulnerable to the far reaching effects of sea level rise. The people of the country have already lost their home and infrastructure facilities. World Bank outlined that about 25 to 54% of the land in south Tarawa and 55-80% in north will get inundated by mid twenty first century and the economic cost would be about $8 million-$16 million. Country's GDP is not enough to cope with these effects. These impacts threaten life of the people, undermine fresh water availability, and destroy limited arable land and coastal shorelines and pastures. (UNESA 2010: 11). Such extreme vulnerable situations are pouring other socio-economic implications on the same group of people.

[14] Kevin, R, Kodama, "Guam and EL Nino", National Weather Forecast Office, Hawaii, [Online web] Accessed 15 July 2017 URL: http://edev3.socialsciences.hawaii.edu/temp/hazards/5%20Publications/Guam%20and%20El%20Nino.pdf

2.4. ECONOMIC AND SOCIAL IMPACTS OF CLIMATE CHANGE

2.4.1. *Implications on Income and Livelihood*

Fisheries and agriculture are the two major livelihood sectors facing threat. They are dependent on fisheries as a traditional means of food security and earning income through exports. The low lying states like Marshall Islands, Tuvalu, and Kiribati are earning half of its national revenue from fisheries exporting. , Period 2004-2013 has shown 8 fold increases in their income while it was 10 fold in between 2000-2004[15]. Similarly fisheries sector play an important role in the national income of Fiji, a study has attributes that coastal fisheries show decline in catch due to climate change while it contributes around 42% of total fisheries production of the country. It further added that the decline of coastal fish harvesting would threatens serious food security implications on the dwellers. Moreover under the non climate - adaptation circumstance fish production of fish production increasing at a negligible rate (Dey et al 2016: 168).

2.4.2 *Coastal Degradation and Beach Erosion*

The coastal vegetations, mangroves, corals, salt marshes and tidal flats are affected and cold even destroy the species around the ecosystem The encircling of coral reefs is an important system because of their natural protection function and as a source of sediment. For this reason, the preservation of coral reef environments is critical to maintaining the natural ecosystem. The extreme heat stress on coral reefs would undermine its life and lead to beach erosion. The coral reef organism is the essential life sustaining system of Islands. At a time it provides livelihood, income, and security, to the islanders. . The coral reef system encourages tourism, fisheries, and protects the land from various climate change hazards likely storms, typhoons etc. In recent years the coral reef system appeared to be degrading and losing its natural beauty because of rise in sea level temperature. If the sea temperature increases at about 11° C it could cause coral bleaching which is reported to have occurred in 60 island countries in Indian Ocean, Red Sea, Persian Gulf, Mediterranean, and Caribbean (J. Blau 2017: 19).

[15]UNO, (2016), *Statistical Year book for Asia and Pacific 2016, Sustainable Development Goals Baseline Report*, United Nations Economic and Social Commission for Asia and the Pacific, Bangkok, p. 37. [Online Web] Accessed on 14 July URL: http://www.unescap.org/sites/default/files/publications/ESCAP_SYB2016_SDG_baseline_report.pdf

Marine biodiversity is a spontaneous element of island ecology that protects islands sustainability and heritage. It comprises of wide varieties of coastal vegetation, flora and fauna, mangroves, reefs, and other biotic and a biotic species etc. It provides nutrition, resources for economic, social and cultural development, and herbal medicinal base. The loss of biodiversity could undermine food security of the islands. (Cherian 2007: 128).It is clear that many of the island states are the creation of coral reefs through their physical togetherness. Studies have shown that coral bleaching or coral mortality can even lead to coral reef degradation in long run. The climate change threat on corals has been identified seriously under risk in small island states even in the lower greenhouse emission scenario. Thereby under the 1-2° C temperature is caused to coral bleaching widely (Nurse& Moore 2007:107).

2.4.2 Depletion of Fresh water

Water security has become a national security concern for many island developing countries. Climate change constrains availability of fresh water resources as acidification, salinisation, and rainfall variability increase. The long extending dry period leads to difficulties rapid spread of water-borne diseases. There are many island states that depend on rainfall for fresh water whereas many Caribbean islands use desalinised water for their daily needs (Cashman 2014:1192). The ground water availability in the recent days become scarce and such islands are compelled to use desalinised water sources[16]. Tarawa in Kiribati and Funafuti in Tuvalu are completely destabilised with ground water depletion. Such countries are depending on international aid to build water tanks and for rainwater harvesting. The severe water shortage in Tuvalu had required importing fresh water from New Zealand. ("Australia must not be afraid of its obligations to Pacific climate migrants", *The Guardian*, 10th November 2015)[17] . The World Bank estimated

[16]Perspectives on water security in Caribbean Small Island Developing States: Keynote Address delivered by Dr. Edward Greene, Assistant Secretary General, Human and Social Development, Caribbean Community Secretariat to the United Nations High Level Symposium on Water Security, 5 February 2009, New York, *Press Release*, 05 March 2009, [Online web] Accessed 14 July 2017 URL: http://caricom.org/media-center/communications/press-releases/perspectives-on-water-security-in-caribbean-small-island-developing-states

[17] [Online: web] Accessed on 10 July 2017 URL: http://www.theguardian.com/commentisfree/2015/nov/11/ausralia-must-not-be-afraid-of-its-obligations-to-pacific-climate-migrate

(2000) on the economic damages of Tarawa could face US$ 16 million (13-27 of its GDP) and the capital loss will go upward as US$430 million (Barnett 2001: 198).

The El Nino as Southern Oscillation reinforce changes on sea temperature year to year through migration warm waters from the western tropical Pacific to its eastwards (IPCC 2000: 52). Both wet and dry phase cyclones and droughts undermine its water availability, agricultural productivity, health status. It also cause to erosion, soil degradation prolonged drought. The Federal states of Micronesia and Marshall Islands have declared a state emergency due to the 2015-16 El Nino effects including drought. Similarly A study has found that in the period between 1847 and 1993, the annual rainfall fell below at 55% the drought line Barbados was declared as a water- scarce nation by both UNDP and Food and Agricultural Organisation (Boruff and Cutter 2007: 30).

2.4.3 Wreckage of Tourism

Tourism is the key indicator of generating employment and boosting economic growth in many island states. The tourism industry is highly sensitive and affected by the direct impacts of climate change. The frequent occurrences of natural calamities affecting directly as makes changes on the behavior of travelers and dismantling of tourist destinations. The indirect impacts are certainly related to the environmental, social and economic sustainability. The observed changes has take place in the recent periods put deliberations regarding tourism sector on the in Pacific region because it would be the most at risk. The small island country Tuvalu currently become less attractive to the global tourism due to the international recognition as it is fascinated to climate change and natural hazards (Prideaux &McNamara 2012: 583).

2.4.4. Health Security Impacts

The people-centred approach of human security justifies healthy environment with healthy life of humans. The 1990s witnessed emergence of global concerns on infectious diseases like Ebola virus in African Countries and Cholera in Latin America. More prior to this the inter-linking of human security and health impacts in terms of spread of HIV/AIDS epidemic became a global concern(Chen & Narasimhan 2003: 186-187). The increasing temperature and extreme events could result into illness, air pollution and

weather-related health effects and spread of water-borne, vector-borne, and rodent-borne. Diseases like Dengue, Malaria, and Diarrhoea have became most common and chronic in tropical island countries like Papua New Guinea, Solomon Islands, Sri Lanka and Vanuatu etc especially after high rainfall and exacerbated floods. Along with this other climate sensitive health impacts are impact on islands of heat stress, skin diseases, and asthma (IPCC 2007: 689).

2.4.4 Environmental Hazards and Losses

Island countries are the most disaster prone sites. The frequent occurrence of hydro meteorological events (floods, cyclone, storm surges and drought) and geo-physical as earthquakes, volcanic eruptions and tsunamis) are directly could interrupt both economic development and human lives of most small island developing states. The Pacific region had experienced intense tropical cyclones since 1990s. Alongside the sea level rise and increases in annual rainfall, high temperature associated with El Nino had result into high economic damages on their national income and salinisation in their agricultural lands.

Table 2.1 Potential Losses of El Nino associated Cyclone 2014-2015

Country	Annual Average Loss (Million US $)	Potential Risk Factor	Potential Losses due to El Nino Cyclone (Million US$)
Marshall Islands	3.7	2.73	10.1
Tonga	11.7	1.14	13.34
Fiji	94.1	1.04	97.86
Cook Islands	6	1.46	8,76
Vanuatu	44.3	1	44.3

Source: Compiled from UNESCAP 2014/2015[18]

[18]UNESCAP (2014), *El Nino 2014/15:Impact Outlook and Policy Implementation for Pacific Islands,* [Online: web] Accessed on 18 June 2017 URL: http://www.mfed.gov.ki/sites/default/files/UNESCAP%20Report%20El-Nino%20Potential%20Impacts%20in%20Pacific%20Island%20Countries.pdf

The El Nino had posed potential risk in Cook Islands, Tuvalu, and Marshall Islands and prompt serious threat on their economy, about 30-40 % higher than the average of previous years. On the other hand the annual loss of Fiji is higher than the other countries. The El Nino effect hit the nations planting conditions and lead downturn its Sugar price level up to 20% at international Market. Further more in the year of 2016, the Cyclone Winston hit the economy of Fiji caused estimated damage of 31% of GDP. The agricultural production of the country on the same dismantled it and fell about 31% (153,000 metric tons) of Sugar harvest due to Cyclone Zena. This has leaded the country to fiscal deficit and little increase in price level especially food items (ADB 2016)[19].

2.4.5. Forced Displacement and Migration

Vast population displacements could be real corollories of global warming (Kohona 2016). Environmental migration may happen because of extreme events like drought, floods and desertification. However environmental degradation alone may not pressurise people to move to another destination. There are other socio-political and economic factors too. Campbell describes that communities within the atoll states and coastal deltas and flood plains of rivers are likely to migrate due to the destruction of livelihood and security (Campbell 2014).

Though the relationship between environmental vulnerability, migration and conflict possibilities are discussed, this is also contested on several grounds. UNFCCC charter has not yet included any provision on the how climate change influenced migration. IPCC mentioned in its first Assessment Report as to how climate change triggered migration will have the gravest effect. In the Paris conference, the issue of refugees and assistance were discussed to include one clause related to establishing a facility to assisting and safeguard people from the possibilities of migration. (Fry 2016: 108). The issue of environmental migration has already been noticed in the international gatherings but no effective policy is being made because of its international legal regime implications. It

[19] Asian Development Bank (2016), *Pacific Economic Monitor*, [Online: web] Accessed on 17 June 2017 URL: https://www.adb.org/sites/default/files/publication/188684/pem-july-2016.pdf

could be because such displacement, evacuation or migration may affect only weaker island states and hence less priority is given in the global policy debates.

2.5. ISLAN STATE'S RESPONSES TO CLIMATE CHANGE

The Small Island Developing States (SIDS) is the diverse group of countries comprising low-lying islands, and coastal countries (UN-OHRLLS 2009) and the most vulnerable countries among the islands. SIDS comprise of 58[20] countries among which 9 islands are Least Developing Countries (LDCs). The SIDS idea has been developed as these states have striking similarities geo-physically, demographically, economically, and even in terms of socially alienation. Small island states has less than 10,000 sq.km land area, with approximately one-half million or below one half million population. They vary in terms of geography, social composition, political influences, economic priorities, physical make-up, and climatic conditions. The climate change actually brought these islands to international glare and attention at the international discourses since early in 1970s. During the period of 1972 to 1982 marked the beginning of international discourse on island countries when the New International Economic Order resolution was place before the global community by the UN General Assembly. This resulted into the formation of various groupings in the international realm including Indian Ocean Commission in 1982, South Pacific Regional Environmental Programme (SPREP) in 1982, and South Pacific Organizations Coordinating Committee (SPOCC) in 1989 Such initiatives from the vulnerable island countries were aimed at safeguarding their degrading environment and making grounds for the emergence of (Association of Small Island States) AOSIS in the international political economy of climate change (Bass and Barry- Clayton 1995)[21].

[20] In the list of "Small Island Developing States", out of the 58 countries 20 member states are not the member countries neither in United Nations nor associate members in any of the regional commissions. United Nations Framework Convention on Climate Change "UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States", *UN-OHRLLS*,[Online: web] Accessed on 29 June 2017 URL: http://unohrlls.org/about-sids/country-profiles/ , Number of small island developing states varies from time to time, (Ghina 2003), & "List of SIDS" *Sustainable Development Knowledge Platform*, [Online: web] Accessed 20 June 2017 URL: https://sustainabledevelopment.un.org/topics/sids/list

[21] Bass, Barry- Clayton (1995), "Participation in Strategies for Sustainable Development", *Environmental Planning Issues*, (7), [Online: web] Accessed on 12 June 2017 URL: http://pubs.iied.org/pdfs/7754IIED.pdf

The NIEO facilitated deeper economic relationship between the developed and developing countries as it was result of huge development gap between the countries in the North and the South.[22]. Subsequently categorization of countries into four sup-groups on the ground of NIEO was done and classified as Least Developed Countries (LDCs), Land Lock Developing Countries and the most crucially affected countries[23], and finally Developing Island Countries (DIC). Later on in 1972 UNCTAD recognized that island countries are special case of being disadvantage to international trade due to its natural physical existence with smallness, insularity, limited resource endowments and internal markets, less accessibility of transport and communication, indivisibilities of costs (Sutton 2011: 143). By admitted this geographical vulnerabilities of island states the UNCTAD passed a resolution 65 (III) calling for expert groups to conduct a study on peculiar problems and difficulties of island states (Grote 2010: 170).

In 1974, the report of this study group was published. It covered the big island countries such as Indonesia, Indonesia and Philippines in the South East Asian coasts (ibid:). UNCTAD then gave common character or name to special islands by calling them as 'small' and gradually the IDC became SIDS in the international negotiations. Being frontline victims of global warming, islands forged active partnerership in international negotiation bodies of climate change. The prime agenda of such alliance is to make comprehensive and advanced adaptive mechanisms and to negotiate with the developed countries to compensate and assist these SIDS for adaptation and lessening of negative impact. However, the weakness of their fragile political, economic and geographical situations has not only constrained them but they have aligned to come up with 'soft negotiation strategies' in international bodies.

In 1987, when Maldives recorded unprecedented sea-level rise and flooding over 1200 islands this incident galvanized island nation states all over the world to recognize changes on earth system. As a result in 1989 the island states officially gathered and held a "small states conference on Sea- Level Rise" in Maldives. Over fourteen island states

[22] 1960s witnessed the 'process of decolonization' which resulted into the rise of new independent states and emergence of another block in the international realm as third world countries; the new independent developing and underdeveloped countries in African, Latin America- Caribbean, South-South East and Western Asia.

[23] These countries are most seriously threatened by economic crises.

from different regions Caribbean, Indian Ocean, Mediterranean, and South-Pacific regions participated in this collective response to the Global Warming threats to island states. This event was the first cooperative gathering of small island states. Thus the conference paved the way to the adoption of "Male Declaration" (UNESCO 1989) [24] on Global Warming and Sea-Level –Rise. It called for collective effort from the international community to the emerging common problem in small island states. This has further turned into the building-up of UN conference on Environment and Development in 1992 at Rio de Janeiro also known as Earth Summit. On this occasion the people of Maldives had submitted a petition duly undersigned by around 80% of its population regarding their vulnerable conditions. Simultaneously similar initiatives emanated from various islands in the tropical Oceans, They created grounds to make global governance preconscious towards this phenomenon (Grote 2010: 183-185).

Simultaneously the small island developing states realized the necessity to keep them united at international negotiations of climate changes to safeguarding their land and people from the potentially demolishing consequences of global warming and sea level rise. Initial leadership of Maldives constituted an alliance of 42 island states of UN and enhanced the synergy of island countries finally leading to the formation of Alliance of Small Island States (AOSIS) in 1990. It was an informal ad-hoc negotiating coalition to UNFCCC at the Second World Climate Conference in 1990.

The AOSIS has been cohesive grouping in the international political platforms. AOSIS put forth twelve important negotiation strategies in its preamble to safeguard islands under the UNFCCC protocol. The main agenda was to address the peculiarities of vulnerabilities and certain needs. This grouping graduated to be a political formation as well as a negotiating figure between the haves and have-nots.[25]. It became a vocal player in UNFCCC in terms of placing the common interest of islanders. However, they largely failed to use platforms as a negotiating party at most of the international climate change

[24] Male Declaration' is the strategies and agendas adopted by the representatives of state of Small Island at small state conference held at Maldives in 1989. See UNESCO: Intergovernmental Oceanographic Commission on "Male Declaration on Global Warming and Sea Level Rise, IOC/OPC-IV/inf.2, Paris

[25] Cuba, Singapore, Trinidad and Tobago etc.., are members in AOSIS developed island countries in the Asia-Pacific, Caribbean Regions, [Online: web] Accessed on 13 April 2017 URL: http://www.aosis.org/about/members / http://www.data.worldbankorg/region

negotiations. The international climate change negotiations and especially the North division of developed countries had given equal priority for both environment and development. Small Island states belonged to South division category and needed to be in a core group of one among the parties. As a result they forged partnership with Group 77 and China[26]. They demanded transfer of energy and technology to the developing countries from the developed nations.

The foremost task before the global community is to respond fairly and find innovative techniques to curtail increasing rate of greenhouse gas emissions. The north-south division between the member countries has made the situation more complex. This was very clearly raised in Kyoto Protocol (1997), considered being the most critical phase ever in climate change negotiations. And it was AOSIS, the first who proposed a draft, calling for Carbon Dioxide Emission cuts of 20% from the base year of 1990 by 2005 during the Kyoto negotiations (UNFCCC 2002).

The necessity to reduce the level of carbon emission is the key demand of Alliance of Small and Island States. Despite the high expectations of AOSIS, each negotiation has been ineffective as commitment to the legal obligations to meet targets has become just a political agreement rather legal enforcement. It often shows the gap and distance between the developed super powers and the least developing countries. Moreover small island states are highly dependable to the developed emitter countries for economic developments and could further alienate small island states from taking stringent demands and positions against the issue of Greenhouse gas emissions. Cancun Agreement in Mexico in 2010 resulted into the agreed support of many parties to the reduction in accordance with the Bali Road Map. It also proposed for the first time that developing countries would be on the path to cut down emission. At same time COP15 at Copenhagen failed to incorporate the demands of Island developing states.

[26] Group 77 and China founded in 1964 in the context of the UN Conference on Trade and Development a negotiating group working through UN System. As of now it has 134 member states than above original 77. The group consists China as a whole and African States, the Small Island Developing States and the grouping of Least Developed Countries, "Party Groupings" *United Nations Framework Convention on Climate Change*, [Online: web] Accessed on 3 February 2017 URL: http://unfccc.int/parties_and_observers/parties/negotiating_groups/items/2714.php

Finally, international climate regime reached at a consensus regarding the reduction of GHG emission target in Paris Agreement. It is considered as a 'land mark' or 'historical' achievement of global community. The AOSIS strongly stood for such an agreement and its initiatives cannot be underrated. The potential threat to island states cannot be addressed by partial fulfilment of such agendas. The President of Maldives, the Chair of AOSIS stated at the COP 21 at Marrakech, Morocco in post Paris agreement that "The entry into force of the Paris Agreement is a cause for celebration, but we must make sure we do not become complacent" (AOSIS 2016)[27]. The cause for celebration mainly rested on the fact that the negotiation had ratified the limiting of temperature rise and extending financial support to the island developing states.

At this present scenario preventing the "dangerous" threat of climate change by minimizing emissions as below at 2°C would be an unfair attitude from the global community to the small island and other least developed countries in the edge of submergence. Though the island society demanded to the global community targeting of greenhouse gas emission not below of 1.5°C, the COP 21 in Parris agreement in 2015 ratified that the temperature will be restricted to 2°C above pre-industrial levels. However the agreement glorified as land mark and historical achievement kept the real victims sidelined.

2.6 SUSTAINABLE DEVELOPMENT INITIATIVES TO TACKLE CLIMATE THREATS

The global community has started highlighting sustainable development mechanism as a pro-active measure to rebalancing the degrading environment. This concern over the environmental protection led to an influential environmental movement that emerged in Northern countries in the 1960s. The UN General Assembly convened the conference on Human Environment in Stockholm in 1972. The Small Island Developing States turned into the path of Sustainable Development since 1990 as a progressive step to face the challenges of Climate Change. By 1992, the SIDS vigorously stepped into the track of

[27] Press Release: Small Islands Call on Marrakech to Live Up To Action COP Billing, [Online: web] Accessed on 20 April 2017 URL: [http://aosis.org/press-release-small-islands-call-on-marrakech-to-live-up-to-action-cop-billing/ 30 June 2017.

political negotiations through the international agenda on sustainable development under the aegis of United Nations Conference on Environment and Development (UNCED) also known as Rio Earth Summit (Ghina 2003). This broke the deadlock for the Island Developing Countries (IDC) and finally prepared a ground for an exclusive focus of international attention on small island states. The first global gathering in response to environmental degradation in SIDS countries was the Bridgetown conference, Barbados held in 1994. This conference opened the door for small island developing states to step towards sustainable development through an action plan. Barbados Programme of Action Plan embodied with the Agenda 21 of Rio Declaration 1992, and stressed on major ten areas which need to be made sustainable. However, the Action Plan of Barbados could not achieve any fruitful developments in account to the fourteen priority areas.

