FIFTY TWO SMALL ISLAND NATIONS ARE ON THE VERGE OF BEING OBLITERATED FROM THE WORLD MAP

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ABSTRACT

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) finds, beyond reasonable doubt that the Earth's climate is warming.Since the 1950s, the rate of global warming has been unprecedented compared to previous decades and millennia.The Fifth Assessment Report presents a long list of changesthat scientists have observed around the world.Since themid-19th century, the average increase in the temperatureof the Earth's surface has been 0.85 degrees Centigrade (°C).Globally, sea levels have risen faster than at any time duringthe previous two millennia.In many parts of the world,including Small Island Developing States (SIDS), changingrainfall is altering freshwater systems, affecting the qualityand quantity of water available. Since the negotiations on climate change that led to the United Nations Framework Convention on Climate Change began, one group of Parties has been particularly active and vocal and they are the small island developing States, or SIDS. These small nations are among the most vulnerable to climate change impacts, which will become critical if no appropriate action is taken. Many islands are threatened by rising sea levels. Another growing concern is the increasing number and severity of extreme weather events with all they entail in terms of loss of life and damage to property and infrastructure that can easily cripple small economies. SIDS are among the Parties least responsible for climate change and are dependent on others to ensure that significant action is taken in support of the Convention. Despite the urgency to stop carbon emission China, the United States and India have boosted coal mining in 2017, in an abrupt departure from last year's record global decline for the heavily polluting fuel and a setback to efforts to rein in climate change emissions. Mining data show that production through May is up by at least 121 million tons, or 6 per cent, for the three countries compared to the same period last year. The change is most dramatic in the US, where coal mining rose 19 per cent in the first five months of the year, according to US Department of Energy data. Coal's fortunes had appeared to hit a new low less than two weeks ago, when British energy company BP reported that tonnage mined worldwide fell 6.5 per cent in 2016, the largest drop on record. China and the US accounted for almost all the decline, while India showed a slight increase. The reasons for this year's turnaround include policy shifts in China, changes in US energy markets and India's continued push to provide electricity to more of its poor, industry the fuel's popularity waned over the past several years as renewable power and natural gas made gains and China moved to curb dangerous levels of urban smog from burning coal. No country in the world is taking the impending danger of climate change of small islands developing states and if the predictions go right the 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 meters, ranging from 0.5 and 0.6 meters in the Caribbean, Pacific and Indian Ocean, and by 0.4 and 0.5 meters in the North Indian ocean.

Key Words: Climate Change, Sea level rise, Small Island Developing States, Carbon Emission, Intergovernmental Panel on Climate Change.

INTRODUCTION:

Sea level rise is caused primarily by two factors related to global warming: the added water from melting ice sheets and glaciers and the expansion of sea water as it warms. There is robust evidence that sea levels have risen as a result of climate change based on observations from tide gauges, paleo indicators and satellite measurements. The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report finds that sea level has risen by 0.19 m since the beginning of the 20th century. Over the last century global average sea level rose by 1.7 [1.5 to 1.9] mm per year, in recent years (between 1993 and 2010) this rate has increased to 3.2 [2.8 to 3.6] mm per year. The IPCC report finds that the rate of sea level rise over the last century is unusually high in the context of the last 2,000 years The IPCC finds that recent observations of global average sea level rise at a rate of 3.2 [2.8 to 3.6] mm per year is consistent with the sum of contributions from:

(1) Observation of thermal ocean expansion due to warming (0.8-1.4 mm per year).(2) Changes in glaciers (0.39 – 1.13 mm per year)

(3) Changes in Greenfield ice sheet(0.25-0.41mm per year)(4) Changes in Antarctica ice sheet (0.16-0.38 mm per year) and(5) Changes to land water storage (0.26-0.49)

