



## CLIMATE CHANGE AND EXTREME EVENTS IN SIDS

**Dr. Asmita Bakshi**

Academic Coordinator, CEC-UGC, New Delhi

### ABSTRACT

*Climate change is leading to the increased intensity and frequency of extreme events globally and Small Island Developing States (SIDS) are the most vulnerable due to their intrinsic and isolated geographic characteristics. A minor change in climate can cause a severe change in extreme climate events such as more or fewer rainfall, intensity and frequency of tropical cyclones and storms. These trends have severe impacts for SIDS e.g. floods, erosion and submergence of coastal areas, land slide, loss of biodiversity and coral bleaching etc. These impacts are being experienced in many SIDS. Therefore the paper tries to assess SIDS vulnerability to climate change induced extreme events and their strategies to reduce the impacts of climate change and to cope with extreme events in respect to their weak structural power and infrastructural settlement. Considering the fact that power lies in coordination and cooperation, particularly in the case of SIDS, the paper identifies strategies to cope with climate change and extreme events through building partnerships at regional and international levels in order to insure their existence and survival.*

**Key Words:** Climate Change, SIDS, Extreme Events, Mitigation

### Introduction

Many previous studies and scientific reports have shown that a very small change and variation in general weather condition such as precipitation, temperature and other climate variables can cause significant increase to extreme events in terms of their frequency and

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intensity or both (Trenberth, K. E., 2011). Thus, climate change is one of the major factors to increase frequency and intensity of extreme events. As a phenomenon, climate change is considered as a variation in pattern of climatic conditions over a long period of time of a specific region or of the whole world (it may be from a decade to millions of years, but generally considered a period of 35 years). This variation includes changes in overall weather patterns, such as precipitation pattern, variations in humidity, temperature and in cloud cover etc. Major cause of the present anthropogenic climate change is human activities that have ensued in an enhanced volume of GHGs in atmosphere e.g. carbon dioxide (CO<sub>2</sub>), water vapour, nitrous oxide, ozone, and methane etc. Climate change and its associated impacts are among the most intractable environment problems, the world faces today. As per the latest report of IPCC (2014), the current trend of GHGs concentration in the atmosphere will double by the end of the 21st century. Considering current development in GHGs emission and concentration, coming years will be very hard to survive for many SIDS.

SIDS are small, island and low-lying coastal countries, located mainly in the tropics. Therefore they are highly vulnerable to climate change and associated extreme events. Present and future climate related risks for SIDS during the century, include: Sea-Level rise, coral bleaching, increased intensity and frequency of extreme events such as tropical, extra-tropical cyclones, landslides, and floods, changing rainfall pattern i.e. more or less, increasing surface and air temperature. In terms of climate change and its impacts, SIDS are more vulnerable than any other places in the world. Extreme weather events as a result of changing climate will affect the environmental, social and vital economic interests of small island developing states and have profound consequences for virtually every aspect of human society. International community already realised the immediacy to address the issues in 1992 and since then many initiatives have been taken-up to reduce GHGs emission and combat climate change.

Therefore, in this regard, the paper tries to assess SIDS vulnerability to climate change induced extreme events and their strategies to reduce the impacts of climate change and to cope with extreme events in respect to their weak structural power and infrastructural settlement. Considering the fact that power lies in partnership, particularly in the case of SIDS, the paper also identifies strategies to cope with climate change and extreme events through building partnerships at regional and international levels in order to insure their interests and survival.

## **SIDS**

Small Island Developing States (SIDS) are islands and low lying coastal countries and they share several characteristics of other developing countries but they face unique challenges in terms of their remoteness and fragile economic and ecological settings. SIDS vary by their geographical characteristics and locations but are mainly located in the tropical zones of three regions: -Atlantic Ocean and Caribbean Sea, Pacific Ocean and Indian Ocean. SIDS with one-tenth of the total world population, contribute in GHGs emission less than one percent but impact of climate change are likely to be felt more severely in small island developing states. Their 57.9 million (as on 2010) people are at risk, which are already under stress due to current anthropogenic pressure such as deforestation, GHGs emission, land use change etc. While climate change presents SIDS with a significant dilemma, while emitting the least global green-house gas, they may experience the most terrible and immediate impacts like loss of agricultural and habitable land, coastal erosion, enhanced strength, volume and frequency of tropical storm, poor food and water security and negative implications on human health. Inter annual variability in temperature, rainfall and sea level related to the El-Nino/Southern Oscillation (ENSO) phenomenon makes these regions increasingly vulnerable to climate change (Nurse et al., 2001: 865; Baer et al., 2007). There is a major possibility of their extinction due to climate change.