The 'World Summit on Sustainable Development (WSSD) held in Johannesburg' in 2002 had rectified the special concern of Islands especially with regard to its environment and development as mentioned in Agenda 21 of Chapter 17. The need to deliver adequate financial support to the island countries through Global Environment Facility (GEF) was highlighted. This was to meet their needs by strengthening institutional capacity for the attainment of energy efficiency and conservation, renewed energy, advanced energy techniques. The UN Law of the Sea of 1982[28], as the framework for all Ocean activities, was also stressed under this agenda. It embarked on achieving sustainable development of Oceans and coastal areas through its exclusive economic zone[29], the protection of marine environment, accelerating fresh water protection programmes, an initiative on

[28] The United Nations Third Conference on the Law of Sea realised the necessity to make laws on the "Peaceful use of the Sea- Bed and the Ocean Floor beyond the Limits of National Jurisdiction" and established a committee to study on it according to the resolution (2340(XXII) passed by the General Assembly. The first official draft on the convention on draft of the Law of Sea had approved at the tenth session of the conference. With the rectified resolutions of (I to IV) together included with the integrated final draft on the Law of Sea on 30th April 1982 at the 182 plenary meeting of UN Convention. Later on the conference held in 1982 adopted the UN Convention on the Law of Sea, it contains 320 Articles and nine annexes and came into force on November 16, 1994 with the ratification of sixteen instruments. "Law of the Sea, 1973-1982 (Third Conference)", *United Nations Diplomatic Conferences*, [Online: web] Accessed on 28 June 2017 URL: http://legal.un.org/diplomaticconferences/lawofthesea-1982/lawofthesea-1982.html

[29] The Exclusive Economic Zone is an extended jurisdiction of coastal states beyond its territorial sea and over the living and nonliving organisms with regard to promote economic development. It protects the interests of both the two parties those who are the costal state in the resources adjacent to the territorial sea and the all states navigating and using all legitimate resources within the jurisdiction (Milic 1976).

sustainable tourism, and considering SIDS into WTO for making small economies exclusive development (UN 2002).

It was in 2014 the 38th session of the IPCC on the ratification of its 'fourth assessment report on impacts, adaptation and vulnerability to climate change' held in Yokohama stressed more on the importance of turning islands into 'ecosystem management' that is incorporated in the Hyogo Framework Action (HFA) as a comprehensive mechanism to conserve regional sustainability from all disaster events engendered through climate change. The fundamental objective of this progressive drive aims at reducing the possibilities of natural disasters and exacerbated risks through enhancing the activities of the ecosystem. This is done by making clear the functions of the ecosystem are eco-friendly than destructing the potentiality of islands eco-culture. It would lead the society of islands into a sustainable path.

The waste management system approach in island States looks upon 3R processes as reduce, rescue, and recycle. The human engenders contamination on ecosystem also lead to climate changes in the present scenario. The increasing volume of drifting non-eco-friendly objects like plastic particles in the sea is recognised as the most serious issue existed in many island states in recent days. Asia Pacific region island countries like Indonesia, Philippines, and Sri Lanka are in the top five states where 'mismanaged' Oceans exist. Indeed tourism sector is the single most contributors to GDP, even though it has been exploiting the ecosystem of the land in one way. Therefore the islands states consider waste management approach through comprehending the 3R processes as vital. SIDS in the Pacific Ocean started to initiate multiple pro-sustainable initiatives like deposit refined system in Federal States of Micronesia and Clean School Programme in Fiji. However, SIDS lacks coordination because insufficient finance, skilled human resources, and complexities on the land and ecosystem.

Islands are giving importance to mitigation policies with the support of financial and technological aid from the emitters. The energy sector of island states has started utilising renewable resources for energy contamination. It is estimated that approximately 20% of the household income of Pacific Islands spend on energy. Consequently many islands have switched to develop their own renewable energy markets. As a progressive step to

using renewable energy resources, Tokelau, a small island state in South Pacific, generates energy and even for powering generators from coconut-bio fuel to meet their energy needs, and it's close to attain its 100% use. Similarly Barbados produces solar water heaters to Caribbean and estimated to save $ 283.5 million by 2029 through providing 29% of it ("Help small island states win their battle against climate change" *The Guardian,* 29 August 2014).

Health education programmes, application of traditional knowledge, locally appropriate technology are used though these are not enough to tackle the real threats. Islands require external financial, technical, and other assistance to adapt. Adaptive capacity may be enhanced by regional cooperation and pooling of limited resources.[30] The 'Third international conference of Small Island Developing States at Apia, Samoa' has given high priority to sustainable development and reaffirmed agenda of 21 of Rio declaration. "We reaffirm that Small Island Developing States remain a special case for sustainable development in view of their unique and particular vulnerabilities and that they remain constrained in meeting their goals in all three dimensions of sustainable development. We recognize the ownership and leadership of Small Island developing States in overcoming some of these challenges, but stress that in the absence of international cooperation, success will remain difficult"[31].

[30] The Rio-Earth summit of 1992 duly incorporated sustainable necessity for island developing states and other developing nation states (Commonwealth Secretariat 2014:03).

[31]Report of the third International Conference on Small Island Developing States , A/CONF.223/10, Apia, Samoa 1-4 September 2014, [Online web] Accessed 1 March 2017 URL: http://www.un.org/ga/search/view_doc.asp?symbol=A/CONF.223/10&Lang=E

CHAPTER III

Food and Water security: A Sri Lankan Experience

3.1 Overview

The small island state of SriLanka is one among the fast growing countries in the South Asian region. Since its independence SriLanka had shown a robust growth in its socio-economic and political infrastructure despite overwhelming discrepancies has been existethat exist internally and externally. Poverty and malnutrition are the most common developemntal problemsthat have prevailed in SriLanka dating long back and it still rampant in herenvisioned journey to development. Lack of sufficient production was the major obstaclethat shook the food security ambitions of SriLanka. Moreover, problems in food supply, unequal utilization, less infastructural networks, hindrances to access markets result in chronic poverty and malnutrition in the country. More over the changing present scenario of food security of Sri Lanka is further threatened by changes in climate conditions and frequent natual calamities. This could destabilise the overall human developemnt, economic progress and human welfare in the nation in a broad manner. This chapter deals with the food security issues and the reulting coundrum in SriLanka through the lense of climate changes.

3.2 The Socialist Democratic Republic of Sri Lanka

Sri Lanka is a resplendent island in the Indian Ocean that seems like a rain drop falling into the sea from the south of India. The country lies between latitudes 5°55′ and 9°51′ north over 244 km and longitudes 79°41′ and 81°53′ East covering a length of 432 km with a land area of nearly 65,610 square kilometers. The small island country is surrounded by coastal plains and has hills and mountains in its south-central part. Apart fromIndia, the nearest neighbors of SriLanka are two islands, the Maldives to its West, and the Andaman Nicobar an archipelago of Indian Territory, to its East and North- east respectively. Excepting the Manner Island in the North-West and the Jaffna Peninsula in the North, the adjoining islands of SriLanka, the largest being Kayts and Delft also adjoining the country, leaves SriLanka with compact land area. The maximum length of the island North to South is 270 miles, from point Palmyrah in the North to Dondra Head

in the South. The greatest breadth is 140 miles, from Colombo in the West Coast to Sangamankanda on the East Coast[32]. The Palk- Strait is a shallow strip on the northeastern side which separates the Bay of Bengal to the South-west and Indian Peninsular in Gulf of Mannar in its north. The Palk- Bridge is a contested area between the India and Sri Lanka on the grounds of its strategic location. Similarly, the Pak strait was the main historic root that leads to Indian presence in the land of SriLanka during the past centuries.

Since long back the country has attracted foreigners from different parts of the world. Thus the land became well renowned in many countries dating back to ancient times and was known by several names recorded in narrations given by multiple travelers and traders. Formerly the ancient Greek geographers had called the nation 'Taprobane' while Arabs referred to it as'Serendib'. The Egyptian geographer Ptolemy had to names for the country –'Simandu' meaning the "head of the sacred law", and Salike, which may be a corruption of the name Sinhala, meaning "dwelling place of lions" (Tresidder 1960: 03-04). Moreover, the inhabitants of SriLanka had called the country by names derived from their ethnic languages such as'Ceylon' was ever popular in the history and life of SriLanka, and has not yet been replaced in many of its economic, cultural and trade collaborations with the outer world.

Since ancient times SriLanka was famous for spices and precious stones, especially cinnamon, which continues to occupy a significant position in its economic development (K.M De Silva 1989:89-90). The ancestral roots of its inhabitants or natives are of Indian or Indo- Aryan origin from 5th Century B.C. The descendants of Vijaya, the first ruler of SriLanka hailing from Northern India formed the Sinhalese race, the major ethnic group of the country constituting two thirds of the total population(74.9%), followed by Sri Lankan Tamils (11.2), Indian Tamils (4.2),Sri Lankan Moors (Muslims) (9.2) , and others (0.5)[33]. these groups make up the vibrant ethnic composition of the country. On the basis

[32]Sri Lanka Year book, 1997, Department of Census and Statistics, SriLanka, p.03
[33]Population of the country described as of 2012 census, Central Bank of SriLanka, *Economic and Social Statistics of SriLanka 2014*, Central Bank of SriLanka Statistics Department, SriLanka, p. 1

of ethnic divisions, the officially recognized languages of the country are Sinhala, Tamil, and English.

3.2.1 ADMINISTRATIVE DIVISIONS

Out of 65,610 sq.km land, an area of 62,705 sqkm of the country is divided into nine administrative areas for the transparency of governance. These are called administrative provinces, namely: Western, Central, Southern, Northern, Eastern, Northwest, North Central, Uva, and Sabaragamuwa. Further, these administrative areas are divided into 25 small districts, 325 divisional secretariats (DS) and over 14,000GramaNiladhari (GN) divisions, or village clusters.

3.2.2 POPULATION AND DEMOGRAPHY

As of 2015, the total population of SriLanka is estimated at 20,966,000 million (World Bank 2015).Population density is higher in the Western region where the majority of the population resides.

Table: 3.1 Population Growth

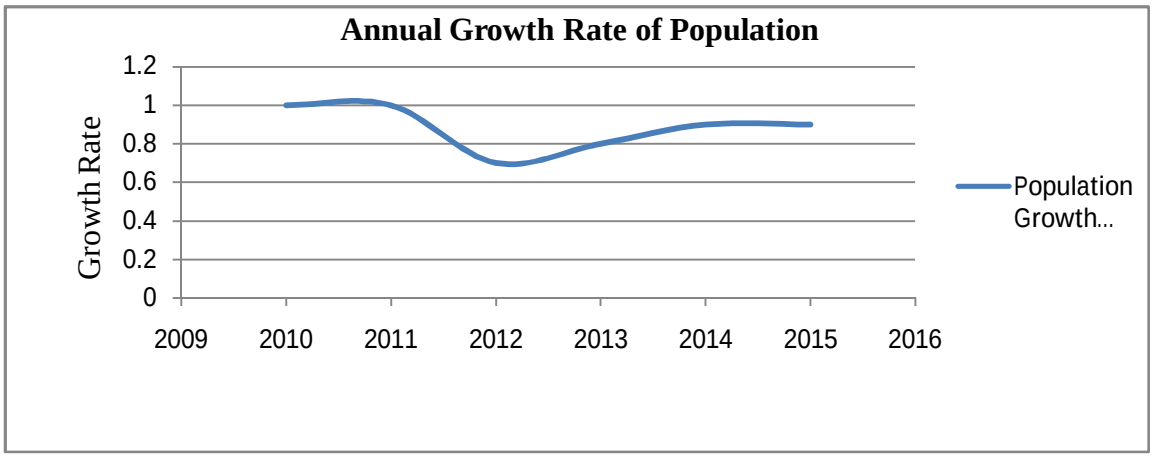
Year	Population (in,1000)	Annual growth rate(%)	Density of population
2010	20,675	1.0	330
2011	20,869	1.0	333
2012	20,424	0.7	326
2013	20,579	0.8	328
2014	20,771	0.9	331
2015	20,966	0.9	334

Source: Central Bank of SriLanka Socio- Economic Data 2015

The population growth had undergone a plunge in2011 but started to increase in a constant rate since 2013. On the other hand, the density of population has been increasing proportionately. The higher density of population is settled in the western parts of the county and vulnerable to frequent occurrence of natural calamities as floods and

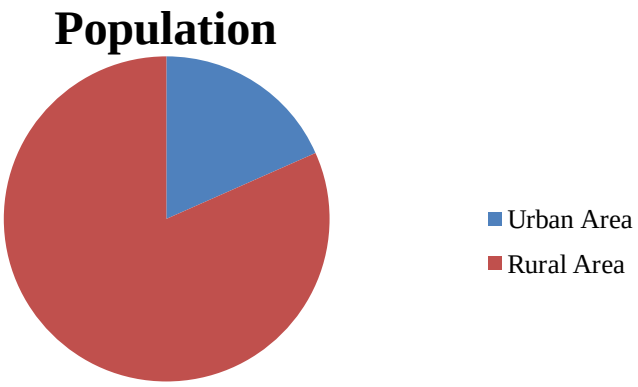
landslides. The least dense population is in the Northern provinces due to the ethnic tensions, hot climate and less fertility of the zone (Zubair et al 2006: 113). The reason behind the large density of population in the western region is the rapid economic growth, employment opportunities, social accessibility, and lifestyle of advanced urban cities. More particularly the weather conditions in this region are comparatively cool alongside other regions. Despite all these plus points, the region is likely to be more sensitive to climate change events, except in a few areas. A recent trend seen among Sri Lankans is that the climatic factors govern their choice of land while settling down as compared to their ethnic backgrounds.

Figure: 3.1 Annual Growth Rate of Population in Percentage



According to the FAO report (2015), the estimated population has been surging upwards in SriLanka. The disparity between rural and urban areas is growing with the high standards of the latter. Urban population till 2015 is estimated 3,966.97 (1000 persons) and in rural sector 17,645. It is evident that in SriLanka, it is prominently the rural areas that are dependent on various agricultural practices for their livelihood.

Figure 3.2: Population Distribution



3.4 THE POLITICAL ECONOMY OF SRILANKA

The life sustainance story of the economic sector of SriLanka was dominated by subsistence agriculture of paddy and '*Chena*'[34]and subsequently plantation sector and fishing. There after export-oriented plantation crops such as tea, rubber, and coconut was introduced by western colonial powers during the sixteenth and seventeeth centuries and that had become the high-income source to the GDP of SriLanka until the 1960s. The plantation sector still continues to be one of the core contributors to the economy with largest inflow of revenue. The Government had expanded social-welfare policies and programmes irrespective of the disproportionate and limited per capita income and it has been widely criticised. The country could have met minimum human development and achieved life expectancy, infant mortality rate and literacy as equivalent to Europe, higher than Chile and other South Asian neighbours (Herring 1987: 325).Unfortunately such policies never had a long life. The mixing of politics with the social welfare programmes lead to economic stagnancy, and the post-colonial era since 1977 witnessed a crisis in welfare form of economy that put constraints of countries actual growth. Therefore the development of the economy had slowed down dramatically, partly as a result of a decline in surplus in the plantation sector and growth sidelined or shrunk into

[34] '*Chenas*' cultivation is the oldest form of agricultural practice existed in five thousand years back in Sri Lankan. This farming includes vegetables, grains and cereals cultivates in the rain-fed areas of the land. [Online: web] Accessed 13 June 2017 URL: http://www.dilmahconservation.org/arboretum/traditional-agriculture/chena-cultivation--466d60ba372e7be52d4c6e8573baf9bf.html

certain areas or groups. The period between1973 to 1974 witnessed an acute food crisis which resulted in starvation, and hunger due to increasing price level internationally and severe weather conditions (ibid 1987: 327).

Therefore, the country made economic reforms in its domestic policies changing it from the inward looking tight economy to an open oriented structure as a result of liberalisation since 1977(J. Mudalige 2010: 1-3,"Changing Economic Scenarios: Economic Liberalisation 1977-1994", *Sunday Times Economic Analysis, 2012)*. It lead to maximisation of exports, arrival of foreign investments, support from international monetary organisations like IMF, private partnership and industrialisation, food stamp programme like minimising subsidies and allocated to a section of people etc. However the liberalising policy re forms did not guarantee loosening of the governments rein in functioning of economic affairs in the country. Focusing on development through inward looking policies SriLanka could achieve tremendous economic growth (Athukorala & Rajapatirana 2000: 544-547) and this period was dominated by manufacturing sector with exports marketing rubber, tea, coconut products, clothing, jewellery, footwear etc. However during the second wave of liberalisation in 1991-92 the economic performance of SriLanka fell well below expected economic growth.

But at the same time the agrarian economy of SriLanka rapidly transformed into a mini industrial and urbanized model of development with the onset of 21stcentury. Till1980SriLanka maintained an equal urban- rural ratio. Thereafter the country witnessed a gradual disparity between urban and rural sectors and these changed the economic face of the island nation. The primary goal of the government of SriLanka under the United National Party (UNP) during 1947-1956 was to reduce foreign dependency on food by enhancing domestic agricultural system and productivity. Mainly because the dependency had become an extra burden on its economy concerning foreign exchanges, thus it led to the realization of the importance of achieving self-sufficiency of staple food grains. Eventually, SriLanka overcame the situation and reduced the amount of imported food from 39 % in 1979 to 33%. Among the major imported items, the rice

supply was reduced from 50 % in 1993 to 11% in 1993 though at the same time dependency on wheat had increased (Alailima 2000:47)

A country such as Sri Lanka with minimum resources had achieved an enviable economic growth within a limited period of time and resources since its independence unlike other South Asian member states. Furthermore, Sri Lanka had shown a rapid economic development irrespective of plentiful difficulties within its territory and from the outer world also. The foremost examples of its economic achievements are visible even after the twenty-six years long ethnic civil war that stretched from 1983 to 2009, between the Government and Liberators[35].Sri Lanka's economy has achieved higher economic growth in all indicators. After the end of Civil War, country has grown at 6.4% GDP in the period between 2010-15 and achieved reduction in poverty which lead to prosperity with middle income status.However the experienced economic growth in its Gross Domestic Product (GDP) have declined with range at 5% growth in 2016 (WFP 2017:14) through expanded industrial and service sectors. As of now both the service sector and industrial sector are the backbone of Sri Lankan economy which produces nine- tenth of the total domestic production. However, the expected growth slowed overall in 2016 as the country faced its worst drought since the last four decades[36].

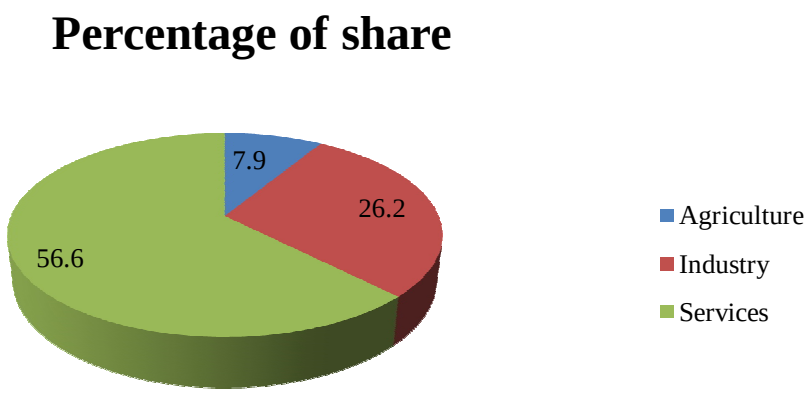
The rapid socio-economic development of the country gave Sri Lanka a high ranking in Human Development Index of United Nations Development Programme (UNDP) 2016. Out of 188 countries, Sri Lanka ranked at 73 with 0.766 indexes, bracketed into the category of high human development with GNI per capita 10,789 (2011 PPP$), GDP per capita 11, 048 (2011 PPP$)[37]and had marvellous performance in other indicators also. In comparison to this, other South Asian countries failed to even come under the first hundred. Social developments in the country were results of the welfare social policies in the fields of education, health and social services. Later on, the plantation sector was

[35]Ethnic civil war in SriLanka between Government and LTTE (Liberation Tigers Tamil Elam) during 1983 – 2009 an unhealed wound over SriLanka ended in Mahinda Rajapakse's period. This could destroy country's resources, integrity, international relations and overall development. The Northeast and northwest provinces are still sufferers due to poverty and lack of economic growth as a result of Civil War.
[36]SriLanka Economic Outlook, posted on March/ 21/ 2017, *Focus Economics*, [Online: web] Accessed 23 April 2017 URL: http://www.focus-economics.com/countries/srilanka
[37]Human Developemnt Report 2016, *United Nations Developemnt Programme*, [Online:web] Accessed 20 April 2017 URL: http://www.hdr.undp.org/en/countries/profiles/LKA

smoothly hijacked by service sector from 1998 and had taken the role of the foremost pillar of the growing Sri Lankan economy by constituting 57% of Gross Domestic Product at present. The services sector includes tourism, hospitality, bank and financial institutions. This sector, followed by agriculture, forestry and fisheries sector together continue to be the source of national income. Paddy is the major crop in the agricultural sector and makes up daily food demand, mainly for domestic use, and other crops include tea, rubber, coconut, and vegetables, which are mainly for export purposes. Wheat, Sugar and Milk products are the major imports to the country.