The IPCC report projects reflect stronger scientific understanding of sea level rise and projections for future sea level rise high are higher than in previous IPCC reports. If emissions continue to track at the top of IPCC scenarios global average sea level could rise by nearly 1 m by 2100 (0.52–0.98 m from a 1986-2005 baseline). If emissions follow the lowest emissions scenario, then global average sea level could rise by between 0.28–0.6 m by 2100 (compared to a 1986–2005 baseline). Sea level rise will continue for centuries to thousands of years after greenhouse gas concentrations are stabilized due to the long lag times involved in warming of the oceans and the response of ice sheets. For the first time the IPCC provides projections for 2300 in its latest report. Sea level rise by 2300 could be kept to less than 1 m if concentrations of carbon dioxide in the atmosphere are stabilized below 500 ppm, or could reach up to 3 m if concentrations of carbon dioxide rise above 700 ppm. There are innumerable risks from the sea level rise particularly to those countries which are either island nations or coastal nations for example, Australia is a coastal society. 85 per cent of the population lives in the coastal region and it is of high economic, social and environmental value to the nation. Nearly 39,000 residential properties are located within 110 meters of soft, erodible shorelines. Exposure will increase as Australia's population grows. The impacts of sea level rise will be experienced mainly through its effect on extreme sea level events such as high tides and storm surges. Rising sea levels will increase the frequency or likelihood of extreme sea level events and resultant flooding. The risks from sea level rise are not confined to the coast itself. In many cases flooding may impact areas some distance from the sea for example along estuaries, rivers, lakes and lagoons. A study of 29 locations in Australia (see figure below) found that for a mid-range sea level rise of 50 cm extreme sea level events that happened every few years now, are likely to occur every few days in 2100. On average, Australia will experience a roughly 300-fold increase in flooding events, meaning that infrastructure that is presently flooded once in 100 years will be flooded several times per year with a sea level rise of 50 cm.

SMALL ISLAND DEVELOPING STATES (SIDS) ARE VULNERABLE TO CLIMATE CHANGE

Since the negotiations that led to the United Nations Framework Convention on Climate Change began, one group of Parties has been particularly active and vocal the small island developing States, or SIDS. These small nations are among the most vulnerable to climate change impacts, which will become critical if no appropriate action is taken. Many islands are threatened by rising sea levels. Another growing concern is the increasing number and severity of extreme weather events with all they entail in terms of loss of life and damage to property and infrastructure that can easily cripple small economies. SIDS are among the Parties least responsible for climate change and are dependent on others to ensure that significant action is taken in support of the Convention. Consequently, they strive not only to support the process directly but also to ensure that proper international action is taken to limit emissions of greenhouse gases and to adapt to climate change. This review paper highlights the SIDS' ongoing needs and concerns that they have expressed in the course of the UNFCCC process. Warming of Pacific Ocean water of three degrees has been measured in the Pacific. Plankton, the tiny single cell plants and animals that are the basis of the ocean food web in northern latitudes and the source of at least half the oxygen we breathe are dying. Zoo plankton in the northeast Pacific hasdeclined by 80% since 1950. In the southern oceans, coral reefs are dying, perhaps because of ocean warming, threatening biological productivity in tropical seas. It is not just small island people who are at riskfrom climate change, 60% of humanity live in coastal areas and therefore, share vulnerability to climate changeand sea level rise. Low lying coastal areas in all countries are threatened; including agriculturally product iveriver delta worldwide. The 52 nations, home to over 62 million people, emit less than one per cent of global green house gases, yet they suffer disproportionately from the climate change that global emissions cause. Climate Change induced Sea level rise in the world's 52 small island nations estimated to be up to four times the global average continues to be the most pressing threat to their environment and socio economic development with annual losses at the trillions of dollars due to increased vulnerability. An immediate shift in policies and investment towards renewable energy and green economic growth is required to avoid exacerbating these impacts, says a new report by the United Nations Environment Programme (UNEP). In all SIDS regions, coral reefs, the frontline for adaptation, are already severely impacted by rising sea surface temperatures. The global net loss of the coral reef covers around 34 million hectares over two decades will cost the international economy an estimated US$11.9 trillion, with Small Island Developing States (SIDS) especially impacted by the loss. In the insular Caribbean, for example, up to 100 per cent of coral reefs in some area shave been affected by bleaching due to thermal stress linked to global warming. Climate threats are projectedto push the proportion of reefs at risk in the Caribbean to 90 per cent by 2030 and up to 100 per cent by 2050.