SIDS share several common characteristics such as physical and structural developmental challenges, that include their geographic remoteness, small territories and small size of population (growing rapidly) and less human resources, SIDS are based on a single or limited range of activities, such as tourism, fishing, particular cash crops etc., vulnerability of external disaster and difficulties to participate in international relations with a strong position (Bass and Clayton, 1995; Briguglio, 1995/ 2010; Mimura et al., 2007). These characteristics not only identify them as a distinct group but also mark their overall vulnerability. Those derive from high vulnerable island ecologies, economies and societies to external influences (Wong, 2011). At the same time, they share common characteristics SIDS are a varied group of countries. For example- some of SIDS are not small (e.g. Cuba and Papua New Guinea), not island (e.g. Belize, Guyana are low-lying coastal countries), not developing (e.g. Singapore) (Betzold, 2010: 10). Though SIDS share some common characteristics but they vary by their geographical, climatic, physical, political, social and cultural aspect of their specific characteristics and level of economic development (ibid). A study by FAO (2005) argues that small island states have a varied economies and different levels of economic

development e.g. some island states depend on primary activities such as agriculture production, forestry and fisheries where others rely primarily on tourism for their food security.

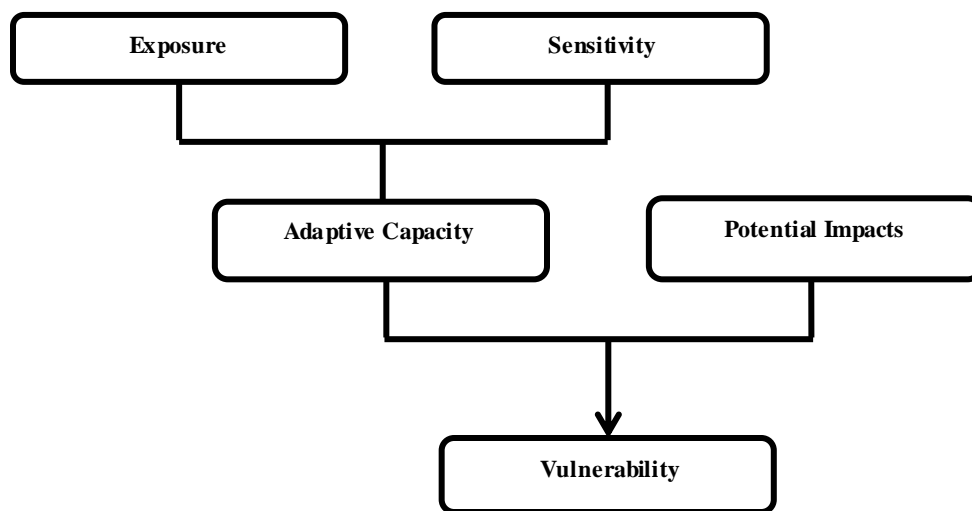
Additionally, the climate of small island developing states depends upon ocean-atmosphere and tropical weather phenomena (e.g. tropical cyclones and hurricanes, tropical winds, ENSO and the monsoons,). These dynamic climatic characteristics, integrated with their specific social and economic conditions, make SIDS among the most vulnerable countries to climate change induced extreme events. An increase in the surface temperature of seas and oceans will have profound impacts for SIDS. It is also predicted in many reports issued by IPCC, that this warming trend is likely to continue in future. Many projections reveal that this warming will become with an increased and heavy rainfall patterns along with other spatio-temporal dynamics in extreme events such as more intense or frequent cyclones/hurricanes or El-Nino event. “The extreme rainfall of 1997 cost Seychelles several million dollars in loss of agriculture and infrastructure. This year, as a result of an anomalous warming of the sea, corals were extensively bleached. The effects are still seriously felt in fishery. And as I speak to you now, if current drought conditions persist, jobs will be lost through critical water dependents industries, such as industrial tuna processing and tourism.” Statement by Seychelles November 1998, Buenos Aires, Argentina (COP 4) (UNFCCC, 2005)

### **Vulnerability of SIDS**

Vulnerability of SIDS depends on their specific remote characteristics, which are mentioned earlier. Their intrinsic geographic and environmental characteristics make them highly vulnerable to the impacts of climate change and SIDS have certain environmental risks related with impacts of climate change. Environmental risks occur when an environmental hazard has the potential to inflict harm (Tompkins, *et al.*, 2005:10) and this potential harm is significant only when there are costs associated with the hazard. For example, if an earthquake occurs or volcano erupts on an unsettled and unpopulated island, this would not be referred to as a disastrous event. Nevertheless, when the same condition occurs on a poor and well inhabited island, surely there would be some significant and adverse impacts for its inhabitants which are referred as a disastrous condition. Therefore, the pre-existent physical, social and economic circumstances of an island play determinant role by the impact of any hazard. Given the physical, social and economic conditions of SIDS, they are often weak and vulnerable by their nature. (Tompkins, *et al.*, 2005:11).