Unlike Service sector, agriculture is not the largest contributor to the GDP of the country, yet though the open economic policy frameworkadopted in late 1970, the paddy production was enriched and its share to GDP increased. Later on, this trend started to decline and other crops could overtake paddy like vegetables and perennial crops. But the glaring necessity to feed the country and to liberate people from hunger and famine throughout the land, made the policy arena think about self-sufficient method. This further led to the expansion of available agricultural land for more production, especially in paddy cultivation.

Figure 3:3 Composition of Gross Domestic Product in 2015 (%)



The expected growth of agriculture has not been realised yet and currently, the country is facing a number of difficulties that reared their heads in the recent decades like climate change, natural hazards, and policy issues in developmental goals etc. The total GDP of the country has decreased in 2009 with the annual percentage growth level at just 3.5 then

it rebound in 2010 at 7.9. Thus it flourished by different indicators of GDP growth as trade and commerce, tourism, hospitality, rather than the agricultural sector.

3.5 CLIMATIC CONDITIONS, CHANGES AND IMPACTS

The climatic condition of Sri Lanka plays an important role in its increasing vulnerabilities in the field of human security. Sri Lanka is located in the Indian Ocean equatorial region that makes it tropical country with warm and humid weather conditions.Sri Lanka's climatic condition is almost similar to the southern states of India which lie in the shallow bed in between the Arabian Sea, Indian Ocean, and Bay of Bengal. Therefore the geographical composition of these states and SriLanka shares clear commonalities in the areas of topography, food preferences, and agricultural patterns. There are four specific topographical features that considerably influence the climate patterns of SriLanka –tropical nature that is associated with warm and humid air, the location of the island as the country is more proximate to the equator, thus making it highly sensitive towards solar radiation and exacerbates problems regarding weather, continuous monsoon rainfall twice every month with cool breezes, proximity to the vast Indian subcontinent widely affects the country's weather conditions particularly rainy seasons (Marambe et al 2015: 1774-1777).In accordance with soil type, temperature, and rainfall patterns the island predominantly classified into three climatic zones namely : Dry zone, Intermediate zone, and Wet zone. These climatic conditions have an impact on the agricultural productivity of the country. The normal fertility of the soil changes according to the variations in mean temperature and annual rainfall. In such circumstances SriLanka will start to deviate from the status quo.

Table: 3.2 Climatic Zones of SriLanka

Climate Zones	Mean Annual Temperature(°C)	Annual Rainfall (mm)
Wet Zone	24	2500-5000
Intermediate Zone	24-26	1750-2500
Dry Zone	28	1500-1000

This division of land determines the agricultural diversity of the country in which the Dry zone covers around 70% of its land area. The Northern region of the country belongs to dry zone and in comparison to other zones this area receives less annual rainfall. Being in the middle region between the dry and wet zones, the intermediate zone has mixed soil fertility and receives favorable rainfall. However, an emerging situation in the recent times is that the intermediate zone is undergoing major changes in its temperature level such as increasing heat days and night and decrease in wet days and has reached the peak of dryness. The wet zone covers south- western part of the land and is mainly constituted of highland and is fertile for plantation agriculture with high rainfall. Around67% of this comparatively cool area is under permanent agriculture, especially coconut.

There is anothersubdivision of land into three on the basis of elevation such as Low country (300 meters below from sea line), Mid country (from 300 to 900 meters) and Upcountry (above 900 meters). The Dry Zone lies in the low country, whereas the Wet and Intermediate Zones are seen among all three sub-divisions. The fore mentioned climatic zones are further divided into 24 agro-ecological regions due to the eco-sensitivity of this island. Irrigation provides the basic support to the country, boosting agriculture especially during extremely hot years and in areas predominantly located in the dry zone.

The topography of the country has twenty-four types of soils.Four types of soils are predominantly seen: Reddish-Brown Earths (RBE), Non-Climatic- Brown (NCB), Red-Yellow Latosols (RYL) and Regosols. These soil types are mostly eroded in both intermediate and dry zone. Reddish brown is the most commonly seen soil type which is widely spread over the country. The soil is characterized by its virtue of holding allow level of water content and rapid release of soil moisture. During the elevation of rainfall, this type of soil can balance normal soil moisture. It mainly used for cultivation of rice and pulses. The Non-Climatic Brown type of soil has very less chemical content and can produce only one type of crop. The Red- yellow Latos found in the northern region of the land has more ground water and is fertile for the cultivation of chilly, onion and vegetables where as regosols type are in the plain beach shores and fit for cultivation of coconut and cashews (Marambe et al 2015:1777).

Crop production system in SriLanka is divided into three - major, minor and rain-fed, according to the water availability for production. The Wet zone and intermediate zones in the South Central part of the country is comparatively favorable for farming owing to its soil moisture and potential rainfall. The wet zone receives high average rainfall annually and produces a good amount of rice yields. Both wet zone and intermediate zones are fit for tea and coconut plantation too. Parts of the rice cultivation in the wet zone are highly sensitive to floods during high rainfall and drought during the dry period while its central part and intermediate zone are susceptible to landslides and floods. Such risks periodically occur in these areas and create damage in paddy cultivation and other subsistence farming. The predominant climatic events that highly threaten these areas are rise in sea level and salinisation because of its ocean shoreline. The natural process of the inclusion of soluble salts into soil and water due to increasing climate change and human activity results in salinisation. It can happen through sea-level rise or flooding, wherein evaporation leads to salt water intrusion into coastal wet lands and aquifers. Such changes give rise to soil infertility, land degradation and brackish water. It is estimated that Sri Lanka's low lying coastal zones are severely affected by salinity and about 223,000 hectors of agricultural land has already been degraded ("Agricultural Livelihood in Sri Lanka impacted by Salinisation[38]", *Daily Mirror*, 15 February 2017). Therefore coastal areas could not overcome climate challenges especially concerning paddy cultivation unless the country made such perpetual adaptation policies.

3.5.1 *Temperature and Rainfall*

Temperature and rainfall are the major climate conditions that influence the sustainability of the land. These two factors in Sri Lanka have remarkable variations than other regions. The effect of elevation on temperature is the foremost factor behind the ecological imbalances in SriLanka. The temperature forecasts in different studies denote that the mean surface air temperature had increased at 0.30° Celsius in the years of 1869 to 1993. According to the studies of Chandrapala the mean surface temperature increased at a rate

[38] Salinisation is a natural phenomenon which occurs when the water in soil evaporates in high temperatures by drawing salt from the soil to the surface. The salt is toxic to many plants and makes the land unusable.

of 0.016°C (Chandrapala 1996 quoted in Esham et al 2017: 04) and soon after, the warming rate had risen at a rate of 0.025° C per year during the period in between 1987-1997 (Fernando et al 2007 quoted in Esham et al 2017: 04).The temperature increment tin 22 years has been calculated as 0.45°C per decade. This resulted in maximized warm and humid days and consecutive dry years in the land by bringing down the number of cold days and nights. And instances of consecutive high rainfall after prolonged dry years lead to a series of floods and landslides.

Table: 3.3 Rain Fall Pattern in SriLanka

Seasons	Weather Condition	Receiving Areas	Average Rainfall (mm)
First Inter Monsoon (March- April)	Warm, Humid, Thunder Storms	South Western Hill Countries	250- 700
South West Monsoon (May- September)	Wind and Lower Temperature	Mid- elevation Western Slopes	100-3000
Second Inter-Monsoon (October-Nov)	Thunderstorm, Cyclone Storms, Strong Winds	Higher in South West, and Country as a whole	750-1200
North East Monsoon (December - February)	Dry and Cold	Eastern Slopes of Central Hills	177-1281

Source: Compiled from B. Marambe et al (2015)

During these rainfall seasons the country has experienced heterogeneous weather conditions or diverse climatic changes. Sri Lanka's agricultural sector is largely dependent on the rainfall patterns which could negatively or positively influence its agricultural productivity. Therefore temperature and rainfall are essential climatic factors that are capable of balancing the fertility, productivity and sustainability of the country. The two consecutive rainfall seasons of First inter monsoon and South west monsoon are

the period when cultivation is done in Sri Lanka. The farming seasons are namely *Maha* and *Yala* seasons. Yala season is subsidiary to Maha and arrives during the First Inter-Monsoon Season (FIM) and South West Season (SWM) rains.

The temperature over the land according to the projection of De Silva gives the highest temperature rise of 1.6 Celsius and 1.6 Celsius in A2 and B2 scenario respectively and "wet season rainfall will decrease over most of SriLanka, it will lead to lower water availability and water stress"(De Silva 2007: 22- 23). Such a case threatened the agricultural scenario of dry areas. Crop injuries and animal husbandry are the key areas which are severely threatened by temperature. During the period of frequent increase of temperature in dry and intermediate zone particularly in Yala season harvests decrease in grain productivity due to increased spikelet sterility (Wanigasundera and Alahakoon 2014:1089).This phenomenon is known as *EhelaPussa*[39].SriLanka demonstrated that the rainfall variability has increased compared to earlier phases between 1930-1960 and 1960-1990. Similarly air temperature level has also increased in the same period both day and night time. The rate of increase of mean air temperature for the 1961-1990 periods is at a rate of 0.016° C per year and annual mean maximum temperature in all stations had shown an increase of 0.021° C per year in Puttalam while the global average for the period1956-2005 is 0.013 degree C per year (Aheeyar 2012: 5-10).

3.6 CLIMATE CHANGE – AGRICULTURE NEXUS IN SRILANKA

Agriculture is the key foundation of the food security of Sri Lanka and it has been considered as an agrarian economy since ancient times. About 29% population is involved in various agricultural activities for both livelihood and domestic food security requirements. It is a sector that is socially and economically bound to human

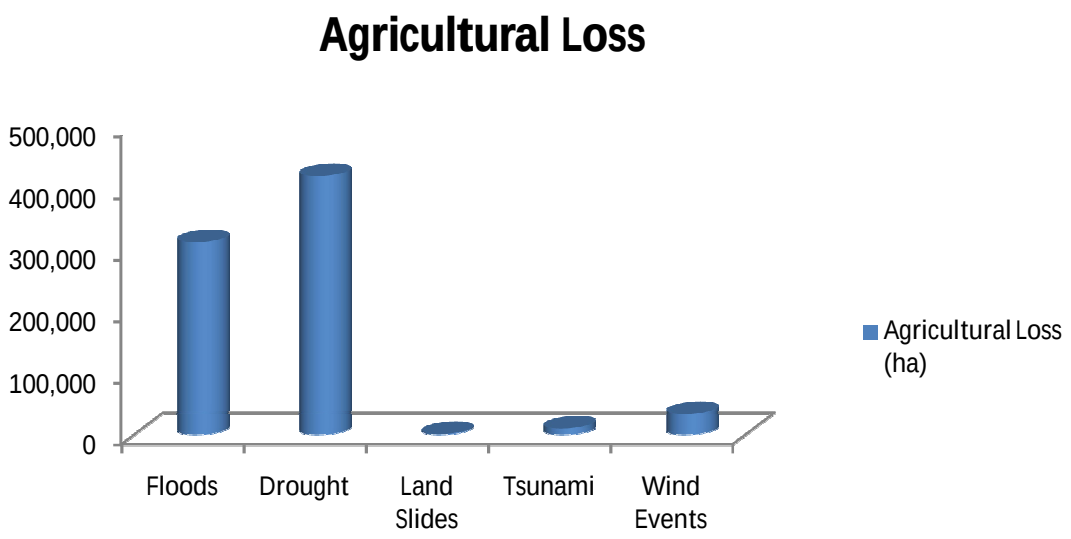
[39]The C3 crop yields (rice, beans, wood, etc.) are optimal for synthesising nutrients from carbon dioxide and water in the temperature range between15 to 30 centigrade. However due to erratic temperatures caused by global warming, yields are severely affected and production has declined, and harvested produce are damaged. For instance tomato has decreased in its sugar content drastically due to increasing temperature at night. *In a Timely Move, SriLanka should join the Climate Vulnerable Forum*, [Online: web] Accessed on 20 July 2017 URL:http://www.efsl.lk/publications/17 Climate Vulnerable Forum.pdf

development. The agricultural growth in Sri Lanka has been struck with many challenges in which climate change and exacerbated events has adversely affected smallholder farming system. Apart from threats due to climatic change, low fertile soils and less availability of land for expansion of food crop cultivation adds to the worsening of food security in SriLanka (Sangakkara and Nissanka 2008: 17-20). The agricultural sector has become more diverse with the dual contribution from plantation sector and food crop production at the local level. Plantation sector is export oriented and was dominant in the colonial era while food crop production dealt with social and political dimensions such as poverty, human development, and food security. The plantation sector is the net exporter and the major source of foreign exchange to its economy. The sharp increase in its foreign exchange reached one billion US$ in 2008 which was a first in Sri Lankan history. However, temperature variation, changes in precipitation, and increasing dry years, adversely affected the productivity of the sector and impeded the aims of food security in the estate area.

Apart from food crop farming the agricultural sector is comprised of livestock, forestry, and fisheries contributing to GDP. The economy has witnessed cultivation of cash crops such as tea, rubber and coconut dating long back along with sugar cane, cinnamon, pepper, cashew and variety of spices and seasonal crops. Foreign exchange through exports from such crops had strengthened both economy and the agricultural sector. Moreover, the sector could produce a large number of people to be employed. But unlike other South Asian countries agriculture is a sheer GDP producer to the economy at present. The climate change deliberately affects Sri Lanka's agricultural sector in both plantation and crop production as a whole at various levels. Climatic variations induced drought, floods, sea level rise, soil erosion, coastal degradation and cyclones have put socio-economic and physical progress in misery. These impacts can be traced back to the changes in agricultural productivity and availability of food for households at national level during the days of severe hazards impacts. In fact the influence of additional stress over the present food security system like population growth, poor distribution of food grains and inadequacies in infrastructural management are unavoidable. Variability of both summer and winter monsoon rains and rains of convectional origin has increased

significantly during recent decades. As a result, both extremes, i.e., water scarcity and excess water, have become a recurrent problem in crop production and its entire value chain in SriLanka. The agriculture accounted for 11.1% of the national Gross Domestic Product (GDP) in 2012, and provided direct employment to 30.4% of the labor force in 2013 (Central Bank of Sri Lanka: 2013) and increased from 30% in 2012 and provided livelihoods for up to 70 % of the total population. Within the three elements of food security: availability, accessibility and utilization, SriLanka has remained backward owing to drought, floods, cyclones, landslides, and epidemics.

Figure: 3.4 Agricultural Loss due to climate change hazards during 1974 - 2007



Such ecological changes will slowly degrade natural resources and fertile ecosystems like water and land. In such case, agriculture is the main source of income and livelihood of the rural population of SriLanka and climate change is a challenge to their sustenance and nourishment.

3.6.1 *Flood and Drought Impacts on Food Security*

Drought is one of the main anomalies of climate change that hits many regions. SriLanka is one among the serious cases which was hit by droughts several times harshly. The major areas under threat due to the drought is seen in ground water and surface water

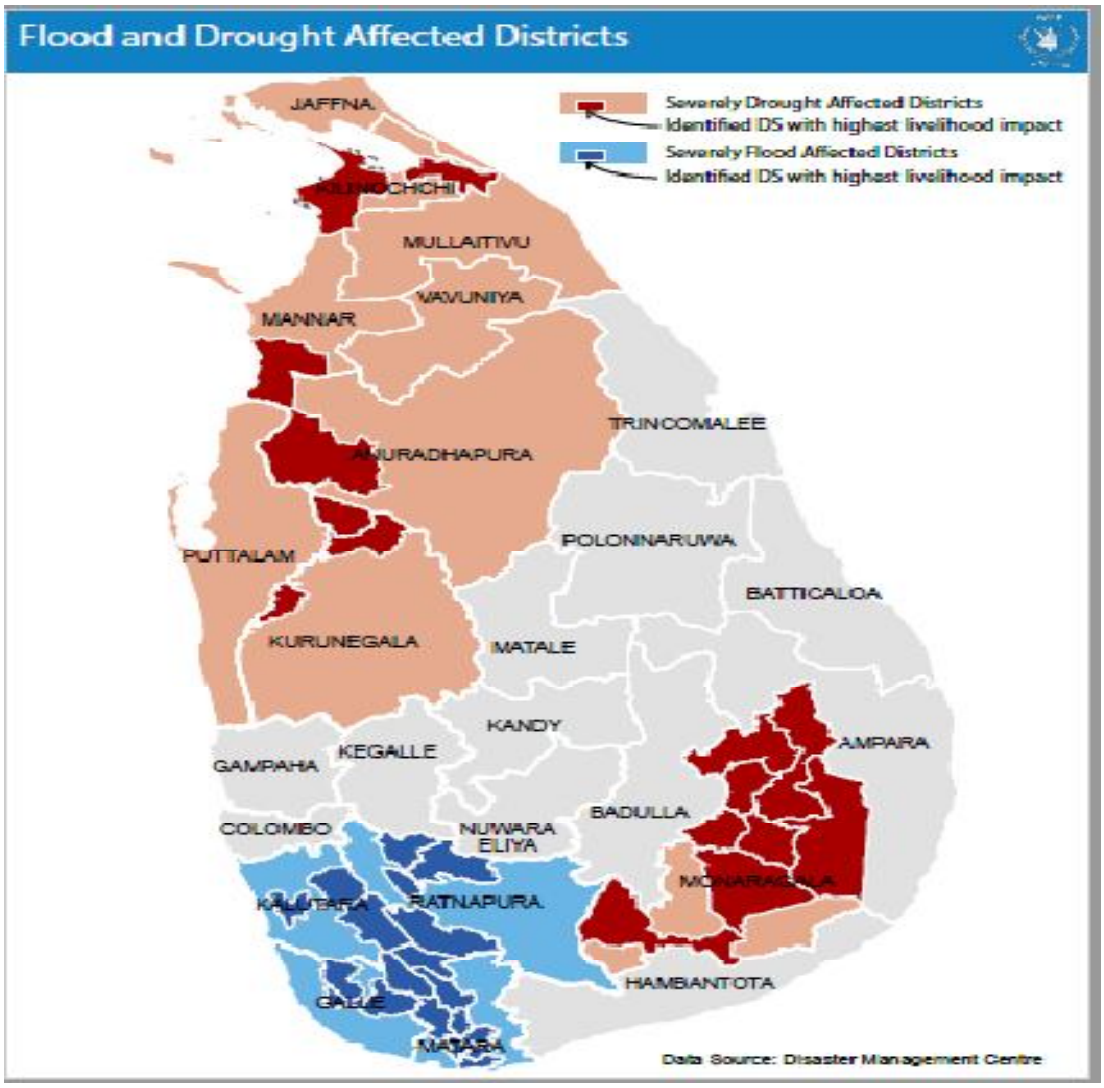
supply, power generation, forest resources, agricultural productivity and human health. The drought has had a direct impact on agricultural activities and it will further create impediments to the food security in the country. Drought is a normal part of climate, rather than a departure from normal climate, or as Domors says “the phase of lack of water; it represents a recurrent phenomenon, being an integral, although an irregular component of climate” (Domors 1981:133-134). But the regular occurrence of such normal changes become a complex and severe attack on the people who are confronting it especially in countries like SriLanka which is at present experiencing a four decades long drought period. The inter monsoon periods, or the period between north east monsoon and south west monsoon is regarded as the drought hours in Sri Lanka. In the calendar pattern it is between February to May and August to October. The decline in the reoccurrence of northeast monsoons every 3-4 years in the dry zone will lead to consecutive drought. The period between 1980 and 1990 witnessed such erratic drought in SriLanka.

Climate change and prolonged drought periods have severe impacts on Sri Lankan economy as well food availability of the nation historically. Sri Lanka was hit by a drought during the period of 1973- 74 when the country sought to reduce their dependency on imported food grains. The drought conditions caused a sharp hike in the market prices of food items during 1973-74, especially due to supply shortages domestically as well as in other producing countries which supplied these items to SriLanka (Karunaratne and Bandara 2000:215-218). Food shortages increased rapidly and constrained the country in terms of trade with other countries and reduced its ability to import food. This increase in World market prices of food items exerted a strong upward pressure on the domestic price level.

In comparison to other crops, rice yields are the most affected crop due to drought and floods in SriLanka. Killinocchi and Ampara are the areas where crop yield decreased heavily due to flood during the last four years. The prolonged drought curtailed the productivity of Yala season in the areas of Kurunegala and Matale districts in the Intermediate zone (Marambe et al 2015: 1777). The year 2016 witnessed Cyclone Roanu

along with a prolonged drought that posed high vulnerabilities on water sector and other natural resources.