A BRIEF HISTORY OF FIFTY TWO SMALL ISLAND COUNTRIES:

Small Island Developing States (SIDS) comprise small islands and low-lying coastal countries that represent adiverse group in a number respects. The United Nations currently classifies 52 countries and territories as SIDS. More than 50 million people live in these countries. They are located across the Indian, Pacific and Atlantic Oceans with the highest concentration of SIDS in the **Caribbean** and **southwest Pacific**, forty-three of them are located in the **Caribbean** and the **Pacific regions**. The group includes countries that are relatively rich by developing country standards, such as Singapore and Bahamas, but also some of the poorest countries in the world, including Comoros, Haiti, Kiribati and Timor-Leste. SIDS also face a greater risk of marginalization from the global economy than many other developing countries as a result of their small size, remoteness from large markets, and high economic vulnerability to economic and natural shocks beyond domestic control. With their fragile ecosystems, SIDS are also highly vulnerable to domestic pollution factors and globally-induced phenomena, such as sea level rise. The lists of the small island developing states which are recognized as UN member as well as non- UN members are are given as below

LIST OF MEMBERS OF SMALL ISLAND DEVELOPING STATES (UN MEMBERS)

1- Antigua and Barbuda

2- Bahamas

3-Bahrain

4-Barbados

5-Belize

6-Cape Verde*****

7-Comoros*****

8-Cuba

9-Dominica

10- Dominican

11-Fiji

12-Grenada

13-Guinea-Bissau*****

14-Guyana

20-Federated States of Micronesia

21-Mauritius

22-Nauru

23-Palau

24-Papua New Guinea

25-Samoa*****

26-São Tomé and Principe*****

27-Singapore

28-St. Kitts and Nevis

29- ST. Lucia

30-St. Vincent and the Grenadines

31-Seychelles

32-Solomon Islands*****

33-Suriname

15-Haiti*

16-Jamaica

17-Kiribati*

18-Maldives*

19-Marshall Islands

34-Timor-Lesté*

35-Tonga

36-Trinidad and Tobago

37-Tuvalu*

38-Vanuatu*

LIST OF SMALL ISLAND DEVELOPING STATES (NON- UN MEMBERS/ASSOCIATE MEMBERS OF THE REGIONAL COMMISSIONS)

1-American Samoa

2-Anguilla

3-Aruba

4-British Virgin Islands

5-Commonwealth of Northern Marianas

6-Cook Islands

7-French Polynesia

8-Guam

9-Montserrat

10-Netherlands Antilles

11-New Calendonia

12-Niue

13-Puerto Rico

14-US Virgin Islands

A BRIEF HISTORY OF INTERNATIONAL RECOGNITION OF SMALL ISLANDS:

Small Island Developing States (SIDS) were recognized as a distinct group of developing countries facing specific social, economic and environmental vulnerabilities at the United nation conference on Environment and Development (UNCED), also known as the Earth Summit, held in Rio de Janeiro, Brazil (3-14 June 1992).This recognition was made specifically in the context of Agenda 21, 1992.The United Nations recognizes the 38UN member states belonging to the Alliance of Small Island States (AOSIS) 5, an ad hoc negotiating bodyestablished by SIDS at the United Nations. AOSIS also includes other island entities that are Non-UN member States or are not self-governing or non-independent territories that are members of UN regional commissions.It should be noted that Bahrain is not a member of AOSIS. In the Cotonou Agreement signed in 2000 between the European Union and ACP countries, island countries continue to be mentioned and the 26 island ACP countries are referred to in Annex VI, Article 4, including larger island states, such as Haiti, the Dominican Republic and Madagascar. Five geographical regions have been identified for the location of SIDS, namely, **the Caribbean**, **the Pacific and the Atlantic**, **Indian Ocean**, **Mediterranean** and **South China Sea (AIMS).** Each of these regions has regional bodies to which the respective SIDS may belong for purposes of regional cooperation. These are the **Caribbean community (CARICOM**), the **Pacific Islands Forum (PIF)** and **Indian**

Ocean Commission (IOC).There is also sub-regional organizations for similar purposes. The United Nations has been assisting and extending cooperation to SIDS in their sustainable development efforts through the Programme of Action for the Sustainable Development of Small Island Developing States finalized at the Global Conference held in Barbados in 1994, known also as the Barbados Programme of Action (BPOA). The BPOA highlights the vulnerabilities of SIDS and outlines their responsibility for their own sustainable development as well as the need for regional cooperation and the role of the international community in supporting the sustainable development of SIDS. The BPOA recommends that, in order for SIDS to achieve sustained economic growth and sustainable development, it is necessary to develop overseas markets for value-added exports in areas in which they are internationally competitive. Prior to the BPOA small islands issues, challenges and vulnerabilities were marginal to international environmental diplomacy. This programme was reviewed and revamped at the five-year review held at the twenty-second special session of the General Assembly in 1999, and the ten-year review held in Mauritius (10-14 January 2005). The latter outcome is known as the Mauritius Strategy for Implementation of the programme of action for the sustainable Development of small island developing states (MSI) which further strenghtened the social and economic dimensions for the