SIDS are already under stress and at risks due to some environmental hazards, like tropical cyclones, floods induced by rain, and storm surges etc. Recognising the existent risks and their changing trends, can help island inhabitants manage and prepare for upcoming hazards. Particularly, it is significant to realise how existent vulnerabilities of SIDS (mentioned earlier) can worsen due to the impacts of climate change and other hazards and what can be done in order to limit the threat of disaster. The major factors affecting the vulnerability of SIDS can be considered as the ability of an island or group of islands to cope with the hazards and to recover from the situation (Tompkins, *et al.*, 2005).

**Figure: Factors, Affecting Vulnerability of SIDS**



### **Changing Trend of Climate change and Extreme Events**

SIDS are mainly situated all around the Atlantic, Indian and Pacific oceans and large number of SIDS can be seen around Caribbean sea also. Similarly in the Pacific region, south-western part has a high concentration of SIDS. Most of the small islands are mainly located around the African continent, in the Atlantic and Indian oceans. It should be noted that SIDS are primarily situated in tropical and sub-tropical zones of three major oceanic regions: (i) AIMS region, (ii) Caribbean region, and (iii) Pacific region. Each region has its own characteristics in terms of geography, economy, culture, the level of vulnerability and the level of economic and human development.

## **Trends in Climate Change in AIMS (Atlantic, Indian Ocean, Mediterranean and South China Sea) Region**

According to IPCC (2007), the observed climate trends in AIMS region include:

- An increased air temperature by 0.7° C and 0.4° C since 1974 (annually and seasonally);
- An increased sea surface temperature by 0.5° C, since 1974;
- Since 1992, sea-level rise of around 4 mm/year (for the gauge tide station data).

The Future Climate Change Projection for the Region includes:

- An increase in air temperature (seasonal) around from 0.6°C warmer by 2030 to 1.8° C warmer by 2070;
- An increase in surface temperature of the sea and ocean by 0.6° C in 2030 to reach 1.8° C by 2070;
- An increase in annual rainfall by 1-9 percent is projected for the Indian Ocean and small island regions (IPCC, 2014b: 14-17).
- An increase in mean sea-level of 14 cm in 2030, which may reach to 40 cm by 2070 and up to 1.1 metre by the end of the 21<sup>st</sup> Century; and
- Increased number of intense tropical cyclones and storm events by 2030, and decrease by 2070.

## **Trends of Climate Change Caribbean Region**

- An increase in sea surface temperature by 1.5° C in the last 100 years, in Caribbean Sea.
- A decreased rainfall in the region and over the last few decades prolonged dry spells have been observed (Clark, 2004).
- In the Caribbean, an observed average rate of sea level rise over the past 60 years was similar to the global average (approximately 1.8 mm per year) (IPCC, 2014b: 5).

The Future Climate Change Projections for the Region include:

- Sea level rise projections in small island regions under an intermediate low-emissions scenario are similar to global projections of between 0.4 and 0.7 metres, ranging from 0.5 and 0.6 metres in the Caribbean region (IPCC, 2014b: 14-17).

- An average annual increase in surface temperature of 1.2-2.3° C is projected across the Caribbean, island regions by the end of the century, compared to 1986-2005 (IPCC, 2014b: 15).
- Under the same scenario, a decrease in rainfall of about 5-6 percent is projected for the Caribbean region, signalling a potential future threat to agriculture and water availability (IPCC, 2014b: 14-17).

### **Trends in Climate Change in Pacific Region**

- An Increase in surface air temperatures has been observed and is greater in the Pacific than global rates of temperature rise. For example, temperature has increased by 0.6-0.7° C since 1920.
- In the tropical western Pacific region where a large number of SIDS community exists, sea-level rise rate is higher up-to four times (approximately 12 mm/year) than the global mean sea level rise rate, have been observed during 1993-2009. (IPCC, 2014b: 5).
- Across the Pacific region, atoll dwellers to move their houses far from the ocean sea coasts because of coastal erosion; due to saltwater intrusion, changes in wind pattern, rainfall, and ocean currents, they have to change cropping patterns.
- Fiji has confronted with two severe drought events and flooding during the last decade (World Bank, 2000).