Figure: 3.5 Flood and Drought Affected District in 2017



Source: Compiled from FAO/WFP Special Report on Food Security Assessment in SriLanka, 2017

3.7 STATE OF FOOD SECURITY IN CLIMATE CHANGE SCENARIO

The food system in the country was deep rooted in their social and cultural beliefs, therefore, the agricultural practices coexisted with tank field, temple, and the village. Moreover in the ancient periods farming was not considered a sector for income

generation; rather it was considered as a service to the nation. Traditionally food system or agricultural practices in SriLanka was synchronized with weather patterns. The people of the land made projections and planned for the upcoming seasons before plowing their crops. This practice dating back in history is called '*Ka l Yal Govinthena'* meaning cultivation at the right season, right time. In those periods the country harvested enough food for their dietary life. A notable classic practice among the people to ensure sustainable food security was through a system of Home Gardens (HG). This system widely practiced in this land supported their nutritious food habits from nature as fruits, vegetables, spices, herbs etc.., were grown and the sustainable soil fertility was provided from plant manure as well animal manure. The livestock husbandry had prevailed in every home garden, these highly contributed to sustainable land fertility. Alongside these, culture-based fisheries in small tank reservoirs were also integrated with the system.

3.7.1 Food Availability

The domestic food availability of SriLanka is accelerated by both local production and import including rice, fish products, pulses and fruits. In the national level SriLanka has a decent enough picture of food security though around twenty percentage of its food demand depends on imported foods. In the household level, food security system of SriLanka has been persistently run by imported food since after independence in 1948. The main food habit of Sri Lanka consists of rice, vegetables, green leaves, pulses, root crops, spices and vegetables. Avariety of pulses are consumed to attain proteins.

In between the close upon three decades of civil strife, regional disparities in economic dividends for growth, and the impact of the tsunami of 2005 had left the country with chronic food and water security deficit (Thiagarajah 2007: 93). The food security of the country achieved marginal progress at its national level as depicted by global Hunger Index (GHI) and Global Food Security Index (GFSI), ranks SriLanka at 84 out of 118 countries and 65 out of 133 countries in 2016(WFP 2017: 01) respectively above all South Asian countries, though the ranking had stepped down from the previous years due to the decrease in harvest at the local level. There are a host of causes including income gap in rural and urban household, population, conflicts resulting in livelihood problems in

some parts of the country, that are considered to be the leading issues while at the same time the sudden complex issues such as rainfall variability lead to frequent drought, climate change in Sri Lanka, increase in the frequency and intensity of floods and landslides, variability and unpredictability of rainfall, drought and to a lesser extent and increase in air temperature expected to have the greatest impact on local and national food security (Aheeyar 2000:). Thereby it seems that the country faces decline of her self-sufficiency in food especially on rice due to the changes in weather condition. The weather condition directly and indirectly affects agricultural productivity in the areas of crop production system, livestock, food pattern and balance of trade of food and the quality of yield.

a) Risk over Rice Production and related cereals to food security

Rice cultivation is the predominant agricultural activity prevailing in SriLanka and it remains the staple diet of Sri Lankans since its cultivation way back in 800 B.C. Later onwards rice cultivation was further encouraged by development of irrigation structures in the land. The rice farming had been the cultural root in the society and that could lead the economy to develop gradually. Foreign invasions during the period of sixteenth and eighteenth centuries witnessed the collapse of rice cultivation by emphasis on plantation crops and cultivation. Still, the rice cultivation was kept alive due to the people's enthusiasm to cultivate their heritage food while plantation crops were part of exporting sector of the economy.

After independence Sri Lanka eagerly tried to attain self-sufficiency in rice production since early as the 1960s. A country becomes self- sufficient when able to produce sufficient food for the population while adjusting both internal and external forces like availability of food for supply in future, rising price level of food grains, internal policies regarding the income distribution and supply chains, import and export factors and so and so forth. In such case, Sri Lanka is still facing an uncertainty regarding rice. The period of 2005-2009 recorded near to self-sufficiency in rice production. The Paddy land Act in 1958 on land reforms was one of the milestones in Sri Lanka's rice farming movement which overcame the issues related to land tenure insecurity between peasants and landlords, the heart of every agrarian land in South Asia.

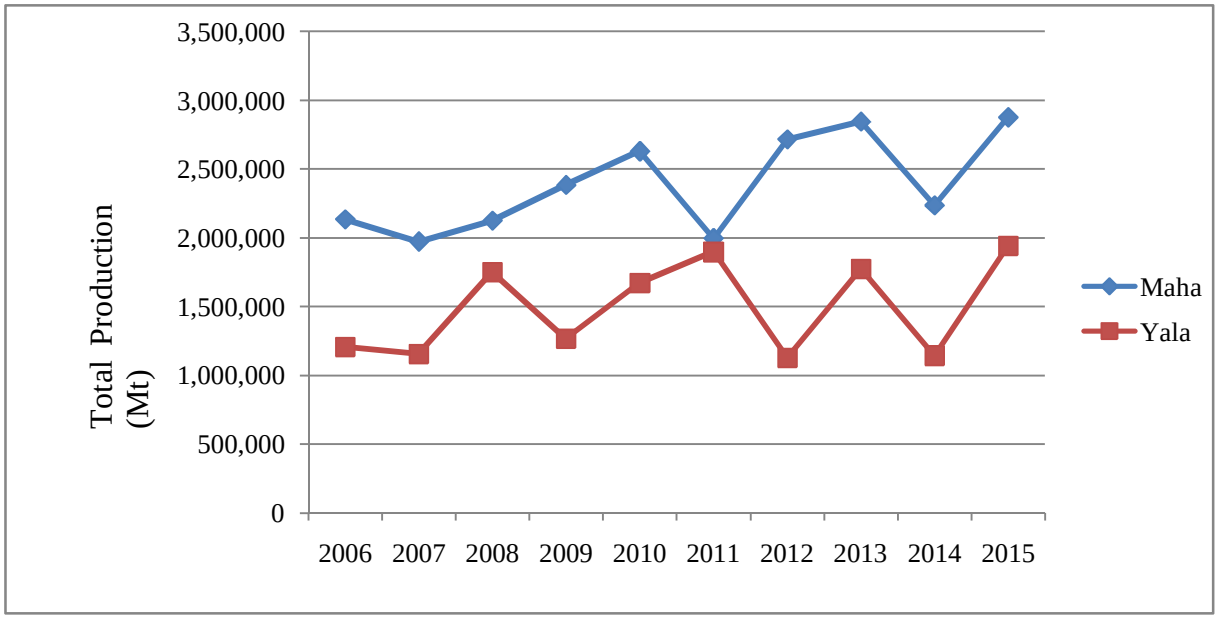
According to the climatic pattern, the Paddy cultivation is very much eroded in the Dry zone than wet and intermediate zones. The asweddumized paddy land viz., the potentially cultivable area under paddy increased from 1,535, 840 acres in 1975 to 1,557, 680 acres, the largest acreage under any single crop in the island (SriLanka Year book 1997:66). In 2015 agricultural-cultivated land extended to 1,253,288ha in which *maha* consists of 772,626 and *yala* 480,662ha land for farming (UNDP 2016).The Sri Lankans are comparatively less likely to produce food grains like wheat despite the major importing of wheat in recent times. The main reason behind wheat not being a home-grown crop and is imported in SriLanka is firstly because rice is their staple food and the land is not suitable for wheat production. Thus it shows the food preference of the people has been changing accordingly. After paddy production, the second largest agricultural activity in SriLanka is vegetable and fruit farming which is cultivated in both intermediate and dry zone. Vegetable varieties that are grown in SriLanka are categorised mainly into two as upcountry vegetables and low country vegetables.

The cultivation of rice largely depends on weather conditions predominantly rainfall and temperature. Rainfall variability in its climatic zones has been changing and meets the anticipated projections though at times it is below the projections. The major seasons are inter-monsoon (April to September) called *Yala*, and the second intermediate season from October to March is called *Maha*. The *Maha* season is considered to be the main cultivating season that sees production of more crops. The rice is majorly cultivated in dry and intermediate zones in the two important seasons mainly depends on rainwater and irrigation facilities in the areas of Ampara, Anuradhapura, Polonnaruwa, Kurunegala, Hambantota, and Badulla.

In SriLanka the clear division of the island into three climatic zones as wet, intermediate and dry zone has duly played a significant role in her agricultural activities, especially in rice cultivation. According to the land condition, rainfall availability, soil moisture, and fertility we could draw the division of land. SriLanka is mainly known for rain-fed farming based on its tropical weather condition. The dry zone consisting of two thirds of the island includes Northern, North Central, and Eastern, and most of the area is under permanent cultivation. Dry zone normally receives less rainfall annually and the soil

conditions have less moisture compared to the other two zones. Still, about seventy percent of dry zone population attains their livelihood through dry zone agriculture. The rice production of the total islands upto20 % relies on the Dry zone. Cultivation in the dry zone is fed by irrigation from the Mahaweli irrigation development scheme. The climate-driven rainfall variability often undermines the available of water facility of this area. Moreover, the vulnerable groups of the communities are settled in the dry zone areas and the water scarcity worsens the human development.

Figure: 3.6 Paddy Production of *Maha* and *Yala* Seasons during 2006 – 2015

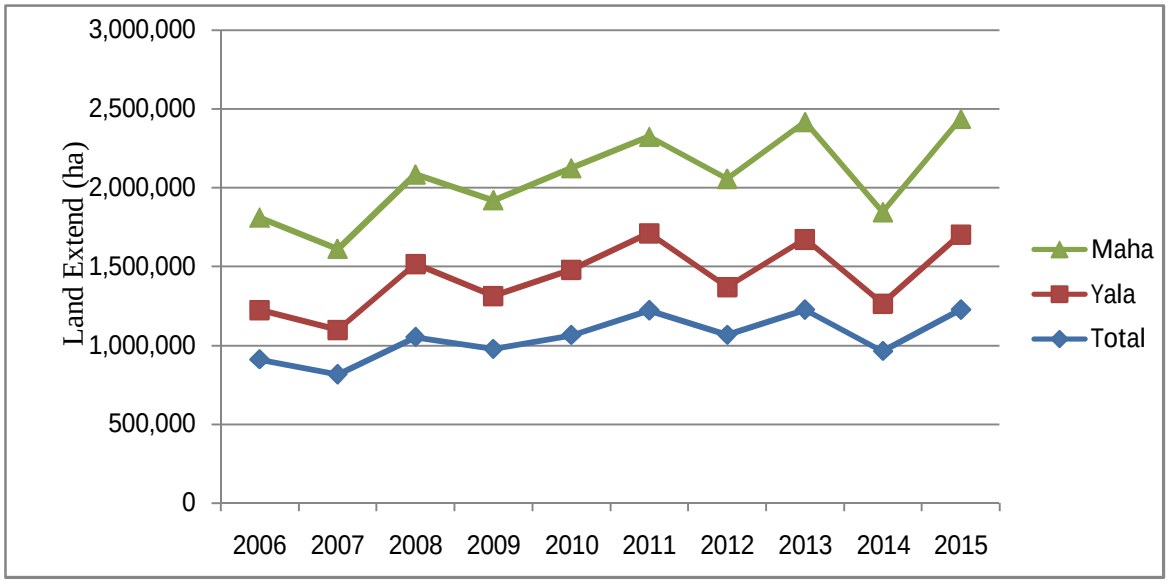


Source: Paddy Statistics, Department of Census and Statistics 2015, SriLanka

The figure shows the production of rice in the two seasons in SriLanka. Maha season Yala seasons production is not sufficient and it has a rising and falling level of production. The years 2007, 2012, 2014 forecasts decrease in Yala production. The monsoon rainfall variability during the Maha season threatened Yala production even though Yala could increase its production while maha diminished in 2011. The Maha season saw less production during this period. The year 2014 has seen a reduced production of paddy due to drought hit and according to World Food Programme report over 750,000 people were under starvation. Sri Lanka was compelled to import rice and other cereals during the periods when it experienced adverse weather conditions

especially in times of drought and floods. For instance in 2015 the country imported 600, 000mt rice while it dropped its food reserves less proportionately at 27% due to prolonged drought. Indeed since 2007 the country has started to diminish in its expected self-sufficiency in rice production[40]. In 2017 Sri Lanka has a projected decrease in harvest due to a decade-long drought and its neighbor Pakistan donated 10,000mt's of rice to Sri Lanka apart from 25,000mt's given in the beginning of this same year("Pakistan Sends rice for drought hit SriLanka", *India Today*, 12 April 2017). Maize, the second largest grown yield in the country is also being affected by rainfall variability and high-temperature rise. Other main crops include coconut, a perennial tree crop which is an important part of livelihood and securitizes the food stability of the nation after rice. Besides, the sector adds a good amount of foreign exchange earnings to the economy.

Figure: 3.7 Extended Paddy Cultivation during *Maha* and *Yala* Season 2006 - 2015



The figure shows the extended land for paddy production. This was one of the major steps which SriLanka has taken to increase the productivity of rice. The paddy cultivation runs majorly through irrigation system. Nevertheless, the production of rice could not overcome drought due to the shortage of water (29%) the country has been plowed only

[40]To importing good quantity of rice is a historical event in SriLanka even though the country has been extended its land for more production. The country has witnessed 150375Mt in 2010, and 129721Mt imports in 2007, see Annual Reports of Central Bank of SriLanka various years and Ministry of Agricultural Reports in 2007, 2015.

35% (281,910 ha) as compared to (804,838) hector that was planned as of November 2016. This maha season (2016 /17) period was hit by drought in August and September at the end of 2016 then later on the rainfall in November was marginal. The major rice producing districts as Anuradhapura, Hambantota, Kurunegala, Polonnaruwa faced losses in harvest with a 35% of reduction.[41](MDM&WFP: 2017). It could be figured out that the changing pattern of climate condition has more impact on crop productivity than other recognized determinants.

Fisheries sector and Marine Ecosystem to Food Security:

The fisheries sector is a very important part of agricultural sector of SriLanka and an important contributor to the economy. A large number of population in coastal areas rely on fisheries sector for their food security and household income. The tropical island harbour of Sri Lanka of 1550 km has a chunk of marine ecosystem including lagoons, marshes, mangroves, coral reefs, seagrass beds and sand beaches. Several lines of sand dunes dominate some coastal compartments, especially stretches between Chillaw and Mannar in the northwest, Rekawa and Potavil in the southeast, Kalkuda and Trincomalee in the northeast and the eastern coasts of the Jaffna peninsula(Weerakkody 1997: 228-229). The coastal zones of SriLanka always depended on the marine ecosystem, but frequently occurring tidal effects like beach erosion adversely affects the ecosystem as seen in countries like Maldives too. Coral reefs are the most important natural resource in the ecosystem, and it provides livelihood and income generation to the rural population. Humans have utilised reef fish as a food, recreation for eco-tourism, coastal protection, and lime for building industries. Coral reefs are valuable to both ecology and economy. Reefs are far less abundant around the Indian Ocean subcontinent and found in Gulf of Mannar and areas of southern SriLanka. The Indian Ocean tsunami of 2004 widely affected the large area of coral reef in SriLanka along with Andaman Nicobar, and Sumatra Islands. It led to 90% mortality of reefs in the coasts of SriLanka (Burke 2011: 51-53) Sri Lanka suffered as it lead to the death of 35000 people and 200,000 lost their livelihood. It totally devastated 75 percent of the fishing fleet and the output of the sector

[41] In normal Seasons these districts has produce around 80% to 90% harvest. (Paddy Statistics of SriLanka, Ministry of Agriculture 2015 maha/yala)

declined by 70 percent in the first quarter of 2005 and sectors contributions to GDP witnessed a sharp decrease in aftermath of the Indian Ocean Tsunami (WFP 2007: 24, D.A.M. De Silva and Yamao 2007: 386).

The Cultural-based fisheries (CBF) isa common acqua cultural activity has existing in SriLanka in order to support the fisheries contribution to food security in addition to coastal fisheries. This is an agricultural practice with two types: Minor Perennial and Seasonal, which take place in small water bodies or reservoirs. This system highly depends on rainwater availability because water could be retained in the small tanks for a maximum of six to nine months approximately. The Southern and Northwestern regions of Sri Lanka are the largest contributors of GDP from fisheries to the whole island. The total production of fisheries has decreased from 535,059mt in 2014 to 520,190mt in 2015 (Central Bank of SriLanka 2016) and the country still relies on importing fishery items for subsistence food habits.

Livestock to food security: Livestock and poultry provide protein for the nutritional requirements of human beings. Many studies over the world reveal that livestock vulnerability is at a high during drought periods. Livestock acts as a supplier of protein in the form of milk, meat and eggs. Scarcity of enough grass and diseases less number of production and impacts the nutritional intake of people. Moreover livestock watering needs a good amount of water but it couldn't be met during drought periods and the grasses become poisoned due to climate changes. SriLanka has largely depended on imported milk products for their daily intake. The nutritional cycle for a minimum health requires milk and egg. But in SriLanka, milk and milk products are highly expensive and couldn't be afforded with the income of an average household in rural areas as the products are imported. "Animal husbandry had been a traditional source of income and an effective insurance against drought for most families in the dry zone" the production shifted to the south due to severe drought impacts in the dry zone and this drastically affected the income security of households in northeastern provinces. (M,Bandara 1983 cited in S. Gamage 2010 :12). Therefore the country has given priority to animal breeding to achieve self-sufficiency in milk products in order to protect food security. In rural areas,livestock contributes multiple services for both agriculture and food intake. The

most important impact of climate change on the livestock is experienced in animal productivity, yields of forages and feed crops (FAO 2016:12).

Table 3. 4 Availability of Food in SriLanka in 2012 – 2014

Items			2013/14 (000 metric tons)				2012 (000 matric tones)			
			Production	Gross Imports	Available Supply	Food Net	Production	Gross Imports	Available Supply	Net Food
Cereals			4,835.36	522.03	5,356.79	3,477.31	3,846.00	36.15	3,861.70	2,392.72
Pulses &Nuts			69.02	161.23	230.25	219.89	49.22	148.03	193.35	185.74
Vegetable(including Onions)			1,055.71	184.26	1,221.35	1,109.00	1,040.39	145.62	1,168.10	1,053.74
Fish	I	Fresh	512.84	15.84	507.32	200.34	486.17	12.82	480.36	201.64
	II	Dried& Salted	68.20	37.61	105.81	105.81	61.32	39.43	100.75	100.75
	III	Tinned Fish	1.12	21.84	22.96	22.96	0.00	18.86	18.86	20.68
Milk	I	Fresh	278.01	0.00	278.01	179.58	218.15	0.00	218.15	131.29
	II	Whole Dried	11.61	89.91	101.85	102.23	9.96	86.32	96.59	96.20
	III	Condensed	7.34	0.02	7.40	7.40	6.15	0.02	6.19	6.19
	IV	Milk Food.)	10.48	0.03	10.51	10.51	9.21	0.03	9.24	9.24

Source: Compiled from Department of Census and Statistics (2013), Sri Lanka. Summary of Food Balance Sheet (2013-14).

The comparison between the availability of two years are had been affected by both drought and flood. The production of Fisheries and Milk items has been increased but the quantity of import has remained same. Therefore the consumption level of protein rich and nutritious food has been increasing tremendously. Likewise, the climatic condition

seems favourable to vegetable production with 15% increase in 2013 however import has increased rather than in the year of 2012.

3.7.2 Food Accessibility

The country has always prioritised self-sufficiency in food crops though food accessibility is one major reason which creates food insecurity in households. Accessibility remains a challenge to households in almost all districts of SriLanka due to increasing level of price, especially during drought years. The districts of Northern and Eastern provinces as Jaffna, Monergala, Kulatara, Ampara etc. face this crisis. It is widely recognized that the impact of climate change that posed sudden shortage in food production escalates the price mechanism of staple food grains and it will further deprive people from their purchasing power parity especially in rural households. In the context of SriLanka accessibility of food has suffered due to income poverty and rising price of basic food grains which lead to undernourishment and malnutrition.

Post-Harvest loss of Food Grains: The loss of food after harvest that is available for consumption reduces the availability of food especially for rice of smallholder farmers in SriLanka. Basically, the issue of reducing post-harvest loss is scientific and technical. Moreover social- economic and infrastructural fitness is required. The Government of Independent SriLanka under President J.R Jayawardene in 1978 failed to achieve in his technological and scientific framework. The unscientific or inaccurate handling of food grains after harvesting, food policies, and storage and marketing mechanisms are the important channels which brought post-harvestlosses. The period of 2016 – 2017 only estimates the loss of rice at 9% and 5% and 2% maize and imported wheat respectively. The changing weather conditions play asignificant role in losing harvests. The climatic factors including extreme wind events, rainfall, temperature, and humidity affects harvest loss in SriLanka. This leads to higher price tags on staple food grains. Thus changing rainfall and temperature has exacerbated threat over harvests in SriLanka largely.