BPOA by placing a more targeted emphasis on certain issues, such as culture, health and knowledge management, education for sustainable development, consumption and production. It also highlighted the implications of globalization and trade liberalization for SIDS in addition to the difficulties being experienced by SIDS in integrating into the global economy. The UN-OHRLLS mandate from the General Assembly calls upon the Office to engage in advocacy and mobilization of international support and resources for the implementation of the Programme of Action for SIDS. In 2014, the international community gathered in Samoa for the Third International Conference on Small Island Developing States to forge a new pathway for the sustainable development of this group of countries. The SAMOA Pathway, recognizes the adverse impacts of climate change and sea-level rise on SIDS' efforts to achieve sustainable development as well as to their survival and viability, and addresses economic development, food security, DRR and ocean management, among other issues. While many SIDS have made advances in achieving sustainable development, their inherent vulnerabilities including small size, remoteness, climate change impacts, biodiversity loss and narrow resource base mean that progress for many continues tobe hampered, and their special case status remains (United Nations Framework Convention on Climate Change 2015

DEFINITION OF SMALL ISLAND DEVELOPING STATES:

One of the main conceptual problems underlying the question of the definition of SIDS hinges on how to define'small'. Different definitions of smallness have been envisaged in the relevant literature, with criteria ranging from population to land area, national income, or the share of world trade. The most commonly used criterion, in recent years, has been a **population threshold of 1.5 million, as proposed by the Commonwealth Secretariat and reflected in the report of the Commonwealth Secretariat/World Bank Joint Task Force on Small States.** A more recent definition of a **'small economy'** relates to trade issues. It is the **'share of world trade'**, as suggested by Michael Davenport who envisaged a threshold of 0.02% of overall merchandise trade, thereby accepting a group of **42 'small and vulnerable States'.** While it makes sense, in trade negotiations, to define smallness through the share of global trade, it should be noted that this variable is only weakly correlated with the population size criterion, and would generate a different set of countries. In any case, neither the definition based on the population criterion nor any other definition of smallness has ever been formally validated by an intergovernmental body. Defining **'smallness'** is, in itself, problematic, but the interchangeable use of, or loose reference to, terms such as "small island developing States" (Barbados 1994), "small economies", "small and vulnerable economies" (Doha 2001), or "structurally weak, vulnerable, and small economies" (São Paulo 2004) gives rise to a great deal of confusion. In any particular forum, the lack of clarity

about what category is actually under consideration is invariably a reason or pretext for decision makers not to take the issue seriously. The absence of a definition of the SIDS category has been the most fundamental reason for which countries that claimed to fall in that category were not able to gain special treatment on grounds of **'small islandness'**. Historically, there has been external support to most SIDS in the framework of international cooperation, essentially by virtue of North-South arrangements such as those maintained by the European Union to benefit ACP countries, or by the United States in favor of specific regions involving island states (e.g. through the Caribbean Basin Initiative). However, little has been done by development partners to translate the recognition of SIDS-specific issues into genuine SIDS-specific concessions, although this specificity has been advocated and sought by SIDS. Considering the exceptional economic disadvantages faced by most small island developing economies as a result of their permanent handicaps, the notion of special treatment by virtue of SIDS status is important to genuine SIDS in the multilateral trading system and inthe area of development financing

REASONS FOR THESE FIFTY TWO ISLANDS FOR BEING VULNERABLE TO SEA RISE:

Global climate change is one of the gravest environmental challenges facing SIDS today. Small islands, especially those located in the tropics, will feel the brunt of physical impacts of global climate change: increased frequency and intensity of weather-related phenomena (hurricanes, tidal waves, and storms), rises in sea level and coastal water temperatures (resulting in coral reef bleaching), and flooding of coastal zones. These impacts could jeopardize the entire territories of the ten SIDS that are barely one meter above sea level. Rising sea level can influence the rate of salt-water incursion into coastal aquifers, expansion of the salt-water wedge in estuaries, and the probability of damage from storm surges along coastlines. This has also been estimated that roughly more than 100 million people live within 1 m of the mean sea level, and the problem is especially urgent and serious for the low-lying small island nations of the world.(Mark F. Meier, 2002) The majority of SIDS populations live and work on coasts, where degradation of the land leaves little defense against raging surfs driven by hurricanes and tropical storms. The impacts, including beach erosion, destruction of valuable coral reefs, loss of fertile coastal areas, and damage to infrastructure (roads, bridges, utility lines, and buildings) could be profound and lasting. The poor condition of upland watersheds, particularly on larger islands, also makes inland areas highly susceptible to flooding and soil erosion, with consequent damage to ecosystems, property, and infrastructure and threats to human health and safety, in part from disruption of sanitation systems. Climate change impacts also make other processes prominent; for example, tsunamis may be higher under the influences of sea level rise .Many islands like Maldives, Marshall Islands, Federated States of Micronesia, Kiribati, Tuvalu and Arctic islands such as Shishmaref and small islands in Nunavut may become uninhabitable due to the rise in sea levels. Coastal areas in Bangladesh are hugely affected due to sea level rise. The factors which causes sea level are:

• Thermal expansion leading to rise in sea level.
• When continental glaciers melt, the run-off rise sea level accordingly.
• Glaciers melt at Greenland & West Antarctica
• Anthropogenic activities are influencing ice sheets melt3 (Nidhi Rawat et al 2016)

THERMAL EXPANSION:
In a more expansive physical definition, thermal expansion refers to the tendency of matter to increase in volume when heated. This change is directly proportional to the temperature change, and can be quantified by a constant particular to a material and known as the coefficient of thermal expansion. Unlike fresh water, whose density is greatest several degrees above its freezing temperature, salt water is at its most dense at its freezing temperature, which is actually just below zero degrees Celsius. This suggests that all of the ocean is susceptible to a temperature induced expansion. As the average global temperature increases, ocean waters become less dense, and the volume they occupy increases, resulting in a net sea level rise. Satellite observations show that sea level rise over the last decade is explained, by about 50%, by thermal expansion and rest 50% includes all the factors. The main causes of sea level rise may be summarized as follows:

TABLE-1 SEA LEVEL RISE IN DIFFERENT PARAMETERS

FACTORS FOR SEA LEVEL RISE	SEA LEVEL RISE
Antarctic Ice sheet melt	0.26mm/year
Glacier melt	0.38mm/ year
Greenland Ice sheet melt	0.73mm/year
Thermal expansion of sea water	1.38mm/year

Source- Rietbroek etal (2016)

While the equation for the thermal expansion is a simple linear proportionality, its application to the ocean involves complexities. Some result from empirical data regarding the effective depth for thermal mixing at the surface of the ocean. Others involve the temperature variations that exist at different depths and locations, and must be smoothed over for the sake of an order of magnitude calculation.

OCEAN CURRENT:

Mass flows of water, or currents, are essential to understanding how heat energy moves between the Earth's water bodies, landmasses, and atmosphere. The ocean covers 71 percent of the planet and holds 97 percent of its water, making the ocean a key factor in the storage and transfer of heat energy across the globe. The movement of this heat through local and global ocean currents affects the regulation of local weather conditions and temperature extremes, stabilization of global climate patterns, cycling of gases, and delivery of nutrients and larva to marine ecosystems. Ocean currents are located at the ocean surface and in deep water below 300 meters (984 feet). They can move water horizontally and vertically and occur on both local and global scales. The ocean has an interconnected current, or circulation, system powered by wind, tides, the Earth's rotation (Coriolis effect), the sun (solar energy), and water density differences. The topography and shape of ocean basins and nearby landmasses also influenceocean currents. These forces and physical characteristics affect the size, shape, speed, and direction of ocean currents. Surface ocean currents can occur on local and global scales and are typically wind-driven, resulting in both horizontal and vertical water movement. Horizontal surface currents that are local and typically short term include rip currents, long shore currents, and tidal currents. In upwelling currents, vertical water movement and mixing brings cold, nutrient-rich water toward the surface while pushing warmer, less dense water downward, where it condenses and sinks. This creates a cycle of upwelling and down welling. Prevailing winds, ocean surface currents, and the associated mixing influence the physical, chemical, and biological characteristics of the ocean, as well as global climate. Deep ocean currents are density-driven and differ from surface currents in scale, speed, and energy. Water density is affected by the temperature, salinity (saltiness), and depth of the water. The colder and saltier the ocean water, the denser it is. The greater the density differences between different layers in the water column, the greater the mixing and circulation. Density differences in ocean water contribute to a global-scale circulation system, also called the global conveyor belt. The global conveyor belt includes both surface and deep ocean currents that circulate the globe in a 1,000-year cycle. The global conveyor belt's circulation is the result of two simultaneous processes, warm surface currents carrying less dense water away from the Equator toward the poles, and cold deep ocean currents carrying denser water away from the poles toward the Equator. The ocean's global circulation system plays a key role in distributing heat energy, regulating weather and climate, and cycling vital nutrients and gases.