The Future Climate Change Projections for the Region include:

- An average annual increase in surface temperature of 1.2-2.3° C is projected across the Pacific, island regions by the end of the century, compared to 1986-2005 (IPCC, 2014b: 15).
- Among the more dispersed Pacific SIDS, the equatorial regions are likely to get wetter, whereas the sub-tropical high pressure belts will likely get drier. In other areas of the Pacific where the trade winds come together, the rainfall outlook is uncertain (IPCC, 2014b: 14-17).

- Sea-level rise projections in small island regions under an intermediate low-emissions scenario are similar to global projections of between 0.4 and 0.7 metres, ranging from 0.5 and 0.6 metres in the Pacific region (IPCC, 2014b: 14-17).

SIDS in all regions, are extremely vulnerable to hydro-meteorological hazards. As mentioned in the coming years, climate change is likely to increase the frequency and severity of such hazards in these islands while simultaneously increasing vulnerability by damaging ecosystems and wiping out livelihoods. Thus, in a bid to increase resilience to extreme weather events and the adverse impacts of climate change, the World Meteorological Congress approved the establishment of a new programme to support and enhance weather and climate services in SIDS and Member Island Territories.

### **Projected Climate Change Trends for 2081-2100 (relative to 1986-2005)**

<b>SIDS region</b>	<b>Changes in mean Temperature (in °C)</b>	<b>Changes in mean rainfall (in %)</b>	<b>Changes in mean Sea-level rise (in metre)</b>
Caribbean	1.4	-5	0.5-0.6
North Pacific	1.4	1	0.5-0.6
South Pacific	1.2	2	0.5-0.6
North Indian Ocean	1.5	9	0.4-0.5
West Indian Ocean	1.4	2	0.5-0.6

Source: IPCC, (2014b: 54), Fifth Assessment Report, IPCC, 2014.

### **Fragile islands under threat**

Situated mostly in the tropics, SIDS are struck by cyclones, thunderstorms, lightning, coastal storm surges, river, coastal and flash flooding, drought, strong winds, heat waves, and dust or haze on a regular basis. These hydro-meteorological hazards can severely impact vulnerable and exposed SIDS by taking lives, destroying infrastructure and livelihoods, and causing coastal erosion, landslides, mudslides, epidemics, and the movement and spread of toxic substances and, occasionally, volcanic material. Such events have hampered the socio-economic development of already fragile SIDS economies, which often have limited possibilities in many cases on tourism development and are sensitive to external price shocks. They are largely reliant on local markets, subsistence farming, fisheries and natural resources to maintain livelihoods.



Climate science predicts that the frequency and severity of climate and weather-related extreme events and disasters will be increased in the future due to human-induced climate change.

### **Some evidences**

Followings are some specific cases of SIDS related to their vulnerability, which exemplify their high exposure to the negative climate change impacts:

- Almost 80 percent of the population and infrastructures, in the Seychelles, are found near the coasts;
- In the Papua New Guinea and Maldives, approximately 50 percent to 80 percent of the land area is under 1 meter above average sea-level;
- In Grenada, critically limited resources are required in order to deal with compelling many short-term problems related to environment;
- In Palau Island, extended droughts periods are observed and confronted during El-Nino Southern Oscillation (ENSO) events;
- More frequent and intense tropical cyclones, along with extreme events (climate related or other), throughout the south Pacific region, were experienced during the 1990s;
- Almost all food products, construction materials, fuels and other goods are being imported in Barbados and many other small island developing islands (UNFCCC, 2005: 14).

The projected trend of climate change and extreme events is likely to affect all sectors in small islands (e.g. agriculture, biodiversity, water availability, human health etc.). The vulnerability and low adaptive capacity of these small island states are directly associated to their socio-economic and cultural circumstances. As mentioned in previous section, vulnerability includes remoteness, lack of resources, a small but rapid growing population, high dependency on international market and trade, exposure to natural disasters, and vulnerability to global developments. Climate change presents SIDS with vital negative implications on their various sectors.

## **Adaption Policies and Strategies**

In many SIDS adaptation is an urgent priority, because through proper adaptation to the impact of climate change, societies and communities can reduce the present and expected risks associated with climate change and take advantage of new opportunity. IPCC describes adaptation as the process of adjustments to actual or expected climate and its effects (IPCC, 2014b: 48). Yet SIDS, with limited resources and climate change adaptation is not dealt adequately due to other pressures such as rapid population growth, increasing poverty, resource depletion.

## **Existential Threat of Climate Change**

Various reports including IPCC's fifth assessment reports suggests that climate change possess existential threat for some SIDS and their partial inundation due to sea level rise and other extreme events. On the whole, impact of climate change will have severe adverse influence on SIDS socio-economic conditions and bio-physical resources (IPCC, 2014b: 3).