3.7.3 Food Utilization

A good proportion of population is living at below the minimum level of dietary energy consumption. It is an alarming off-track target directly related to food security and nutrition which is an indicator of millennium development goal in SriLanka (UNO 2017:01).Irrespective of the income growth and rapid economic and social development in Sri Lanka, food security and nutrition is a rampant problem across its household in rural areas. Food insecurity and poverty are intrinsically intertwined, and the alleviation of both is strongly correlated (Mukherjee 2015). The nutrition level has declined at marginal value from the base year of 1995-96 at 51.3% to 47.8% in 2012-13. Sri Lanka has been identified as one among the 14 countries which are facing food ' emergencies' in the global scale and about 23% of the total population of the country has been reported as 'undernourished'. According to World Food Programme's Zero Hunger goal, the hunger map of 2015 shows that the hunger level of SriLanka is moderately high in between 15-24 percent. As a result Sri Lanka was one of the countries in which food assistance programmewas implemented by the World Food Programme. But the country could not fulfil the goal to achieve food security within the targeted duration of World Food Programme. Yet, the country is on the track to achieve the second sustainable development goals 2 as to end hunger and all forms of malnutrition by 2030 under the banner of United Nations[42]. Similarly, Sri Lanka was a beneficiary of United Nations Millennium Development Goals that was to 'end hunger and extreme poverty' by the year of 2015.

Households and Nutritional Security[43]:The household food security refers to that "set of processes underlying nutritional well-being, that determine the quality, quantity and nature of food that a household has access to, and its allocation to the individuals

[42] UN Food relief agency working with SriLanka to end hunger and malnutrition, UN News Centre, http;//www.un.org/apps/news/story.asp?NewsID=5617#,WQxeguklHlW

[43]Food Security and Nutritional Security are consists different terms which is often interchangeably using to determine the poverty status of a household. Food security is an input sustains the nutritional outcome as good helth, quality life, (World Bank 2006b: 31), [Online: web] Accessed 19 July 2017 URL:http://siteresources.worldbank.org/SRILANKAEXTN/Resources/233046-1222978473355/ch3LKNutritionOct2008-2.pdf

belonging to the household" (FAO 1997)[44]. Put it differently, the household food security means the physical and economic access to adequate and nutritious food for each household member irrespective of risk and losing factors. Household food insecurity still prevails in SriLanka. 82 % of the total rural areas and especially remote lying areas are suffering due to lack of nutritious food while SriLanka was able to reduce poverty at the national level. Sanitation and hygienic environment are prerequisite for ensuring better health, and nutritious consumption of food is a prerequisite to avoid undernourishment at household level. Factors such as pure water availability, quality sanitisation, livelihood preferences, education are highly relevant to synchronise with utilization (Abafita2014:139).Notably the household food security system in SriLanka have been the most threatened and yet to be secure.

Climate changes pose adverse implications on household food security. Change in onset of rainfall and fluctuation in temperature have been observed to be a challenge for households. Similarly people those who live in coastal beds are less resilient and home garden systems are rarely practiced mainly because of limited land and chemical and unfertile soil. Observations out of the 25 districts reveal that the plantation households, fisheries and labour-led households, rain fed paddy farmers in southern part, daily wages houses in the north east and north of SriLanka are chronically food insecure and do not have sustainable lively hoods while south western part has food security. Climate change is one among the many factors behind insecurity in food which is also caused by unstable income (mainly fisher folk households), increasing price of habitual food grains especially imported food during disaster periods, less accessibility of micro-finance plans which are supports to eradicate poverty.The decrease in rainfall has substantially brought down the crop production of *Maha* season in 2013 and continued to do so in 2014 *Yala* season namely North- Eastern monsoon period. As a result, SriLanka was unable to achieve self-sufficiency in rice for 2014 with total production providing for only 105 kg per capita for the year (WFP 2015:12).

[44]FAO (1997), *"Assessment of the Household Food Security Situation, Based on the Agregate Household Food Security Index and the 6th World Food Survey"*, Committee on World Food Security, 23rd Session, Rome 14-18 April 1997, [Online Web] Accessed 14 July 2017 URL: http://www.fao.org/3/a-bn223e.pdf

SriLanka is a medium food deficit country as it has to resort to importing staple foods and other subsistence items in all times. Therefore the state took initiative to expand the production of rice and other crops widely to give people access to food at minimum expenditure. But while observing the recent scenario, environmental changes have been a problem resulting in less harvest from the extended farming. Moreover the food producers' expenditure has been increasing rapidly at this juncture. The farmers themselves have started to divert other livelihood options.

3.8. CLIMATE CHANGE AND WATER SECURITY IN SRILANKA

Sri Lanka is characterised by its rainfall regime indispensable to its water availability, and its spatial variability in monsoons threatens its agriculture economy and social security in multiple ways. Areas of intensive agricultural water use tend to experience land and water degradation, resulting variously in salinisation, declining water quality, less ground water availability, and degraded coastal water reservoirs. The consequences of such occurrences threatens the resource bases of the poor, farmers, households and other groups which largely rely upon water for their food security. "Children are the most vulnerable group to water security in SriLanka; the lack of quality freshwater has changed their normal routine life" (FAO: 2017).

Irrigated agriculture is the main type in SriLanka and it would be affected by shortage of water and duly the decrease of rainfall will decrease water availability in the rivers and aquifers. In such a situation of drought, the state is compelled to supply the reserved irrigation water for agriculture, to the people for drinking and sanitation. Moreover, the people living in the coastal areas are facing difficulty in finding water due to salinity in the wells. That time the country turns to fulfill the thirsty of people during drought periods, and hunger becomes a resultant of less production of staple food. Water pollution due to increase in population and unscientific waste disposal from industries further exacerbate the quality of river waters in urban and rural areas and leads to poor quality of water unsuitable for both agricultural and drinking purposes. Furthermore, a rise in sea level would lead to increase in influence upstream and also increase salinity in

open bays because the increased cross section would slow the average speed at which freshwater flow to the oceans.

Ground water pollution is one of the major challenges to water security in SriLanka, especially in the dry zone. The dry zone has enormous potential in ground water availability but no proper water management even from political and legal heads of the state, to reserve it especially in conflict threatened areas of Northern Province. The Dry zone largely relies on the shallow aquifiers or agro wells for both drinking and agriculture. Water shortages in the future have already shown its symptoms by a cut down of the reserved water availability in SriLanka. During the drought period people are mostly dependent on bottled drinking water in urban areas sold at higher prices. In addition to climate change and water scarcity issues, the country faces threat of water issues in the policy arena. Riparian river water rights and civil unrest over the reconstruction of water infrastructure in tsunami-affected areas are still alarming in the country.

3.9 Water Availability, Distribution and Security

Water reservoirs in Sri Lanka are fed with intensive rainfall throughout the year. The island SriLanka has 103 distinct radial river basins which are mainly from the south-central part of the country and other extensive water spots including 80 dams. The river Mahaweli is the largest river 208 mi (335 km) which rises on the Hatton Plateau from the western hill of the country and covers most of the districts and provides enough water support for agriculture and drinking water supply. Twenty out of the 103 rivers in SriLanka are classified as wet zone rivers, which carry about half of the annual surface runoff. Annual runoff is estimated to be around 35% of the annual rainfall (UNO, 2006). When it comes to food security the prevailing condition of Sri Lankan agriculture is driven by rainfall and temperature. The tendency of increasing temperature and decreasing rainfall (simultaneously high level) leads to an inequitable distribution of water in major agricultural zones. The wet zone becoming more wet and the dry zone getting drier negatively impacts agriculture and food security (IWMI: 2010: 09)

Water and energy are the two basic intertwined resources that largely influence the development of Sri Lanka. SriLanka depends primarily on its surface water resources for agricultural and domestic and industrial sectors, energy requirements. A good share of surface water has been used for the agricultural purpose in Sri Lanka (ibid 2010: 13-15). More precisely the increased volume of rice production in order to achieve self-sufficiency will put serious consequences on the fresh water availability by consuming 68.9% fresh water withdrawals (David et al 2016: 307-308) On the other hand in out of the total requirement about 42% of electricity has been generated from hydropower sources. In addition energy requirements for the food production activities are increasing gradually and it leads to water stress on the available fresh water sources. Water scarcity is the driver of the trilemma of this complex cohesion. The scarcity of surface water is further strained due to the over use of ground water facilities.

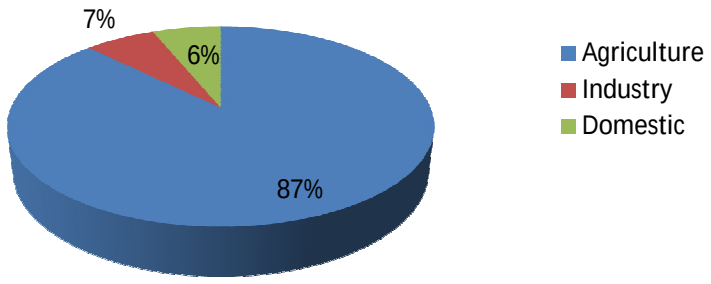
Irrigated agriculture has become common in many developing countries particularly in South Asia where water scarcity is immensely climbing up day by day. South Asian countries are especially agrarian economy and produces food grains for their livelihood by themselves. Irrigation has become a prominent factor in such areas where fresh water availability for agricultural activities is scarce. At the same time irrigation turns out to be a source of water-borne diseases in many regions mainly because of unhygienic conditions, less sanitation among the household and less improved drainage system.

SriLanka had a hydraulic civilization in irrigation water supplies over a century in its pre-colonial era.And the country is still following that legacy in present. Emerson Tennets in his two-volume study of Ceylon published in 1859 describes the country as a “great pond” and says it is “probably associated with the gigantic (irrigation) tanks for which Ceylon is so remarkable” (Tresidder 1960: 03). The extent of irrigable land in the country has been increased to 483,000 hectors including 80,000 hectors of well-drained upland with the commissioning of lands under the Mahaweli river system and other minor irrigation schemes. SriLanka has almost no natural lakes, yet it has 3 ha of inland water per sq.km of land almost 2% of the land surface. About 51,300Gm3 is the estimated average annual surface water in SriLanka and 95% of water withdrawals for agricultural (A. Gunatilaka: 2007: 10-12). The smaller rainfed village tanks have played a greatest

role in shaping livelihoods within the lowland dry zone and life in most villages continues to revolve around the system. The principal crop of paddy in the 600,000 ha of land is cultivated under the major and minor irrigation and one-third of the fields are run by the Mahaweli irrigation development scheme.

Thus it meant that the dry zone has less access to water, however, the area accounted for withdrawals two third of the irrigation reasonably due to its climatic condition. The studies on water scarcity at the national level have been identifying that there will be no severe water scarcity at national level when normal climatic conditions exists. However, by 2025 the expected impact of climate change on water security will mostly affect the Northeastern phase of the country that belongs to the dry zone which will become drier even under the increased efficiency of irrigation schemes in the socio-economic scales (IWMI 1999: 17-21).

Figure: 3.5 Annual Freshwater withdrawals by Sectors during 2013-2014



The crops and vegetable production of the country is carried out with the help of irrigation and therefore irrigation systems are an inevitable part of their food security system .In the dry zone agriculture favorably runs by the aid of about18, 0001water tanks during dry periods. Climate change projections regarding the water scarcity indicate that the dry zone would be the most vulnerable case due to water stress where agricultural activities especially paddy is already located. Northeast and East areas of the dry zone

have already experienced water stress for both drinking and agriculture. Research has found that drought years have severe impacts on their agricultural activities by reducing the availability of water and salinisation of fresh water. Moreover irrigation water security cannot bolster the agricultural sector to feed around 20 million people of this land.

*3.*10 CLIMATE CHANGE IMPACTS

Surface salinity in the ocean is natural and important, though the salt water intrusion with inland water would be a complex phenomenon. Increased temperature and rainfall will cause evaporative effects in the atmosphere. This directly leads to salinisation of agricultural lands in the semiarid parts of the country. For instance, the island of Delft ('Neduntheevu' in Tamil), a part of SriLanka situated in the Palk strait to the west of Jaffna peninsula surrounded by shallow water and thick coral beaches, is severely affected by salinisation in dwellers drinking water facilities and the serious reduction in rainfall induced drought that put a stress over the availability of water in wells and ponds. This makes the tiny population of this land highly vulnerable due to the increasing sea level rise. Almost every household has a single well for their day to day general use, except for the western part of this is lands where well water is most likely unsuitable for drinking due to brackishness (Pathiraja et al 2014: 33-40). The central city of Colombo is severely affected by the salt water intrusion in Kelani Ganga drinking water supply to the densely populated areas. More over 23,449 acres of cultivated land unfertile due to salinisation (Thiagarajah 2007: 96- 97).The people of Delft already started to migrate to other parts of the country and also to West- Asian countries for livelihood earnings whist the majority of the dwellers of this area highly rely on fisheries sector for their livelihood.

The interconnectedness or the less gap between watersheds and coastal belt, unsustainable developmental activities and adjacent mining activities on marine ecosystems have a direct impact on Sri Lanka and it result of human induced climate changes. Natural hazards are often common in the small island SriLanka, among the all such anomalies tsunami was a heavy attack on the country in 2004 that resulted the death of thousands of people, dismantled coastlines, submerged wetlands, and huge impact on

physical, social, natural financial security of the nation to a large extend (Ariyabandu& Fonseka 2009: 1216-1217). Along with destruction of drinking water infrastructure of the south-western coasts of the island it largely tampered with the water purity through salinisation and other contaminants. The shallow aquifers on coastal spits and bars in the island of Mannar and aquifers in the areas of the north central region are found vulnerable to over extraction. As of now the total extent of these two types of aquifers is estimated at around 125,000 ha (UNESCO 2006: 24), and it supports basic needs and livelihood of these areas.

The major visible impacts of climate change on its economy when water is scarce and there is less productivity from agriculture has resulted in Sri Lanka depending more on importing food grains and higher foreign exchange rates. Thereby, household expenditure for food and drinks has been increasing. At the same time, the country has already allocated a huge share of GDP to import fertilizers and associated materials for the cultivation of paddy and other crops to harvest quality food grains. SriLanka pays a good share to tackle the climate change impact the land.

According to the concept of human security (UNDP: 1994, Chenoy: 2007), food and water crises are a threat to the security of the people. Human security concept guarantees people's security from ‘fear ‘and ‘want’. The fear aspect assures security from sudden hazards either natural or human induced. The climate threat in SriLanka is the feeling of insecurity due to the aftermath of earlier experiences of sudden hazards. The aspect of ‘want’ demonstrates security in employment, food, and health, and water is inadequate to attain it. In accordance with the Sri Lankan situation, the human security and environmental security of the island goes through crises. SriLanka is much more sensitive towards the phenomenon of climate change. In order to securitize sustainable food and water security, SriLanka has to formulate perfect policy measures and strategies. These can be achieved only through the mechanism of adaptation and mitigation for a long lasting climate security.

CHAPTER IV

ADAPTATION FRAMEWORK AND RESPONSES OF SRILANKA

4.1 Overview

In the last chapter, gave a view of diverse perspectives of climate change vulnerabilities that SriLanka faces so far specifically on the grounds of food and water security. Obviously, such emerging impacts will cause to worsen in future as global warming elevates. Being an island country, SriLanka needs to take swift and accurate measures to overcome such vulnerabilities and to rebalance its ecosystem. The country woke up to such issues in the period of time when its land devastated by the tsunami in 2004 and continuing prolonged drought and flood series. Since then SriLanka realised its responsibility to keep the country safe and sound from all predominant harms and dangers emanating from global climate change as much as possible. It is mandatory to formulate certain policies and plans which can strengthen the society for a long run and adopt various measures to cope with exacerbated disasters. The including the case of SriLanka economic costs of many climate change hazards are much higher than the annual per capita GDP of many South Asian countries;. Moreover, some of the most vulnerable region in the world, South Asian countries cannot handle many of the climate threats individually; it should be done with either regionally or with the enhanced support of international donors. In short, the cooperation and collective responsibilities are the key areas that need much attention to mitigate and adapt climate change issue in an organised and successful manner.

MITIGATION STRATEGIES

Mitigation involves “addressing the causes of climate change such as reducing the anthropogenic emission of greenhouse gasses, cleaner energy generation, and reduced deforestation while adaptation measures as actions that will reduce the impacts of climate change” (Decosta, 2009:). The GHG emission contribution from SriLanka to the global emission scenario is quiet limited even though it is mandatory to take appropriate action to tackle global warming especially under the “common but differentiated responsibility”.

The energy, industry, agriculture, and waste are key sectors that produce GHG emission which is inherently increase global warming. In SriLanka Energy sector contributes the high rate of GHG around 65% and followed by Agriculture with not less than 20% of emission. The energy sector of the country were produced its grid electrical energy from hydro plants since 1995. Later on it started to depend on fossil fuels to generate energy due to the rapid expansion of electricity to households. Such a situation SriLanka have been recognized the need to reduce the energy from conventional energy sources and had found an alternative as Non Conventional Renewable Energy (NCRE).

Similarly GHG emissions through aforestation, reforestation, sustainable energy development and incorporation of emission reduction strategies have opted to the transport sector. The Government of SriLanka have been taken impressive policy measures and plans to increase renewable energy resources as a way of mitigation of GHGs emissions. The policy of Sri Lanka: the Emerging wonder of Asia: 'Mahinda Chintana Vision'[45] has aimed at to expand at the rate of 20% of renewable energy by 2020. In addition to this the enactment of Sustainable Energy Authority Act and National Climate Change Policy of SriLanka adopted in 2012 has included the necessity to explore the renewable energy. It often exacerbated that the SriLanka has been in the path of mitigation.

The National Agricultural Policy (2007) of SriLanka took initiative to adapt climate friendly technologies and related equipments that are less harmless to the health and the promotion of sustainable agriculture. Therefore it adapted the use of Climate Smart Agriculture (CSA) techniques which involves genetic diversity and production of food crops and livestock varieties include improved rice, tea, and such crops. and manure production and bio-fuels, intercropping, and organic fertilization etc (World Bank 2015: 1-11). In addition to this home gardening and urban agricultural has been encouraged to increase tree cover and carbon sequestration[46], and promotion of investments in

[45] The mahinda Chintana vision is was the Governments policy framework for sustainable development which is based on the economic philosophy that the growth in gross domestic Product alone would not bring economic prosperity to the society. This had given priority to the infrastructural development by generating electricity, communication technologies, road connectivity, education and health. (The Development Policy Framework, Government of SriLanka 2010: 01-5)

[46]

agriculture in order to conserve post harvest management which tends to reduce the waste accumulation and methane emissions, fostering etc. The land use pattern and land use changes and forestry are one of the keys to GHG emission to the atmosphere. The ministry of Agriculture Development and Agrarian Services Ministry could implement organic fertilizers and curtailed subsidy for chemical fertilizers to keep soil climate friendly.

Similarly the National Policy on Waste Management of (2007) with regards to the National Strategy of Solid Waste Management in 2008 had set out policy guidelines to reduce emission from waste. The major technical missions are addressing promotion of Life Cycle Management system includes polluter pay principle, disposal of industrial solid waste management and apply zero waste concepts, hazardous waste management. This largest source of Methane (CH_4) is treating by handling waste. In addition the ecological biodiversity of the land and its use have greater importance.

4.2 ADAPTATION TO CLIMATE CHANGE

Mitigation and adaptation are the two comprehensive mechanisms to cope with climate change impacts in the global scenario and inadequate step to tackle climate-induced threats over economic, social, political and human security in the world today. Adaptation refers to make adjustments in advance or afterward in ecological, social, economic and behavioral systems in response to existing or expected climate changes and impacts in order to secure the environment. It refers as short as the changes in practices, policies, structure, and agendas to reduce or to moderate the potential impacts of climate change hazards and associated benefits.

There are different types of adaptations are take place in SriLanka are mainly anticipatory, relative, planned and autonomous. The reactive adaptation is that measures are taken as a response to climate change impacts whereas anticipatory as measures taken in advance to climate change. In contrast autonomous adaptation methods are taken by private participants or individual actors where the government does not have choices on it, on the other hand, planned method consists as taken by government bodies (Eshaam&

Garforth 2013:). As a small island state, SriLanka as a first South Asian country had prepared and submitted its first Initial Communication for the UNFCCC in 2000 and in which the government of SriLanka has ratified various sectors which are highly threatened by climate impacts likely Food, water, coastal, health, human settlements, biodiversity, tourism, and recreation, export development, and industry- energy- transport.

4.2.1 National Adaptation Strategies

As a tropical country, the farming and farmers of SriLanka are being the most vulnerable sector to climate changes. The identified climate changes are complex in nature, because it's beyond the predictions and contrary to the expectations, so it needs logistic adaptation strategies in response to it. The disparities in rainfall pattern, extreme temperature both in the air and sea surface, and it's exacerbated hazards. At present, it seems adaptation is the single safest way to protect the culture of agriculture and food stability of the country. Formulating and implementing effective adaptive measures to protect agriculture in SriLanka and any of the country is not much easier to be done. Why because it depends on many factors includes social and economic, environmental, institutional factors as the size of the household income, expenditure, the availability and accessibility of climate information, location and nature of the farm land, choices of adaptation, support of the local governmental bodies and authorities.