SEA LEVEL RISE:

Instrumental records reveal that the world's oceans have warmed since 1955, accounting over this period for more than 80% of the changes in the energy content of the Earth's climate system. Records further reveal during the period 1961 to 2003, the 0 to 3000 m ocean layer has absorbed up to 14.1 × 1022 Joules, equivalent to an average heating rate of 0.2 Watts/m2 (per unit area of the Earth's surface). During 1993 to 2003, the corresponding rate of warming in the shallower 0 to 700 m ocean layer was higher, about 0.5 ± 0.18 W/m2. Hence, relative to 1961 to 2003, the period 1993 to 2003 had much higher rates of warming, especially in the upper 700 m of the global ocean.(Susmita Dasgupta and Craig Meisner200) Sea level rise is going to affect very adversely to the small Island developing states as their survival, their economy and their existence on the world map are on the stake, according to Caribbean Marine Climate Change Report Card 2017 Sea level in the Caribbean region has risen by around 20 cm over the past 100 years, increasing the risk of flooding. While the overall frequency of Atlantic storms may decrease in the future, the strongest category 4 and 5 storms may increase by 80% in frequency over this century, with higher winds and rainfall rates associated with these storms. Global mean sea level is projected to rise by a further 26-82 cm (10-32 inches) over the coming century, but higher increases exceeding a meter are possible. In the northern Caribbean, sea level rise could be 25% higher than the global average due to other physical factors affecting land elevation. In a study carried on revisiting the contemporary sea-level budget on global and regional scales the author has claimed that besides the steric and mass components, a systematic but globally non significant sea level component is also co estimated (0.22±0.26 mm/yr), which closes the sea level budget against the altimetry data. Well above average sea level rise is found regionally near the Philippines (14.7±4.39mm/yr) and Indonesia (8.3±4.7mm/yr) which is dominated by steric components (11.2±3.58 mm/yr and 6.4±3.18 resp.). In contrast, in the central and Eastern part of the Pacific, negative steric trends (down to - 2.8±1.53mm/yr) are detected. Significant regional components are found, up to 5.3±2.6 mm/yr in the Northwest Atlantic, which are likely due to ocean bottom pressure variations (Rietbroek etal (2016) This projected rise in sea level and severe storms is likely to increase the risk of storm surge events for Caribbean states, which will further exacerbate risks to biodiversity, settlements and infrastructure across Caribbean states. In the future, a tendency towards both more dry spells and extreme rainfall events is projected, increasing risks from drought, as well as flooding.These impacts will necessitate an increased level of planning around water availability and a need to increase the resilience of coastal infrastructure and populations to storm damage and flood risk. Fifth Assessment Report has a chapter on SIDS which says about how these factors of climate change bring about impacts on the ecosystem of small islands, based on the magnitude, frequency and extent of the event, as well as on the bio-physical nature of the island and its social, economic and political setting. Therefore, small islands have varying climate change risk profiles (confidence). The sea level rise is also different in different zones of islands .The Fifth Assessment Report has not provided data for all SIDS and this is because of the fact that the data collection has not been kept on a priority stage and data relating to climate are sparse also. Some of the data which are available have been used in IPCC Fifth assessment so as to show how the climate change has been affecting SIDS, for average temperatures have been found to increase at a rate of between 0.1 and 0.2°C per decade throughout the Pacific islands during the 20th century. Temperature has been on rise and rainfall records averaged across the Caribbean region for 100 years (1900– 2000) show a consistent reduction in rainfall. In contrast, rainfall data over the past 100 years from the Seychelles has shown substantial variation related to the El Niño. However, an increase in average rainfall from 1959 to 1997 and an increase in temperature of around 0.25°C per decade have been found to take place in the Seychelles. The rate of sea level rise since 1850s has been much bigger than the average rate during the previous 2,000 years (high confidence) at a rate of 1.3–1.7 millimeters (mm) per year over much of the 20th century but increasing to 2.8–3.6 mm per year since 1993. However, sea level rise varies between regions, and large differences in the rate of sea level rise have been detected in the Indian Ocean and the tropical Pacific. This has occurred due to a complex set of interactions. There are many factors responsible for the sea rise and like Shifting surface winds, the expansion of warming ocean water and the addition of melting ice can also alter ocean currents which, in turn, lead to changes in sea level that vary from place to place. Past and present variations in the distribution of land ice affect the shape and gravitational field of the Earth, which also cause regional fluctuations in sea level. Some of the extraneous factors for example, Sediment and tectonic movements in the ocean bed cause additional variations in sea level. In the tropical western Pacific where a large number of small island communities exist, rates of sea level rise of up to four times the global average (approximately 12 mm per year) have been reported between 1993–2009 Here, the El Niño Southern Oscillation (ENSO) plays a strong role in regional sea level with lower than average sea level during El Niño events and higher than average sea level during La Niña events, by as much as plus or minus 20–30 cm. Large variations in sea level have also been shown between years in the Indian Ocean, for example, in the Chagos Archipelago, and in the Caribbean. 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). For example, at Fongafale Island in the Funafuti Atoll, Tuvalu, high spring tide floods have been well publicized and areas of the central portion of Fongafale Island are already below high spring tide level.In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans, including SIDS (IPCC's Fifth Assessment Report 2014)