A lack of long-term monitoring of baseline conditions is also a constraint when trying to understand risks from saline intrusion, invasive species, biodiversity or large ocean waves. Thus, while change is occurring, it is not easy to quantify the probability, speed, scale or distribution of future climate risks (IPCC, 2014a: 16). Also, differences in exposure to climate change induced extreme events vary among islands, depending on their physical form. The culture, ecosystems, populations and hence vulnerabilities are different for each island. It is therefore critical to understand the context-specific conditions for each island when considering risks (ibid).

Individual island states can undertake specific actions, however, without external assistance large scale collective adaptation may not be possible.

## **Adaptation in SIDS at Local and Regional Level**

As mentioned earlier in SIDS, agricultural lands, bio-diversity, water resources are already under risk from sea level rise and other impacts of climate change. At the same time population growth and unsustainable use of natural resources contribute to further challenges for SIDS. Inundation of lands, tropical cyclones, soil and coastal erosion, coral bleaching are causing high cost socio-economic and infrastructural damages (UNFCCC, 2006: 28). During 1950 to 2004 tropical cyclones accounted for 76 percent of the reported disaster in the pacific

region that caused damage of UDS 75.7 million per event (World Bank, 2006). In 2004, hurricane caused damages were estimated to be USD 2.2 billion in four countries of the Caribbean region e.g. the Bahamas, the Dominican Republic, Jamaica and Grenada<sup>1</sup>.

Co-operative regional and international efforts are required in order to enable SIDS for adaptation actions towards the current and future impacts of climate change (IPCC 2007). It is well recognised by the international community that adaptation to climate change in SIDS is vital and a high priority issue. Though grave situation continues in the context of impacts of climate change, in several SIDS there is ample knowledge and information available related to strategies and plans in order to execute adaptation actions now (UNFCCC, 2006). Nonetheless, SIDS have limited capacity which make adaptation efforts more challenging for them e.g. limited human capacity and financial and technological resources, constraints imposed by the existing political and legal frameworks, their social and cultural acceptability of measures etc. (IPCC, 2014a: 21). Various UNFCCC meetings and workshops highlight a range of environmental factors and stresses that are the most efficacious adaptation approaches for SIDS to address the challenge. Many programmes and strategies require combine with co-ordinated attempts aimed at enhancing water availability and food security, poverty alleviation, reducing land degradation and biodiversity and other ecosystem services, as well as improving adaptive capacity. The realisation of Millennium Development Goals and sustainable developments are essential in integrating adaptation into developmental policies, which are important for adaptation effort (Sem, 2007: 17-18).

Most small islands have already initiated efforts as part of their adaptation actions on a local scale. Since the hurricane Ivan hit Jamaica, putting concrete blocks on the roof tops has become usual exercise, as it prevents the zinc roofs from blowing away during such events (OECS, 2004). Similar efforts have been taken in Vanuatu with the financial help of Canada. The South Pacific Regional Environmental Programmes has shifted more than 100 villagers inhabiting in the Lateu settlement of Vanuatu island to higher land 600 metres from the coast and 15 metres above current sea level as prevailing erosions and flooding led the location unsuitable for settlements (UN-OHRLLS, 2009: 35-36; Boto and Biasca, 2012).

The traditional knowledge is very significant for SIDS in order to enhance resiliency and strategies to combat the impact of climate change. For instance, farmers in Timor have

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<sup>1</sup> For detail see United Nations Economic Commission for Latin America and the Caribbean press release. <http://www.reliefweb.int/rw/rwb.nsf/db900SID/JCDR-677LG5?OpenDocument> .

developed their own essential crop varieties suited to adapt to fickle rainfall patterns and cyclones to insure their food security. In Cuba populations of coastal areas have been shifted to 5 km inland to the coast as adaptation to the sea level rise and resulting coastal erosions<sup>2</sup>. Since a sever reduction in available water resources has been predicted (IPCC, 2007; 2014), many SIDS have started their adaptation efforts to enhance water resource through choosing suitable drought tolerant vegetation types, incentives to encourage the use of water saving techniques; setting up river buffer zones in order to increase the resiliency of the rivers and catchment areas, improving managements of water resources and time to time updating of usual national water policies and strategies (Sem, 2007: 17).