Such factors are typically underpinning the rural agricultural adaptation in SriLanka. Major scientific studies suggest some adaptation methods to agricultural practices of SriLanka are the introduction of micro irrigation, changing planting dates, reduction of irrigation depth and crop diversification and livelihood. Moreover, the climatic condition of different agricultural zones required different adaptation methods because three different zones have different climatic patterns. It meant that adaptive mechanism is not exactly applicable to three different agro zones of SriLanka. No regret adaptive methods are reinforced by many studies (De Silva, 2007) especially International Water Management Institute as rainwater harvesting and traditional tank systems is in practice in SriLanka. It can be divided into three major forms are;

Long- term Structural Adaptations

This system has been in practice since a long time in SriLanka specifically in the dry zone, as a traditional way of reducing or complete with prolonged dry periods. This method contains both rainwater harvesting through community-based reservoirs and shallow well or “agro wells”. The dry zone covers large areas of agricultural production to the country and more vulnerable to climate change and especially water scarcity. The northern part of the Dry zone is rich with ground water and people are used to depending on good aquifers for both household and agriculture. Using ground water for agriculture through agro wells is the newly adopted measure and mostly private owned.

Medium- term strategic Adaptations

Strategic adaptations refer to the changing pattern of farming according to the weather conditions for a fixed time period. More importantly crop diversification and conservation of eco-friendly technologies and improved farming with resilient varieties are considerably adapting to this method. These proactive methods rely on the socio-economic and institutional factors include information, awareness, and materials for the selection of crop varieties and farming patterns. Recently farmers have started to experiment traditional crops and agronomic or conservation practices to protect agriculture from climate change and it seems coast effective and productive way of adaptation than from Green revolution patterns.

Short- term tactical adaptations

This technique evolves short term structural adjustment in seasonal or annual farming activities by farmers in response to the changing climate or weather patterns. In which farmers makes the accurate short term timing of logistic arrangements of in farming activities carried out as per the hints visible from local climate indicators (Senaratne & Rodrigo 2014: 10-12). In rainfall season which is the foremost indicator to agriculture and some extend easier to make flexibility in agriculture pattern and less risk for short term however for well- term periods, it would be quite difficult because of changing and heavy rainfall thus because they must do quick changes in farming patterns. ‘Adapting short term varieties to avoid the low rainfall periods also could be considered’ (De Silva,

2006: 292). Decisions over the dry sowing of paddy in upland areas during the first rain-fed maha season and the selection of various crops and its sowing date are highly dependent on the observation of intensity and duration of early rainy seasons. Similarly, the farmers started to use different crops instead of paddies like chili and fruits during Yala seasons and making changes on the planting date.

A study on the Kurunegala district of North Western Province (Intermediate Zone) compiled that the changing of planting date has made increase in the rice when the date pre pond to one month, while at the same time around 170 kg decrease when postponing one month. Moreover changing dates to one month earlier would be a cost-effective adaptation strategy for farmers (Dharmarathna 2014: 111).

4.4 MEANS OF WATER AND FOOD SECURE ADAPTATION

Through the above mentioned scientific approaches, SriLanka has been engaged with certain means for adaptation, especially for food and water sector.

Rainwater Harvesting or Small Tank System

SriLanka has the legacy of small tank systems and irrigation and her massive public fund invested in its improvement and wide accessibility in rain-fed areas of the land. Notably, the rain-fed areas of the dry zone covered by small village tanks and that act as a community- managed rainwater harvesting device recently (De Silva 2006:290-293). The system of harvesting rainwater has been in practice the country since long back but the system was not widely recognized. Such village tanks harvests and reserved a significant amount of water during monsoon and uses to supplies for annual lengthy dry spells it really a helpful to manage fewer rainfall seasons some extent. The many village tanks are interconnected with a cluster of surrounding tanks through the surface and sub-surface channel of water, giving rise to networks of reservoirs known as ‘Cascade System’ (Senaratne & Rodrigo 2014:13- 14). Organisation of village tanks to cope with dry spells stands as unique system to enhance farmer’s socio-economic, cultural and physiological capacity to adapt.

The institutional arrangements of the village tanks is a matter of adaptation intertwined with its ownership which deals with the allocation, distribution, limited and equal supply and utilization. Village tanks are considered to be Common Property Resource (CPR) and the ownership of the tanks holds by the Farmers Organisation (FO) which is legally enacted by the government through the Agrarian Development Act of 2000. Thus the way village tanks privileged to the ecological and livelihood services to the farmers even in climate prolonged drought periods (ibid 2014:17)

Agro- wells or Shallow Aquifers

Agro wells are the recent development and an effective response to climate change. This system is widely common in the dry zone as North- north south and eastern parts of the country whereas ground water largely available. The shallow regolith aquifer provides the foundation for tapping ground water for agriculture through agro wells. Using agro-well water for agricultural purposes does not have long history hence it would be a major history in dry-zone farming. This agro- well system seen as a structural response to the climate change triggered water scarcity in the extremely vulnerable areas of the country. This option may be considered as an individual adaptation mechanism to water scarcity and agriculture because Agro-wells are mainly owned and operationalise by individual households and it needs technological support as low-cost pumps operated by diesel and Kerosene (SWATEE 2014: 19-20). Therefore it is the most expensive way of water supply for farming. The important dry spell and market revenue potential crops as chili, big onion, and vegetables are the main grown agro-wells supported farming.

Reintroduction of Traditional Farming

The prevailing paddy cultivation in SriLanka is the outcome of Green revolution of 1960. It adheres to the New and Improved Verities (NIVs) of crops and promoted green technologies (chemical inputs) fertilizers etc result into extended irrigated paddy lands and comparatively more production. However, in the light of changing the climate, recent studies have totally dismantled this system by arguing that many popular NIVs are do not appear to be favorable to overcome climate change impact and less likely to be resilient to overcome climate shocks. Therefore the country has been nationally accepted to follow

traditional paddy varieties over many years against climate change as a means of adaptation. Traditional paddy verities are much resilient to climate threats because it's unique character to live longer than NIVs (2-4 months than 2-3 weeks of NIVs) and potentially capable of overcoming heavy rain, drought and flood(ibid 2014:22-24). Moreover, friendly agronomic practices like the use of organic fertilizers keeping the sustainable fertility of land produce microorganisms while chemical fertilizers lead to land degradation and high health impacts on both plans and humans. The traditional farming is widely common in Sri Lanka; '*Nava Kekulan' (*dry sawing system) is one of the famous farming in its dry zone. Moreover, sharing and practicing of indigenous knowledge is the best factor along with this adaptation would be an additional benefit.

The midseason drainage paratcice to moderate water requirement for paddy farming as well increased rop yeilds were practiced in SriLanka with the support of FAO.This system exists in Japan and China and some other South East Asian Countries. Eventhough the programme doesnot harwest at an epected rate.

Land Use Pattern

Homegardens are the oldest land use system in the world wide and presently existing in African contries, South east Asia, South Asia and Asia Pacific islands[47]. Home Garedens represent intimate, multistory combination of vrious trees and crops, sometimes in association with domestic animals, around the homestead (Kumar and Nair, 2006: 251). According to the FAO (2009) estimates as of 2005, around 977 700 ha land of SriLanka covers Homegardens or agroforestry. Homegardens system is potential for dual purposes as both mitigation and adaptation. Multi-layered Home Garden (MHG) are a common agroforestry system, which covers a considerable part of the central province of SriLanka know as Kandyan Forest Gardens. The water use by MHGs forms as important consideration in the catchment water balance of the central province of Lanka, which is the most important rainfall catchment on which much of the SriLankan agricultural power generation depend on (Decosta 2006: 252).

[47] African countries, Kerala and SriLanka in South Asia, Philippines, Malaysia, Indonesia in South East Asia, Small Island Countries in Asia Pacific , (Kumar and Nair 2006)

As an adaptation way the HG is nationally accepted in SriLanka mainly to ensure food security sustainable system as well as capable to increase and sustain fertility of the land and refreshing degraded environment. Thus the idea on expanding HG in SriLanka into new areas is related to the pathway of rehabilitation of degraded lands. The estimated area of open dry forests in SriLanka is presently eatimates about 7.5 % of the total land area where about 85% considered to be degraded. In this perspective the GOSL has taken initiative to widen the agroforestry sytem. Similarly in the mitigation perspective home garden plays an active role. Agroforestry can reduce atmospheric CO2 levels by holding carbon and biomass. In addition this would be mitigation option too for SriLanka in order to achieve the UNFCC purview to mitigate the impact of deforestation and forest degradtion called REDD+ strategy (Eskil Mattsson et al, 2013). The Depatrment of Forest and the Government of SriLanka has developed a policy that The REDD+ vision for SriLanka is ‘ Beyond forests, sustaining life and livelihood in a greener SriLanka. This programmen envisioned that to manage degraded environment through better management, conservation of biodiversity and wildlife, reduce the risk of natural disasters. Such a way SriLanka is prtially resilient to climate change due to the adaptation strategies by increased Homegardens.

4.5 LEGAL FRAMEWORKS TO ENVIRONMENTAL ADAPTATION

The legal framework for the protection and promotion of climate sensitive areas of the country has become mandatory. The ecosystem of SriLanka is highly important to safeguard the people and environment sustainable to the future of the nation. The country witnessed wide environmental issues which can threaten its food security, water availability and sustainable growth. Degradation of the environment, coastal erosion, landslides, depletion of marine vegetation, salinity, deforestation, all such implications leads to natural hazards either human induced or climate-induced. Such facts were noticed by the legislation in time to time and formulated such preventive measures through legally binding acts.

The Environmental Impact Assessment (EIA) of SriLanka was established through the National Environmental Act (NEA) No. 47 of 1980, the first regulatory framework for the environmental conservation and protection in the country, with Central

Environmental Authority (CEA) as a regulatory and enforcement agency. Thereafter this act has been amended in 1988 (Act No.56) and strengthened EIA. The establishment of EIA was mandatory for high impact projects in 1988. Thereafter the Ministry of Environment was set up in 1990 and formulated a National Environmental Action Plan and a report for the historical Earth Summit of Rio de Janeiro in 1993 (L. Zubair, 2001: 470). The government has also developed the Environmental Protection License (EPL) Scheme, It includes Coastal conservation act of 1981 with CEA as the enforcing agency, as a regulatory instrument and in 1993 the government made Environmental impact assessment (EIA) a legal requirement for a range of development projects (Mullawatantri et al 2014:03-5). The major scheme of Mahaweli Authority, the largest developmental infrastructural plan was developed under EIA in the 1980s to enhance hydro-electricity and irrigation to the whole SriLanka.

The introduction of EIA to the country seems successful and progress through the establishment of sustainable projects and training programs to the society as a whole. Moreover the active participation and support of NGOs and international donors like World Bank and ADB especially for power plant projects. The mechanism of transparency and public review platforms for projects seems limited, it lacks cumulative mechanisms to assess the environmental impact of major projects, and frequent non-availability and accessibility of environmental data for further improvements for maintaining sustainability. It could lead to environmentally sound impacts. The EIA has avoided a detailed chapter on legal requirements of standard practices to incorporate its reports on disaster risk even.

4.5.1 The National Environmental Policy (NEP) of 2003 and 2012

SriLanka has the legacy to protect its ecosystem through various levels of approaches. The environmental policy to be a legal and institutional framework to the country to use, maintain and preserve the natural ecosystem. Natural Action Plans have been implementing since the 1980s and National Action Plans in an active mode since 1992. This intervention to the society reflects certain guiding principles to the government, non-governmental organizations, and the public to curbing activities that are thought to

accelerate climate change. In which strategic approaches to natural resources management, economic sectors which are vulnerable to climate change, and its scenic landscapes rural-urban-coastal-inland as well as sites of archeological, cultural sites are to be protected (National Environmental Policy and Strategies, 2003). In order to safeguard the environmental sustainability of the country the new institutional structure were established in 1999 by the Ministry of Forestry and Environment in 1999, known as 'Committee on Environmental Policy and Management (CEPOM)' this is considered to be the finest institutional mechanism incepted recently to achieve economic development and integration process. In addition to this, the action plan on environment titled "Caring for the environment (CEF) was one of the main paths to the sustainable development for the implementation of the NEP (Hewage and Mallika 2011). The climate security of the country is undergoing through a serious risk since when the GHGs emission has been aroused. The adoption of The National Climate Policy was the outcome of deliberations within the institutional realm and received demands from the environmental concern of the public. The policy contains the vision, mission and set of principles and statements under vulnerability, adaptation, and mitigation, sustainable use of the land and knowledge capacity building.

4.5.2 The National Climate Change Adaptation Strategy (NCCAS) 2011- 2016 and 2016- 2025

The Government of SriLanka (GOSL) has formulated its first major initiative to the climate change as, 'The National Climate Change Adaptation Strategy for SriLanka' in 2010 and soon after prepared it's The National Climate Change Policy (NAP). It is often known as preparedness for climate change impact. The first National Climate Change Adaptation Strategy in SriLanka (2011-2016) was formulated under the key areas identified in the Mahinda Chintana Vision of SriLanka as inclusion of climate change adaptation into national planning, Human capacity building, to reducing the impacts on climate change on food security, make economy climate resilient, protection of biodiversity (Climate Change Secretariat, Ministry of Environment 2011).

In contrast, the second National Adaptation Plan for Climate Change Impacts in Sri Lanka has been developed in 2015 on the basis of the broad guidelines of UNFCCC and submitted its Nationally Determined Contributions to the UNFCCC in September, 2016. It covers adaptation needed areas into two levels as key vulnerable areas and, cross-cutting national adaptation required spots. This includes food security, water, coastal sector, health, human settlements, biodiversity, tourism and recreation, export development and industry- energy and transportation. In addition, the inception of the 'Blue-green Era' in 2016[48], an initiative taken by the government, marks the adoption of a blue-green development strategy for the sustainable development of Sri Lanka. The second major factor is often visible here is the issue of food security is continuously being a key vulnerable part which needs immediate adaptation and the issue of water security also identified under high confident adaptation requirement. The Preamble of National Climate Change Policy of SriLanka states that 'extreme weather events such as high-intensity rainfall followed by flash floods and landslides, and extreme dry periods resulting in water scarcity are now becoming a common occurrence in SriLanka'.

Coastal Legislation – Coastal Conservation Act No. 57 in 1981

The coastal zone of SriLanka is vulnerable to the thrust of the climate-induced sea-level rise and other related consequences. Thereby the country alarmed to coastal sustainability and green mechanisms. SriLanka has approximately 1,600 km long coastline and hosts rich ecosystem. Moreover, it encompasses ports, harbor, tourism, and large density population settlements and agriculture to livelihood. Coastal erosion has been identified quiet severe in the shoreline of western and southern costs of SriLanka where corral mining and fishing take places for livelihood. Integrated Coastal Zone Management (ICZM) system for the development and conservation of coastal areas and resources SriLanka was one of the first countries to establish its Coastal Conservation Department (CCD) under the ministry of Fisheries in 1978. The overview of the coastal management

[48] Climate Literacy in Sri Lanka's development pathway', Daily Mirror (SriLanka), 28 April 2017, SriLanka, [Online: web] Accessed URL: https://www.pressreader.com/sri-lanka/daily-mirror-sri-lanka/20170428/28284507590837

planning of the country aims to preserve the mangroves system for sustainable coastal ecosystem and wildlife, nursery for fisheries and coral reef etc.., It was after the tsunami in 2004 the country deeply realized that the importance of mangroves in the protection of coastal systems and the inhibited people from such climate triggered hazards and has given greater attention to restoration and rehabilitation of mangroves in the coastal belts. Along with it, various projects have been initiated as Even though studies demonstrate that mangroves are declining at a rate every year.

4.4. REGIONAL INSTITUTIONS ARRANGEMENTS AND POLICY ADAPTATIONS

4.4.1 South Asian Association for Regional Cooperation (SAARC)

Greenhouse Gas led climate change crunches almost all adjoined member states of SAARC while the region together contributes less GHGs emissions. As a result environmental, degradation natural hazards and exacerbated events now come under serious concern to SAARC rather than other conventional security threats. The initial decades of its summit in 1987 at Kathmandu fruited with two milestones as a Regional Study on the "Consequences of Natural Disasters and the Protection and Preservation of the Environment" and in the fourth Islamabad summit on 1988 initiated conduct a joint study on the "Greenhouse Effect and its Impact on the Region" (SAARC Secretariat: 2017). From the light of this studies the first collective response to the environmental issues has emerged in its third ministerial meeting held in Maldives in 1997 and adopted SAARC Action Plan on Environment. It enhanced the importance of regional and international cooperation to the fulfillment of environmental security in the region through the shared responsibility to implement the action. The Colombo Declaration of SAARC in 1998 duly reaffirmed the implementation of international and regional agreements for the protection and sustainable use of natural resources in South Asia.

Later on the Dhaka ministerial meeting and Declaration on climate change, and SAARC Action Plan in 2008 (Dhaka Declaration, 2008) turned to natural disaster response system and disaster risk reduction Plans and three broad thematic areas were covered as adaptation, mitigation, technological development and deployment and joint mobilization

of resources. South Asia is basically a highly sensitive region exposed to natural disasters[49] that are either climate-induced or anthropogenic. This trend has been notified many times at several SAARC Summits[50]and has taken curious steps to tackle the issue. The sudden loss and damages due to the tsunami in India, Maldives, and SriLanka then after an earthquake of 2005 have influenced on think –tank heads of states to make an immediate requirement to promote regional cooperation through SAARC. In Male, Maldives in 25th June 2005 held a special session of ministers in response to the serious outbreak of Indian Ocean tsunami in 2004 in the region. This emergency meeting set out a "Comprehensive Framework on Disaster Management 2006- 2015"[51]. Thereby the establishment of SDMC in 2006 aims at fulfilling all the plans taken under the roadmap and by coordinating both regional and national disaster management efforts through capacity building and exchange of resources and experience. This framework also embraced with the Hyogo Framework of Action (HFA)[52] 2005-2015) to build nations and communities resilient to natural disasters and fortunately every country of the region has been committed to its implementation but due to the political rivalry between the member states loses the effectiveness of the disaster management system and has been deadlocked. However, the progress of the SDMC seems unimpressive due to legally

[49]Major Disasters occurred in South Asia as includes Indian Ocean tsunami (2004), Flood in Nepal (1993), Oil Spill in Pakistan (2003), Earthquake in politically unrest areas of Kashmir, India, Afghanistan, and Pakistan (2005), and Nepal (2015) and Cyclone in Bangladesh (1991) and Cyclone Sidr in (2007) series of floods in SriLanka and Pakistan. (Mahim Karim, 2013); [Online: web] Accessed 7 June 2017 URL: https://www.scidev.net/filemanager/root/site_assets/sa/framework.pdf. It is estimated that of over the last forty years 1,333 disasters experienced in different parts of the region and that killed 980,000 people, 2.4 billion people affected by serious destruction, and it could result into the damage of worth US$105 billion. (Naseer Memon 2012)

[50]The third summit of SAARC at Kathmandu 1987 emphasised deep concern over environment degradation and special stress on natural disasters, and endorsement of recommendations Sixth in Colombo 1991, The Male Declaration on 1997 had extended a deep apprehension on the issue of disasters and agreed to collaborate with action plan on environment and natural disaster risk.

[51]"Male Declaration", *SAARC Secretariat*, [Online: web] Accessed on 4 June 2017 URL: http://saarc-sec.org/areas_of_cooperation/area_detail/environment-natural-disasters-and-biotechnology/click-for-details_6

[52] The world conference on Disaster reduction held in Hyogo, Japan in January 2005 adopted a 10 year plan from 2005-2015 to protect world from natural hazards. This global blueprint referred as the Hyogo Framework Action as an effort to build communities resilient to disaster risks to their lives and harmony. 'Hyogo Framework for Action 2005-2015', [Online: web] Accessed on 7 June 2017 URL: www.unisdr.org/2005/wcdr/intergover/official-doc/Hyogo-framework-for-action-english.pdf.

binding instruments which could support Disaster Risk Reduction (DRR), insufficient data for action and also constructive nature in sharing of data with different agencies, and lack of adequate finance for resource mobilization[53].

The Sixteenth SAARC Summit at Thimphu in 2010 turned into a legally binding convention on environmental protection that ever had in its history. This Silver Jubilee summit of SAARC, the heads of states turned into its milestone declaration on the environment as emphasised the view 'Green Happy South Asia.'[54] which sets an ambitious goal for South Asia to lead the world in furthering renewable energy, cutting carbon emissions, and reducing poverty while strengthening resilience to climate change turned out to be a more concern to climate change particularly the discussion inter-governmental monsoon initiative on the evolving pattern of monsoon to asses vulnerability due to climate change, mountain initiative, and its contribution to sustainable development and livelihoods, intergovernmental marine initiative to strengthen the understanding of shared oceans and water bodies in the region. Moreover Thimbu summit set out the fundamental target to low carbon technologies and initiate to increase renewable energy[55]. Capacity building and experience sharing on climate change was one of the key objectives of SAARC Action Plan. In respect to this the issues related to coastal fisheries resources monitoring and conservation and Oceanographic observations SAARC was organized A study tour in SriLanka and a training workshop on energy audits was also conducted in 2011.