**Table: Adaptation Projects in SIDS**

<b>Project</b>	<b>Region</b>
Implementation of Pilot Adaptation Measures in coastal areas of Dominica, St. Lucia and St. Vincent and the Grenadines, Regional (2006-2010)	Caribbean
Kiribati Adaptation Program, Phase II (2006-2009)	Pacific (National)
Mainstreaming Adaptation to Climate Change, Regional (2002-2007)	Caribbean
Coastal Resilience to Climate Change: Developing a Generalised Method for Assessing Vulnerability and Adaptation of Mangroves and Associated Ecosystems	Global
Adaptation to Climate sector in Fiji Change in the Tourism Islands	Pacific
Pacific Islands Adaptation to Climate Change Project	Pacific
Piloting Climate Change Adaptation to Protect Human Health	Global
Wise Practices for coping with Climate Change in Mauritius (2006)	Indian Ocean (National)
Assessments of Impacts and Adaptations to Climate Change (AIACC)	Global
Capacity building for Stage II adaptation to climate change (2003-2005) Caribbean South Pacific Sea Level and Climate Monitoring Project (SPSLCM), 2000-2005	Pacific
Capacity building for the development of adaptation measures in the Pacific island Countries (CBDAMPIC), 2002-2005	Pacific
Adaptation to Climate Change in the Caribbean (ACCC), 2001-2004	Caribbean
Caribbean Planning for Adaptation to Climate Change	Caribbean

<sup>2</sup>For detail see: UNFCCC database on local coping strategies <http://maindb.unfccc.int/public/adaptation/>.

(CPACC),1997-2001	
Climate Adaptation in the Pacific, 2001-2003	Pacific
Pacific Islands Climate Change Assistance Programme (PICCAP),1997-2000	Pacific

**Source:** UN-OHRLLS, (2009: 42).

### **Adaptation Measures within the Context of the UNFCCC**

During the 1990s, various scientific researches and negotiations related to climate change concentrated on adaptation and mitigation under the UN framework convention on climate change. In 1997, rigorous efforts during that period resulted in the establishment of the Kyoto Protocol. There was a difference between the priorities of the developed and industrialised countries and SIDS. Developed countries' priority was to reduce GHGs concentrations while small island developing states were worried about their vulnerability to the impact of climate change.

As far as reduction in GHGs concentration is concerned, this issue has also been one of the main objectives of UNFCCC. At the same time, the scientific studies made international community to significantly realise the importance of adaptation; especially for island states and other developing countries that have greater vulnerability to climate change impact. This acknowledgement is noted in the UNFCCC texts under Article 4 as, parties shall take full account of the special conditions and specific necessities of the developing and under developed countries in their actions with regard to transfer of technology and funding, (UNFCCC, article 4.9). The other articles devoted to adaptation to climate change are:

- All Parties are to “formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to... facilitate adequate adaptation to climate change” (Article 4.1: b);
- All Parties shall “Cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods”, (Article 4.1: e);
- All Parties shall “Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimising adverse effects on the economy, on

public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change”, (Article 4.1: f);

- “The developed country Parties ... shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects”, (Article 4.4);
- “The Parties shall give full consideration to what actions are necessary under the Convention, including actions related to funding, insurance and the transfer of technology, to meet the specific needs and concerns of developing country Parties arising from the adverse effects of climate change and/or the impact of the implementation of response measures”, (Article 4.8).

At the 12<sup>th</sup> Conference of Parties of the UNFCCC (2006) the Nairobi Work Programme (NWP) on impact, vulnerability and adaptation to climate change was adopted and it was a significant step towards adaptation assistance for developing and poor countries. This five-year programme had two main objectives (UNFCCC, 2007a; UNFCCC, 2010a):

- To assist vulnerable developing countries, particularly to SIDS and LDCs to enhance their understanding of vulnerability and assessments of impacts of climate change in order to improve their adaptation;
- To provide vulnerable countries with the sound, scientific, technical and socio-economic base in order to make informed policies on pragmatic adaptation efforts and measures to address climate change, considering present and future climate variability.

This is very significant vulnerable small and developing countries like SIDS to implement Nairobi Work Programme and other such activities under UNFCCC that help and prioritise the needs for adaptation for the SIDS.

There are various adaptation programmes and projects (Table-3.7) that have served to enhance SIDS national and regional capability to properly adapt to the impacts of climate change. The Caribbean region has demonstrated such initiatives with the establishment of the Caribbean Climate Change Centre in order to address the region's concerns for climate change, led by the Caribbean Planning for Adaptation to Climate Change project. In spite of such programmes and policies, still there is a need to develop adaptation capacity for SIDS. SIDS cannot deal with or adapt to climate change in isolation due to their scarce resource base and less capacity. Raising adaptive capacity will only be productive when it is incorporated with

other policies such as land-use planning, coastal planning, disaster preparedness, environmental conservation and national plans for sustainable development. Therefore, they need international cooperation and assistance in order to address the problem adequately and to integrate their climate concerns to development efforts (Sutherland, *et al.*, 2005).

### **Need for regional and International Cooperation**

Due to lack of adequate resources, SIDS needs international assistance in order to support adaptation measure such as their national plans for sustainable development, to enhance capacity-building efforts and funds and technology transfers. Proper and adequate planning and capacity-building are also required to minimise the risks related to natural disasters due to climate change and enhance the resiliency of populations towards increasing extreme weather events like floods, tropical cyclones, storms surges and droughts etc. Financial assistance for adaptation measures in SIDS must be adequate and sustained. In particular, small island developing states need some special consideration in the context of their extreme vulnerability in the face of climate change.

Different regional organisations and associations such as Association of Caribbean States, CARICOM Indian Ocean Commission (IOC), Pacific Islands Forum, The Global Island Partnership (GLISPA) and CCCCC, organise their regional or inter-regional meetings annually and at different intervals of time or if there is any urgent and specific issue to be presented at the international negotiations then they meet according to the need. This process helps them to understand their different need and the urgency of the issues to negotiate on the international fora (Bakshi, 2014a). Therefore, these regional forums and organisations are serving to make SIDS more aware of each-others challenges and make them unite over urgent issues to deal with in international negotiations.

### **Mitigation**

For many SIDS, climate change is a subject of their future viability or even survival. As discussed earlier, though the emission levels of green-house gas by SIDS are very nominal, but huge emission levels by other countries pose disproportional effects for them. Therefore, apart from adaptation, to convince other countries for reducing their emission levels of greenhouse gas is a priority for SIDS. At the international fora, many small island states are also members of a negotiating bloc for developing countries, the G-77 and China. However, this negotiating group of developing countries also has some of largest emitters of GHGs

among them such as China, India etc. Thus, it is a dilemma for small island states that they are also member of the same negotiating group, in which some of the members have continuously increasing levels of their GHGs emissions and at the same time the countries with the high emission levels, are not willing to limit their emission levels because of their economic developmental objectives. Member countries of the OPEC are also member of G77-China. Combustion of fossil fuels is one of the main factors contributing to GHGs concentration as well as the main factor for industrial development, so reducing their GHGs emission levels may not be in their short-term economic concerns.

Developing countries that are the large emitters and member of G-77 and China, usually mention the principle of “common but differentiated responsibilities” for justifying their stand on reducing their respective emission of green-house gas. Consequently, SIDS are at differences with some of their developing nations negotiating partners in the context of emission reduction of greenhouse gas. It is needed and a big challenge for SIDS to make convince their developing country partners to take lead on the responsible actions in order to reduce their GHGs emission levels.

### **Adaptation**

Since the emission levels of SIDS as a whole are very little, their policy actions are heavily limited to adaptation measures. Given very limited financial resources, SIDS on their own are not able to afford huge adaptation costs. Various studies have proposed that in Jamaica, protecting the coasts from submergence or disappearance due to a sea-level rise of around one metre will cost approximately USD 462 million<sup>3</sup> additionally the same adaptations estimated to costs around USD 50 million in St Kitts and Nevis and around USD 71 million in Antigua. Approximately, USD 10-40 billion will be needed as a cost for adaptation measures in developing countries as estimated by the World Bank (World Bank, 2006). At the international level, there are several global funds available for developing countries which have been established to provide assistance particularly poor and vulnerable countries such as SIDS and LDCs in their adaptation efforts. The Adaptation Funds is one of these funds, which receives its financial resources through a levy of 2 percent on the CMD projects assigned under the Kyoto Protocol. Some estimation has revealed that the fund could provide financial assistance between USD 270 million to USD 600 million for adaptation projects in

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<sup>3</sup> Government of Jamaica, Jamaica’s First National Communication to the UNFCCC (Government of Jamaica 1999).



developing countries. It is evident that this financial assistance is not sufficient to meet the need of even the current adaptation projects (Muller, 2006).

Most of the developed countries are financially strong and able to fund themselves their national adaptation efforts. Under the UNFCCC, developed country parties have been directed to provide financial assistance to developing countries in their adaptation initiatives; but at the same time, usually the provided assistance is insufficient when divided among several countries. Generally, there are major three international funding schemes, that provide financial assistance regarding adaptation measures in developing and poor countries and thus these funds may be of relevant to some island states also.