When it's reached at Colombo SAARC recognized the potential threats from climate change and decided In 2008 the Colombo Statement of food security" developed a policy

[53] "SAARC Regional Progress report on the important action of Hyogo Framework (2011-2013)", [Online: web] Accessed on 7 June 2017 URL: http://www.preventionweb.net/files/32602_RegionalHFAprogress-SAARC(2011-2013).pdf.

[54] Ministry of External Affairs (2010), Government of India, '16th *SAARC Summit Declaration (29 April 2010)*', Media Centre Document, 30 (4) April, [Online: web] Accessed 8 June 2017 URL: http://mea.gov.in/bilateral-documents.htm?dtl/3886/16th+SAARC+Summit+Declaration+29+April+2010

[55] SAARC focus on climate change, for a green, happy South Asia, Climate & Himalaya- chimalaya. org/2010/05/08saarc-focus-on climate-change-for-a-green-happy-south-asia/

guidelines to all member countries in order to reduce climate impact change on food security through give deep concern and agreed the commitment to exchange experience, and promotion of technological developments. The Colombo Statement on Food Security" of 2008 provides the policy guide to all SAARC countries and highlights the need to evolve and implement people – centered short to medium term collaborative projects, which will help in achieving food and nutrition security.

Arrangements on Food Security

Poverty eradication and achieve human development has been the fundamental goal SAARC since its inception. The five major areas which outlined in the 1981 Colombo summit include agriculture and rural development often clear that the situation of rural South Asia was being under poverty, illiteracy, unemployment and economic backwardness. After a period the issue of environmental degradation and climate change added to the category with a high ranking. The first ever joint arrangement of food security made by the SAARC heads of states in 4th November 1987 at Kathmandu and came into force on twelfth August 1988 under the view to promoting the economic and social welfare and development of South Asia. The ministers recognised that to attaining food security as a means to collective self-resilience and as a tool to tackle the inflicting effects of natural and man-made calamities. Thus the summit provided an in-depth '*Agreement on the Establishment of SAARC Food Security Reserve*'[56].

This agreement literally stands to reserve food grains and provide to member countries during emergencies. Under this agreement (Article VII&VIII) SAARC Food Security Reserve Board were established to administrate and regulate the reserve. The Article III of the agreement entitled that 'each member country shall be approved to draw on food grains forming part of the reserve in the event of emergency'. The emergency means that the situation member country may have suffered reserve due to unexpected natural or manmade calamities and such a country unable to cope with such a situation by using its national reserves and is unable to procure the food grains it requires through normal

[56] ' Agreement on Establishing the SAARC Food Security Reserve', *SAARC Agreement and Conventions*, [Online: web] Accessed 4 June 2017 URL: http://www.asianlii.org/saarc/other/agrmt/aoetsfsr537/aoetsfsr537.html

trading transactions on account of the balance of payments constraints. As per the Article IV and V entails certain condition for the draw on food grains that the state shall responsible to directly notify their emergency requirement to other member countries and the same time to inform the Food Reserve Board. Moreover the trade- simply put it would be subject to the direct negotiation between the member countries. However it could not operationalise successfully, remarkably no country could utilise the facility up to the end mainly due to difficult procedures enclosed in the legal framework[57]. Likewise in 2002 the reserve had 241,580 tonnes of food grains even though it could not be utilised for the emergency situation emerged due to the Indian Ocean tsunami in different parts of the region, flood in Indus and earthquakes in Kashmir ("Nepal Crisis shows its SAARC food bank gets going" *Hindustan Times*, 30 April 2015). Overwhelmingly lack of political will and the scattered political interested of countries also undermined the food reserve as ineffective.

The food security and poverty are the two sides of the same coin. Therefore poverty eradication and the right to food can go hand in hand where in which the region has food surplus exists and has the potential further to produce food. ("Challenge to SAARC" *The Hindu* 26, March 2000). The move to eradicate poverty in the region through the cooperative arrangement of SAARC has been started since early; further, it literally started in its 6th Summit at Colombo in 1991 with the establishment of an Independent South Asian Commission on Poverty Alleviation (ISACPA). The report named "Our Future our Responsibility" and the recommendation of the commission were economically and politically echoed in SAARC and its lead to the region to found coherent strategies as social mobilisation and empowerment[58] to achieve human

[57] The SAARC food reserve was failed due to various loopholes in the agreement. Firstly, during 1997-98 Bangladesh went through the situation of acute food shortage, but it could not attain the food reserves because of the procedural barriers embodied in the agreement. Secondly, in 2002 the agreement was amended because of the term entitle 'emergency' was questioned on the grounds of its clarification. Thereafter number of issue gradually had come across including the nodal points and institutions, safety standards, pricing guidelines, specimen of grains, transport delivery etc which lead to the agreement null and void. [Online: web] Accessed 4 June 2017 URL: http://www.saarc-sec.org/areas_of_cooperation/area_detail/agriculture-and-rural-developemnt/click-for-details_4

[58]Mahendra, P. Lama 'SAARC Programmes and Activities Assessment, Monitoring, and Evaluation', [Online: web] Accessed 6 June 2017 URL: http://siteresources.worldbank.org/SOUTHASIAEXT/Resources/223546-1192413140459/4281804-1192413178157/4281806-1265938468438/BeyondSAFTAFeb2010Chapter17.pdf ,

development by eradicating poverty. This has led to deliberations on SAARC heads and they realised the need for being on the track of international effort of Millennium Development Goals (MDG) by 2015. Furthermore, it turned SAARC responsibility to endeavor to set out regions own Development Goals (SDGs) named "An Engagement with Hope" released with deep commitment in 2004 covered twenty-two goals to address livelihood, health, education, and environment(ISACPA Report 2007). The SAARC Plan of Action on Poverty Alleviation had been revised at the 18th SAARC Summit held in Kathmandu in November 2014 recognised to step up to achieve sustainable economic growth and development. In this context, intergovernmental cooperation for the operationalisation of Sustainable Development Goals (SDGs) is highly recommended (SAARC Secretariat). In respect to this UN emphasise that widespread hunger and malnutrition in South Asia point to the further urgency of enhancing regional cooperation to complement national strategies for food security (UNESCAP 2016).

Food Security Bank Agreement

SAARC Food Security Bank was the initiative emerged out from the Twelfth SAARC Summit at Islamabad in 2004. The agreement on Food Bank duly signed by all member countries at the 14th SAARC Summit held in New Delhi on 3-4 April 2007. The food bank is the revamped form of SAARC food security reserve to provide food support to the countries through collective cooperation. Importantly Food Bank can perform at various levels as stabilizing the food price in the region and would be an essential mechanism to cope with climate change during both emergencies and a shortage of food during drought and floods hours and can regulate food price inflation (Pant 2014: 8). The study, However, its implementation and operationalisation remains slow and just as a notion. In accordance with the provision enclosed in the Article V entitled the withdrawal of food entitled that it can be utilised both the situation of emergency and shortage of food. Emergency refers to the condition in which the country unable to meet its food requirement from its own its surfed reserves due to unexpected natural or manmade calamities. On the other hand during the phase of production shortfall or storage shortfall meant the production of food grain in the current shall be lower than the average production of the previous three years by 8%. And there is no clear identified procedure

for storage shortfall situation. The newly added provision to reduce the difficulty in access to food grains from food bank did not much improve rather than the food security reserve agreement except the conditions of the price level[59]. So far the both programmes are failed to meet its exact objective to meet even the emergencies with adequate food security and act as an entity of regional food reserve to support regional security[60].

Seed Bank Initiative

The food seed bank is another initiative had taken by SAARC at its Seventeenth Summit in Addu City, Maldives in 2011 and came into force in 2016 (SAARC Secretariat 2016). The main objective of the plan to secure the region food secure especially from climate change emergencies and normal periods also. The normal tendency exists in the region over the past years have shown climate changes adversely threatens crop production and even in post-harvest too. It would threaten the self-reliance of the nations to feed their people and even threatens the income and GDP of many SAARC Countries. The Seed Bank ambitious to make region resilient to climate change threats over their staple food systems. Thereby the member states unanimously signed the agreement despite food security bank yet operationalised and seed bank faces challenges to its initial establishment also. Even though the SAARC conducted a three-day meeting on the availability, accessibility, and demands of climate resilient crop verities, supply and its scientific facts for the proposed agreement ("Seed Bank key to food security", *The*

[59] According to the Food Bank agreement during the emergency a country shall be able to withdraw food grains and the condition of price negotiations will be settle between member countries and the humanitarian concern also will be applicable if it is needed. However nothing was worked.

[60] Even though when Nepal went through such an immense situation no regional food security bank were supported in 2015, and the country Sri Lanka has been gone through the condition of food shortage due to prolonged drought years but nothing worked for it as a food support mechanism as per the Article V of the agreement. More Over both this case the member countries of SAARC namely India, Pakistan and SriLanka individually supported Nepal, Lama, Mahendra, P. (2015), 'Lender of Last Resort', *Kathmandu post* [Online: web] Accessed 9 June 2017 URL: http://kathmandupost.ekantipur.com/printedition/news/2015-04-03/lender-of-last-resort.html , likewise both Pakistan and India had extended its support by giving food grains and water and also the flood situation in the monsoon period SriLanka has been largely supported by India and Pakistan recently. It shows the cooperation and collective integration yet does not work in SAARC, 'Pakistan to Send relief assistance to SriLanka', [Online: web] Accessed 9 June 2017 URL: http://www.colombopage.com/archieve-17A/May27_1495893967CH.php , "Pakistan to Provide Food Aid", http://www.adaderana.lk/news/39925/pakistan-to-provide-food-aid- , "India rushes aid to SriLanka as floods claim 122 lives", [Online: web] Accessed 9 June 2017 http://www.economictimes.indiatimes.com/new/politics-and-nation/india-provides-help-as-death-toll-tops-100-in-sri-lanka-floods/articleshow/58871892.cms.

Hindu, 29 December 2015). The regional cooperation and mutual effort is the key priority area which needs for the successful functioning of any regional agreement and the Seed Bank also emphasised this as a traditional custom in it.

The possibilities for joint action were complicated by SAARC in the tsunami affected areas of South Asia. It often shows that the overlaps of interests in the area of response to a natural disaster as well. Lesson learned from this within a month after the tsunami of 2004, SriLanka established a Disaster Management Centre (DMC) with the support of UNDP[61]. SriLanka formally adopted its charter providing for the promotion of economic and social progress, cultural development within the South Asia region and also for friendship and cooperation with it. This forum must be fully exploited to deal with the common problems of environmental degradation. The concept of 'information sharing' 'technical support' 'financial assistance' and 'training' could be utilized to fight the menace of environmental degradation jointly (Jha, 2004: 1669). This can be seen its initiative to established South Asia Cooperative Environmental Programme (SACEP) for the cooperation and bridging of information and experience between the member states with regard to environmental concerns especially disasters and degradation.

4.5 United Nations Frame Work Convention on Climate Change (UNFCCC) to SriLanka

UNFCCC is the utmost policy mechanism at the global level which constitutes the majority of the countries in the world with the ambition to formulate adaptive policies and measures to protect the world from the exacerbated dangers of climate change. This administrative body majorly concentrating on the view that to regulate the countries from the increasing rate of Greenhouse Gas emission (GHG) and to adapt assorted laws in order to protect the sustainability of this earth through various summits and adjourning purposeful actions.

[61] Howard Roy Williams, (Undated), "Response to the 2004 Tsunami: An International Perspective", Forwarded by Julia Steets and Daniel S. Hamilton , *Raising the Bar : Enhancing transatlantic governance of disaster relief and preparedness*, Research Volume, Global Policy Institute, Germany, p. 405 [Online: web] Accessed URL: http://www.disastergovernance.net/publications/research_volume/

Not surprisingly that the island nation of SriLanka has fallen into the Intergovernmental Panel on Climate Change (IPCC) and UNFCCC's category of "vulnerable" small island nations under serious threat from various climate change impacts, such as sea-level rise, floods and droughts, and variability and unpredictability of rainfall patterns.[62] On the basis of this UNFCCC had ratified Sri Lankan's inclusion in the forum on 20th November 1993 and since 1994 being a part of this organisation. As a developing country, SriLanka has been regulated by the eyes of the law of UNFCCC. With due respect to UNFCCC the Ministry of environment in 1994 carried out an assessment of GHGs emissions within the country based on the limited available data and related information's. Recently at the legislative level, the secretariat of climate change under the authority of Mahaweli development is the key legislative agency established for the management of climate-related issues of SriLanka and same time it recognised as a designated national entity of UNFCCC.

The global level adaptation to climate change does not exactly favourable or effective to all the recognised member countries under the UNFCCC. It meant that adaptation to the impacts of climate change is not organized at the global scale. Some adaptations by individuals are planned while others may be spontaneous reactions to changing circumstances related to resource use (in agriculture, forestry, and other sectors) or related to changing economic circumstances or opportunities. Adger identifies that the responsibility of adaptation to mitigation on the grounds of equity and fairness from local to global level (Adger 2001: 922). In spite of IPCC's belief that the climate change vulnerability correlated with the level of development (per capita), Adger argues that but in fact it determined by a complex set of economic, social and institutional factors and in the very rare span of time it correlates with per capita. But also it is often taken as in only in national level socio-economic indicator of vulnerability i.e. the ability to cope with and adapt to climate stress (Adgar 2001).

[62] Government of SriLanka, (2000), 'Final Draft , Initial National Communication under the United Nations Framework Convention on Climate Change", Government of SriLanka, SriLanka, accessed from http://unfcc.int/resource/docs/natc/srinc1.pdf.

Sri Lanka's initial communication under the obligation of UNFCCC had been identified several sectors in which the country suffers lot are agriculture, coastal zone resources, forestry, health, human settlements water resources transportation and energy supply. Out of all the South Asian countries, it is SriLanka that could first submit its initial communication to UNFCCC. In the local level policy adaptation shows that SriLanka is the only country which has a permanent secretariat under the ministry of environment in order to deal with climate change triggered issues in the country called climate change secretariat. In spite of this, the country could not achieve many initiatives in regard to climate change issues. Because it's having a limited number of adaptation and cross cutting strategies considered to be the highest instance for this.

4.5.1 Kyoto Protocol: The Kyoto Protocol was the key inception to the mitigation of Greenhouse Gas emission scenario in 1997[63] as the result of the third Conference of Parties of the UNFCCC. The protocol was legally stipulated limits of Greenhouse Gases to industrialized countries. Though it was quiet complex and controversial largely because of stipulated separation of targets to different parties. SriLanka had been unanimously decided to be a take part of global ratification of the Kyoto Protocol and recognised the importance to be a stakeholder in global mechanisms of reducing greenhouse gas emissions more particularly as an island. SriLanka became a member by ratifying the legal binding of Kyoto Protocol since 1993 and 2002, and belonged to Non-Annex1 list of countries and is expected to compliance with reduced Greenhouse gas emission from developed countries. As far as SriLanka was not responsible for the increasing rate of global emission with its negligible share of less than 0.6% per a year and likely to be having no target to be done according to the protocol. Therefore the country could not much to do with the protocol but the vulnerabilities due to increasing global warming and sea level rise compelled SriLanka to take actions over to the increasing Greenhouse gas emissions. Thereby Clean Development Mechanism (CDM) by the ministry of environment and natural resources focus on sustainable development had adopted under the Article 12 of Kyoto Protocol was the single most achievement to the country. The awakening CDM was assigned to all the developing countries as a

[63] The Kyoto Protocol is the treaty was a consensus by UNFCCC in 1992 and signed on 1997 though which become effective only since 2005.

flexible mechanism runs through projects which could result in mere carbon cuts and sustainable development as of UNFCCC. There were around seven identified sectors which could have been getting the great scope for SriLanka as agriculture, energy, waste, transportation, forest management, and plantation. But the time was crucial for the country due to lack of awareness of the new mechanism, new climate-friendly energy technologies, and lack of financial support to technology transfer.

The Kyoto Protocol was adopted in 1997 as the legally binding instrument to achieve the objectives of UNFCCC. This protocol introduced three controversial mechanisms namely Joint Implementation (Article 6). Clean Development Mechanism (CDM, Article 12) and the emission trading (Article 17) further establishment of markets for GHG emission reduction ongoing Civil War[64] (Batagoda, 2002:25-27), so and so forth lead to limited contribution to the proposed mechanism. At the same time, China and India are the two giants could achieve some sort of sustainable development benefits from it while comparing with SriLanka. In spite of this, the country has given priority to hydropower generation during this period and also CDM had given attention to the importance of sustainable future and helped to made ground for the preparation of national adaptation action for climate change.

4.5.2 Paris Agreement: Paris agreement the recent legal innovation taken by the UNFCCC in order to mitigate climate threat by cuts greenhouse gas emission by 2020. Paris agreement was featured as a historical treaty to global climate change battle. Though there have multiple controversies and unsatisfied parties from different areas especially from the Association of Small Island States (AOSIS), the highly vulnerable groups of global warming. Being a small island SriLanka also becomes victim to global warming and sea-level rise. According to the base year of Kyoto Protocol, the emission rate of both developed and developing countries have been shown an immense rise. The country also signed the Paris Agreement in 2016 with consequent ratification on the 21st of September 2016.

[64] B.M.S, Batagoda, (2002), "Sri Lankan policy perspectives on the Clean Development Mechanism (CDM) and the Kyoto Protocol" *Energy for Sustainable Development*, Vol.6 (1), p. 25-27

4.6 INTERNATIONAL SUPPORT TO SRILANKA

The international cooperation for sharing the burden of climate changes is an important part of adaptation exemplified in the international climate change accords in regards to developing conutries. The friendly diplomatic relationship between SriLanka and Japan has started since 1952. Thus the relationship encouraged Japan to be involved on the grounds of socio-economic developments of SriLanka. Japan has supported the country by providing adequate financial, technological and informational assistance to the reconciliation rehabilitation and reconstruction of the people those who have displaced and severely dismantled due to Civil war and those who affected by Natural disasters as Indian Ocean tsunami, flood, and drought. Besides the political and economic interest on the country the Japan has extended brotherhood affection to Sri Lanka on religious and cultural basis. The capacity building to the adaptation and management of SriLanka in response to the climate threat has become a major concerned area which Japan insisted and gives training, educational support through its various universities to enhance youth's participation in environmental protection. As of now Japan promptly provide approximately 1,400 billion dollars to SriLanka for various schemes such as Grant Assistance and technological cooperation through its Japan International Cooperation Agency (JICA). In addition to this Japan is being an important donor to the country through various international organizations as UNO, ADB, WB, SAARC, and other humanitarian organizations includes NGOs and Development Fund and Human Security Trust Fund. For the support of disaster management and cope with climate change JICA provides both hard ware and soft ware assistance based on Japanese experience and knowledge of disaster management and has given priority to floods and landslide which is a natural occurrence in the southwest region of SriLanka[65].

The Europian Union (EU) has a strong bilateral relationship with SriLanka since more than forty years. EU support to the humanitarian and developmental concerns of SriLanka mainly in cooperation with government projects. Over the last forty years,

[65] Overview of JICA Sri Lanka, Japan International Cooperation Agency, accessed from web on 25/5/17, https://www.jica.go.jp/srilanka/english/office/about/overview.html,

SriLanka had received €760 million for various developmental programmes. EU had extended its support as financial and technological assistance for post-tsunami rehabilitation and reconstruction of infrastructure development. The 'Green economy'-SWITCH Asia programme has been started by 2014 to empower SriLanka through the sustainable path by giving renewable energy technologies and aims at achieve economic growth. In support with the Ministry of Environment, EU envisioning that reduction in poverty, sustainable production and consumption and enhance adaptation to climate change impacts. More particularly EU also stands to protect human development through supporting rights, civil society, women rights, food and sanitation of SriLanka. The implementation of sanitation and hygiene initiative under Asian Investment Facility (AIF) by the National Water Supply and Drainage Board (NWSDB) has developed under the core support of EU intended to assists the Government for capacity building. (European Commission, 2016)

USAID is the leading partner for water management and agricultural developments in SriLanka. The bilateral relation in humanitarian assistance programme has started since 1956. The areas which covered under USAID include education, health, technology, agriculture, environment, livelihood, natural hazards etc. US played a leading role in providing humanitarian assistance to tsunami affected areas, similarly conflicted areas, 2010-2011 floods in SriLanka. The USAID supported the water scares areas of SriLanka Vauniya in Northern Province, Uva Province by giving financial aid at $ 483,300 for the construction of rainwater harvesting tanks in the year of 2012. This could build 750 water tanks at village households, selected hospitals and schools (USAID Frontline, 2014).

Likewise, Jaffna peninsula of Northern Province was critical due to water scarcity and depletion of ground water. The USAID initiative helped SriLanka to implement a sprinkling water programme a resilient adaptation to drought by named 'Building the Reliance of Returnees' a progressive strategy for the effective use of water for sustaining agriculture same way a helping hand to the farmers those who rely on irrigation.