These mechanisms are as followings:

- The Special Climate Change Fund (SCCF): provides additional financial support to poor and vulnerable states to the impacts of climate change.
- The Least Developed Countries (LDCs) Funds: this fund assists the particularly least developed countries on plans and strategies in order to implement their NAPAs.
- Funding for Pilot Adaptation Measures founded under the GEF: financially assist the implementations and execution of pilot adaptation projects in developing countries.

The UNFCCC and other such international agreements are the important operators of adaptation measures at the regional and international levels. This is not only because they provide financial opportunities to weaker countries, but also because of such institutions put some restrictions on countries for taking adequate actions, for instance in order to prepare national communications countries are supposed to involve undertaking vulnerability and adaptation measures (UNFCCC, 2010).

The main objective of the Special Climate Change Fund (SCCF) is to support developing countries in their activities in the field related to adaptation initiatives, transfer of technology, transports, energy, industries, agricultural activities, economic diversification and forest and waste management. Activities under adaptation measure to deal with the negative impacts of climate change are top priorities for financial assistance under this SCCF.

The LDC Fund is established to provide least developed countries with financial assistance for their adaptation actions. The fund has provided funding assistance to more than 40 national level action programmes for adaptation in many LDCs. As of 2007, total resources

available under this funding mechanism had reached USD 150 million of which USD10 million was devoted for the preparation of national adaptation programmes of action. Presently, there is no specific fund that deals with SIDS concerns, yet SIDS are the most vulnerable places to climate change along with least developed countries. With regard to the current negotiations on climate change, especial consideration should be given to the needs of financial assistance for adaptation in small island states. Priority access for small island countries to the current adaptation funds is just one factor; on the other hand, the establishing a special funding mechanism in order to address the adaptation requirements in SIDS must be regarded as an option. Additionally, to international treaties and agreements on climate change, at the global level there is a need to mainstream concerns related to climate change in other development policies and programmes.

As a body entrusted with controlling the financial mechanisms under the UNFCCC, the GEF, as a part of its trust-funds, founded the Strategic Priority on Adaptation (SPA). The ultimate objective of the strategic priority on adaptation is to enhance adaptive capacities and thus to reduce vulnerability to the negative impacts of climate change. The strategic priority on adaptation assists demonstration and pilot projects that simultaneously deal with adaptation initiatives at local levels while generating global environmental benefits.

## **Conclusions**

Clearly, SIDS are at the frontlines to face the adverse consequences of climate change, but the irony is that they stand on the margins of the present global geopolitical debate over climate change. As a whole, SIDS contribution to global greenhouse gas emissions is negligible and the current rate of climate change is likely to continue even with the most optimistic targets for reductions in global GHGs emissions, therefore priority concern for SIDS is adaptation. Adequately adapting climate change is not only a challenge of sustainable development for SIDS but also a survival and existence issue in some particular SIDS cases i.e. Maldives, Marshall Island and Kiribati etc. (Yamamoto and Esteban, 2010). For successful adaptation measures, a number of actions and issues are needed at both levels i.e. national and international:

- Firstly, more research is required to properly understand the diverse climate change impacts for SIDS and alternatives for adaptation measures in respect of their limited structural power. Therefore, it would be very significant to have better understandings

of multiple stresses at all levels i.e. global, regional and national levels to make proper and adequate decisions related to negative impacts of climate change.

- Secondly, NAPAs established by the SIDS are a significant move towards enhancing their adaptive and coping capacity. As, currently many of the adaptation programmes are focusing on one or two sectors only, so more comprehensive programmes are required for adequate adaptation. Indeed, adaptation initiatives need to be integrated in national development policies and strategies.
- Thirdly, SIDS do not have enough technical capabilities and financial resources to meet their adaptation requirements. Therefore, it is needed for developed nations to provide adequate and stronger technical and financial assistance to small island developing states, both through the especial funds such as the LDCs Funds and other international frameworks, such as the Barbados Programme of Action (BPOA) etc. Furthermore, in the context of SIDS particularly, special consideration should be given to establishment of other special funds for them.
- Fourthly, it is needed for SIDS to make their influence within the G-77 and China in order to get supports of other developing countries for a significant reduction of global emissions of global greenhouse gas.

In addition to all the above mentioned issues, which are important for the development of SIDS, there are many other issues (i.e. reduction in greenhouse gas emissions, financial resources for adaptation) which are important for the survival of small island states and for what they cannot do anything alone at national, regional and international level. On the issue of GHGs emission reduction, SIDS need the cooperation of major emitter countries, whether it is developed (e.g. USA, Japan etc.) or developing (e.g. China, India etc.). The major issues for SIDS in international climate negotiation is to achieve the target of emission reduction and financial assistance for adaptation.

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