4.6.1 Intergovernmental and Non-Governmental Organisations

United Nations and its integrated branches are heavily assisting the Government of SriLanka in her initiative to lead the country on human development path. Food Agricultural Organisation since extend its international effort to shutdown hunger and poverty to SriLanka since her inclusion in 1979. The climate change threatened agricultural problems has been recognised by the agency has giving huge financial and technical support to make country sustainable to agricultural activities includes livestock, fisheries, and forestry. Diversification of drought resilient crops, technologies, and community based awareness programmes against climate changes has been undertaken. SriLanka was fortunate to included FAOs special pilot study on 'Special Programme for Food Security (SPFS). World Food Programme on the similar hand giving assistance to enable SriLanka in multiple to achieve sustainable goals and tackle food insecurity. The 'Meals Programme at Schools' for the nutritional support to primary school children's was the keen initiative of WFO while FAO supporting the country by giving assistance to the victims of natural and manmade hazards.

In response to the efforts taken by the SriLanka in its vulnerable stages due to internal calamities ADB has extended her helping hand to ensure inclusive economic growth. The identified areas of SriLanka mainly infrastructural development, as transport, efficiency in renewable energy, water supply, sanitation and management. The ADB and International Fund for Agricultural Development have together financing for the irrigation development in North Central Provinces. Similarly NGOs play an important role in mitigation and adaptation of climate change threats in SriLanka. NGOs operations are more flexible and being a bridge between governmental agencies and beneficiaries of major sustainable plans to the society that sometimes may not reach them. Furthermore, it could give innovative policy suggestions to the policy makers and community-based adaptations. Some of the major active NGOs include Lanka Jathika Sarvodaya, Sharmadana Sangamaya, Practical Action, SriLanka Nature Forum (SLNF), and National Federation for Conservation of Traditional Seeds and Agricultural Resources, Such organisations are enormously concentrating on the food security and agricultural adaptations through public awareness gatherings and resource mobilisation.

4.6.2 Flood Relief Assistance

SriLanka had been experienced with flood with South-West Monsoon (SWM) result into drastic socio- economic and crisis in SriLanka in the year of 2017. The Disaster Management Centre (DMC) has reported about 77, 432 people had displaced while 1,505 houses had been damaged and 99 people were missing ("Sri Lanka floods: Scores die as monsoon triggers mudslides", *BBC*, 26 May 2017). The South West monsoon had been hitting the country since 2003 beyond the physical damage of people, the country has been largely undergone a crisis due to scarcity of water due to salinisation. The Galle was the area which is severely affected by flood in the south-west region of the country alongside Hambantota, Kautra, kegalle, Matra and Ratnapura the climate sensitive areas of the country[66]. Moreover the United Nation have reported that in the month of June witnessed prolonged drought followed by flood and it could deteriorated agricultural production resulted into 900,000 people are under food security threat[67] irrigation reservoirs had started to decrease the level of availability of water, Apparently the market price for have boomed.

In this juncture Government of SriLanka directly and indirectly had approached both foreign countries and international security agencies. United Nations International Children's Education Fund (UNICEF) and World Health Organisations (WHO), Non-Governmental Organisations, Water, Sanitation and Hygiene (WASH), and Red Cross Society agencies are unanimously assisted the humanitarian agencies of Sri Lankan Government by regarding water purification tablets, medical and health care support[68]. Government of SriLanka could urge with the international assistance for every single natural calamities. These flood days often witnessed international humanitarian support from the countries like Australia, India, China, Japan, Korea, and Pakistan. Especially

[66] SriLanka: Floods and Landslides- May 2017, *Relief Web*, [Online: web] Accessed on 20 July 2017 URL: http://reliefweb.int/disaster/fl-2017-000057-lka

[67] "Drought, Floods Slash Sri Lanka's Rice Production", Threaten Food Security- UN, *Flood List*, [Online: Web] Accessed on 23 July 2017 URL: http://floodlist.com/asia/drought-floods-slash-sri-lankas-rice-production-threaten-food-security-un

[68] United Nations Support to the Flood Relief efforts, *Relief Web*,[Online: web] Accessed on 20 July 2017 http://reliefweb.int/report/sri-lanka/united-nations-support-flood-relief-efforts

The Indian humanitarian relief had supported the affected peoples and offered food and water assistance[69].

The government of Sri Lanka's has well alarmed concentrated on the early adaptation mechanisms to cope with natural calamities since after the event of Tsunami. However, the humanitarian strategies that the country has following criticised on several grounds due to the lack of transparency and adequate action on time. This has reported by UNICF as noted that The Presidential Task Force (PTF) has not any detailed reports regarding the action strategies since 2016 when it started to initiate. Recent outburst in the flood assistance and relief mechanisms shows that the government lacks adequate support to their people and importantly international assistance has become increasing in compare to the previous occurrence of natural hazards.

[69] UNICEF (2017), "Sri Lanka Humanitarian Situation Report No. 3", [Online: Web] Accessed on 24 July 2017
URL:http://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF%20Sri%20Lanka%20Humanitarian%20Situation%20Report%20No.%203%2C%202%20June%202017.pdf

CHAPTER V

CONCLUSION

The attempt has been made to the foregoing chapters to narrate the thrust of climate change and its exacerbated impact on two major sustaining objects of human security of islanders and the challenges on food and water security in the context of SriLanka. Out of the six small islands in the Indian Ocean region, SriLanka was being the most turbulent state. At the same time, it is striking that its robust economic growth irrespective of all grounds of nationally and globally identified challenges. Predominantly the strategic location of the country in the Indian Ocean preferably makes it attractive to its global counterparts, especially to India and China. Maldives and SriLanka are the close- friendly states of Indian Ocean and has belonged to SAARC. Both of the countries are extremely vulnerable to climate change exacerbated threats basically sea-level rise. Unlike Maldives, SriLanka is not a member of the Association of Small Island Developing States. Even though Sri Lanka's extended support and encouragement to SIDS are remarkable in response to the international politics of climate change. As a member country to the Commonwealth Small Sates, SriLanka could host one of its ministerial summits regarding climate change impact on small states and the intergovernmental responsibility to address it through the agenda of 'common but differentiated responsibility'.

Being a small island, it is not a surprising fact that SriLanka also a victim of climate change especially in the fields of food and water. It is evident that climate shocks and exacerbated problems really threaten the country by affecting its natural diversity, heritage, and great ambitions about future as a fast-growing developing country. Increasing population growth and limited land area is a challenging factor that Sri Lanka finds an obstacle to tackle sustainable livelihood resilience and development in addition to climate change variability. Deforestation and expanded agriculture in the historical days had increased the role of farming as a key livelihood sector, though it reduced forest land and natural ecosystem of the country. Although Green Revolution was such a progressive movement in SriLanka which could end the practice of deforestation and enhance country's goal to achieve self-sufficiency in rice production through breeding

and fertilizer irrigated farming. However self-sufficiency in crop production has been struck down by continuous drought and other natural hazards. Therefore, the issue of food security is remaining as policy challenge in Sri Lanka's national security agenda.

The observed fact is that there are fluctuations in production that are positive against climate change and that is in some extent contradictory to the projected or expected production in accordance with climate changes. In terms of water security, the country has not exactly fallen into the emergency category in comparison to the other South Asian countries like India and Pakistan, even though the country does not have a safe picture at present and the near future. The major reason would be the earlier identified frequent occurrence of climatic changes and increasing consumption of ground water. Moreover, the food security of the nation largely depends on its half yearly production from irrigated water systems. Exacerbated drought series, floods, and cyclones always undermine the water availability, infrastructure, and purity. At present, the increasing population and urbanization in the country have increased demand for water consumption.

The threat exacerbated by sea-level rise on SriLanka as like Small Island developing states has been high in depth. Therefore the complex climate change negotiations in regard to sea-level rise would be an important matter to SriLanka. This meant that SriLanka would fully support the efforts taken by the AOSIS to cut down the global GHGs emission. But still, there are uncertainties over the physical existence of many tiny islands in the world map in the coming future until and unless the issue could address effectively through action than bind written paper agreements.

The turbulent situation of SriLanka emerged from its historic ethnic- national cultural plurality between Tamils and Sinhalese. In this context, the emerged separatism operated by Liberation Tigers Tamil Elam led to long year civil conflict in the island. Afterward, the international intervention seeking the no-humanitarian activities taken place during war further complicated its internal rest. In between the sudden attack from the Ocean, the so-called tsunami opened the eyes of the country to be careful and vigil to environmental factors too. During this phase, SriLanka went through immediate actions to rehabilitate and reconstruct people those who witnessed this destiny. It is later referred

that climate change is a serious threat to SriLanka than the civil war. But it's also important that the human interaction leads to natural hazards to the land. Because it visible in the case of SriLanka involved in unscientific or poor infrastructural or developmental planning in coastal beds and inadequate attention to the coastal livelihood and opening the buffer zone to private business entrepreneurs for economic and political gains. Coastal areas of the country have found to be more sensitive both in climate threat to agriculture and settlement. The natural inhabitants of the coastal ecosystem would be a major area which worsening due to sea-level rise and environmental degradation and more over the human interaction. For long term benefits, the country has to more vigil to wide its climate change response policies to focus on its coral reefs sustainability, mangroves, and related flora and fauna habitats, coconut plantation, and fisheries.

ECONOMIC IMPACTS OF CLIMATE CHANGE IN SRILANKA

It is not worthy to expecting the economic consequences due to the exacerbated climate change effects on SriLanka in these decades. While reaching upper- middle-income category SriLanka has had experienced with a number of climate change anticipated events many several issues internally related to its economy, politics, cultural disparity and moreover degrading environment and climate exacerbated flood, drought, landslides, cyclones, and Sea-level- rice. The recent fluctuating trends in rainfall and temperature have an unpleasant affair with its economy caused to curtailing the crop yield and the faster crunching of their water availability. In such a way climate change would surely have economic dimensions such as social welfare- equity, and food security which further have social unrest and political uncertainty.

Poverty alleviation remained the utmost goal and an economic issue for Government of SriLanka since the post independent era even could not overcome in certain extend. Within this backdrop, the recent changes in climate have poured multiple threaten the country had in the past decades by curtailing food sustainability and water availability. World Bank was estimated in its report that; out of all countries in South Asia, Sri Lanka will be most affected by rising temperature and hard hit, and this could undermine efforts

to overcome poverty and increase economic growth[70]. Agriculture is the main resort to relay for sufficient food to feed its population and agriculture includes livestock production, fisheries, and plantation sector are the single most source of employment, income generating option of a significant number (28%) of farmer household's even though economy does not have much gain (9%) from agricultural sector at present. Changing weather condition and less income from the harvest, production costs, scarcity of water, reduced labour force are the internal factors are the rural households has experienced. During prolonged drought years the economy significantly spent a good sum of its income for imported food items includes rice, wheat, cereals, milk products, sugar, dhal, potatoes etc.

Plantation sector of SriLanka includes tea production, rubber, and coconut is the important exporting market-oriented agricultural products apart from Paddy. Even though the farmers depending on plantation sector of SriLanka is the most food insecure category with a low level of income support. Tea production of SriLanka is highly vulnerable (not less likely to paddy) due to climate change impacts. Tea yield also uses seldom irrigation support for all its farming activities. It is vital and crucial to SriLanka economy for net foreign exchange earnings and contributes to Gross Domestic Products. Moreover, it supports the physical food accessibility to about one million people of the country by provides employment and income. Due to prolonged drought, rainfall changes, water scarcity, short-term weather variation on tea production resulted into reduction and degradation in tea quality pose significant hit on Sri Lanka's economy. It will further bring vulnerable people of the land again vulnerable in respect of food security.

The country has witnessed the dynamic demographic changes, and fluctuations in political and environmental condition will make impacts on the agricultural sector and it will reflect on its economy. When population raises the demand for food rapidly will increase. The possibilities of economic imbalances due to climate change can be seen in the coming years Sri Lanka's accessibility to global rice market or importing countries

[70]World Bank, (2013), "Climate Related Shocks Could Slow Down Sri Lanka's Economic Growth and Poverty Reduction Efforts, World Bank Report Implies, Press Release, World Bank, Washington, www.worldbank.org

might be limited. The history of SriLanka shows that the same tendency was already taken place. In this century the issue of climate change has been threatening the food production of many countries all over in the world. During the extreme warming years, countries would like to their domestic demands than importing. A shortfall in food production had resulted in the higher price on foods in the mid of 1970 worldwide.

The economic impacts of climate change triggered food and water security not just a humanitarian crises in SriLanka but rather a heavy economic burden also. The prolonged drought perception in the recent years has shown the economy largely endorse to make the appropriate decision. Water is not only needed for rice but also need other rain-fed crops including vegetables and cereals. In response to drought, the government has to provide relief fund to the people those who rely on agriculture. The government had become provides financial support to the paddy farmer households every month. Thus the effort counted between 0.1-and 0.2% of GDP; this is out of the relief effort of other crops. The country has received food and water aid from neighboring countries during the crisis period and the government has cut down the import taxes to encourage rice imports this would be an another hit on its foreign reservoirs. Moreover, supply-chain turmoil in the economy will lead to high consumer price inflation.

Water scarcity due to less rainfall over a period dragging economic development of SriLanka for a short while may be longer in future. The Mahaweli Development Project at a time it strengthens three broad basic necessities of the country as energy security, water security, and Food Security. In short water- energy- food security nexus of the country virtually depends on this mega project. Drought years of SriLanka have shown a great impact on hydropower generation and electricity of the country. Apparently, the electricity generation from thermal power plants had put additional expenditure on its economy. Macroeconomic impacts are seemingly increasing by reducing taxes on imported energy sources includes Fuels and Oils.

INSTITUTIONAL CAPACITY BUILDING AND ADAPTATION

The policies and climate actions include both adaptation and mitigation can result in better economic and social benefits from their environment. And at the same time, mal-

adaptation or failure to recognizing critical vulnerable areas will increase country's burden to manage climate risk and will uplift economic dependency from different sources and time-consuming task. Integrated adaptation policies are needed to make greater cooperation at the regional level as between and among the countries mandatory for capacity building, sharing the overburden of consequences more precisely for an in-depth cooperation will make the region vibrant and curious to any exacerbated events.

The great possibility to achieve food security and economic growth sustain water availability and allocation, enhance energy security and mitigate GHGs emission simultaneously by combating climate change, is the critical issue the country requires urgent mechanisms both in policy realm and action segment. As of now, SriLanka has involved in such a policy action path to cross-cutting issues. In the institutional level, the country has made enormous progress by established research institutes and capacity building programmes. But it's alone does not give more productivity and relief from importing food expenses. Science and technology are highly important along with traditional knowledge about spatial and farmland changes.

Traditional Knowledge to climate changes and people-centric policies is very much important for scientific analysis and adaptation processes. The log –term history of changing climate with regard to farming and water management would be convenient and precious to develop suitable adaptation framework for different climatic zones. In the case of SriLanka traditional knowledge has yet to be utilised in both mitigation and adaptation framework as totally. Local knowledge have been identifying and support

Irrigation development in SriLanka has played a pivotal role to achieve increased rice production. The accelerated Mahaweli Development Project was started in 1970 to achieve food security, hydropower generation, drinking water supply and employment. It plays a vital role in the water allocation and distribution to both farming (especially in dry zone) and producing electricity. Despite the project has yet not to be finished due to lack of finance. Even though Government's of SriLanka heavily invested for major and minor irrigation developments so far which helped to improve crop yields and enabled

rural access to water. However further maintenance and infrastructural developments have fairly stuck so far.

The country had witnessed severe tsunami in 2004 led to a huge impact on its economic prosperity and fast growth and about its 1.5 million people had been affected. The rehabilitation and reconstruction of infrastructure process had been a big task to SriLanka along with the expenditure of war consequences. For the rehabilitation of tsunami affected areas of its coastal land, the country had to spend a huge amount in addition to foreign assistance. After this event country established an early warning system for the preparedness and effective management of tsunami and other related natural hazards by adopting a roadmap for disaster risk management in 2005. However, Floods and landslides have been continuously taking place in SriLanka has to lead to economic impacts through adapting and managing disaster risk reduction. Moreover, flood and landslide always happen in country's important economic centers in the Southwestern and Central regions. Most recently the GOSL sought financial assistance from UNDP for flood management.

The emphasised programs and policies of Government of SriLanka focus on the socio-economic development of the people especially the vulnerable categories towards climate resilient from all exacerbated threats. Nevertheless, challenges are still ahead of such as inefficiency in adaptation, limited and inappropriate awareness about cross-cutting issues of climate change risks. It could make people out of human development. Largely because most of the adaptation mechanisms are ad hoc manner or incorrect can be seen in rainwater harvesting. Similarly, resources mobilization for effective management of climate change threats found another constraint facing the country. Agriculture and water resources have needed feasible resources for infrastructural development, scientific and innovative resources for the diversification of economy to cope with vulnerabilities of climate change, finding extra resources for such activities are not exactly generating due to the lack of fiscal and monetary support. The CDM of North-South cooperation would be an available choice for the country could attain more resources support and it is necessary to give more priority to agriculture, and water security and also it enhance Sri

Lanka's initiative to building international cooperative mechanisms while being with multiple vulnerabilities.

The green development path of SriLanka cannot be avoidable in this context. The country had taken its initiative to safeguards its sustainable environment developments. The National Action Plan for Green Lanka programme initiated in 2009 had been identified ten thrust areas which immediately needed adaptation includes clean air, protection of flora fauna ecosystem, coastal belt, etc.., However, the coping capacity of the communities many not be enough to tackle with the intensified future variations of climate change. Therefore it should mandatory to the Government to further enhance the adaptive capacity of both communities and policy makers and its execution. Food and water are closely interconnected and similarly, water is interconnected with other economic and social sectors too. Therefore, integrative methods of adaptation would necessary to implement for the protection of such sensitive resources rather than passive voluntary mechanisms. And the same way much attention needs to be given to climate change mitigation through advanced technologies. The Government of SriLanka recently moved to operationalise sustainable development initiatives of Rio+20 conference of UN at Rio De Janeiro in 2012 through its newly adopted 'The Blue- Green Strategy' on 2016. The policy enshrines common goals of the country to adapt and mitigate climate change with the active participation of all the stakeholders of the land such as public, private and civil society actors. And the program is in its infant period yet.

QUESTION OF HUMAN SECURITY

As far as concerns island states are the newly recognized category to the international framework of security and peace. Therefore United Nations General Assembly has unanimously passed a resolution by considering the vulnerable situations of island states due to the climate change impacts; it states that inter alia, that the General Assembly is "deeply concerned that the adverse impacts of climate change, including sea-level rise, could have possible security implications"[71]. The emergence of non-state actors has been

[71] Pacific Small Island Developing States United Nations Member States Views on the Possible Security Implications of Climate Change to be included in the report of the Secretary-General to the 64th Session

place serious implications on newly independent depressed states in the international arena. Climate change posing threats are not exactly ending with the large displacement or demolition of a piece of land or people in an island of course it could undermines the territorial integrity, sovereignty and peaceful statehood of that particular nation. However there is less possibility to generalize the impacts over the whole islands in the world. Global warming triggered climate change indeed quiet difficult to synchronize in future days. To being the frontline states, island's climate awareness and education through communication technologies, sustainable development initiatives may reduce anthropogenic environmental susceptibility in remote areas of islands in coming years. Such means for the attainment of islands have needed holistic international support from governmental and non governmental agencies than they are receiving at present.

Therefore the implementation of Paris COP 21 is highly critical for island developing states particularly small islands. Moreover it would be the resort for vulnerable countries to attain grants finance and technologies from the developed countries to curb the impacts which they have showered if there will be a successful implementation of the Paris COP 21 agreement. However the recent symptoms which comes from the big emitters like US plans to withdraw from the agreement would be a set back to the treaty and it's often shows how small powers are treated by the so called pragmatic fairness and equity of international law and regimes that they are possesses orally.

In SriLanka, the links from climate variability and shock on the stability of agricultural productivity and its dependent food security, water stress and scarcity leads to the insecurity of life of a large population of people. While considering the external threat of any coercion or military attack from a nation simply accounts as a national security threat, but it is clear that there will be no more such concept when climate used to change. SriLanka is a victim of 26 years of stupid war in the name of separation and self-esteem. The history draws that a huge number of people died, infrastructural development in the provinces of North-Central and Eastern provinces are in the way of progress. Likewise, the tsunami was the sudden attack on the nation's coastal zones during nearby

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of the United Nations General Assembly, *General Assembly Resolution A1RES/63/281,* [Online: web] Accessed on 7 July 2017, http://www.un.org/esa/dsd/resources/res_pdfs/ga-64/cc-inputs/PSIDS_CCIS.pdf

the same period. Human security of a country deals with their people's economic social and political performance. In this context SriLanka social stands up above all the South Asian countries. In terms of human development, SriLanka came up with a progressive status and significantly belonged to the status of medium human development. The country witnessed two threats as ethnic conflict and tsunami are the real hit on human security. The government, international agencies, and NGOs played an active role to reintroduce human security by implement policy initiatives and programmes. Along with this natural weather changes exacerbated agricultural productivity comes in the middle of the national agenda because the shortcoming of food grains will leads the country into food secure. Human security guarantees food security for the people as the basic fundamental requirement of life as well as the basic measure to count the physical aspect of security. In addition to this water scarcity for agricultural activities, drinking, and sanitation sparked in SriLanka. It will affect the livelihood of the people of the country to a huge extent.

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ANEXTURE I

Climate Zones of SriLanka