PREDICTION OF IPCC FIFTH ASSESSMENT REPORT: IPCC Fifth report has been predicted four scenarios based on climate modeling, and they are popularly known as Representative Concentration Pathways (RCP). These different pathways have been found out on four different levels of green house gas emissions and it has been proposed that how the temperature and sea level rise will go up by the turn of century. In all scenarios, carbon dioxide concentrations are higher in 2100 than they are today. The low-emissions scenario (RCP2.6) assumes substantial and sustained reductions in greenhouse gas emissions. The high-emissions scenario (RCP8.5) assumes continued high rates of emissions. The two intermediate scenarios (RCPs 4.5 and 6.0) assume some stabilization in emissions. In the next few decades, warming will be the same in all scenarios. Regardless of action taken now to reduce emissions, the climate will change until around the middle of this century. In the longer term, in all except the low-emissions scenario, global warming at the end of the 21st century is likely to be at least 1.5°C. In the two higher emissions scenarios, global warming is likely to be 2°C. In the second lowest emissions scenario, global warming is more likely than not to be 2°C. Warming will continue beyond 2100 under all emissions scenarios except the lowest and will continue to vary between years and between decades. On the basis of different scenarios IPCC Fifth report has predicted temperature trends, rainfall trends and sea level rise in different regions of countries as mentioned below

PROJECTED TEMPERATURE TRENDS:

Under an intermediate low-emissions scenario (RCP4.5), an average annual increase in surface temperature of 1.2–2.3°C is projected across the Caribbean, Indian Ocean and Pacific Ocean small island regions by the end of the century, compared to 1986–2005

PROJECTED RAINFALL TRENDS:

Under the same scenario, a decrease in rainfall of about 5–6% is projected for the Caribbean, signaling a potential future threat to agriculture and water availability, compared to a 1–9% increase projected for the Indian Ocean and Pacific Ocean small island regions. But again, there are large variations within these small island regions. For example, among the more dispersed Pacific islands, 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.

PROJECTED SEA LEVEL TRENDS: 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 meters, ranging from 0.5 and 0.6 meters in the Caribbean, Pacific and Indian Ocean, and by 0.4 and 0.5 meters in the North Indian Ocean. Table 2:

TABLE-2 CLIMATE CHANGE PROJECTIONS FOR THE INTERMEDIATE LOW SCENARIO FOR THE SIDS REGIONS

SMALL ISLAND REGIONS	RCP4.5 ANNUAL PROJECTED CHANGE FOR 2081-2100(RELATIVE TO 1986-2005)		
	AVERAGE TEMPERATURE(IN	AVERAGE RAINFALL (%)	SEA LEVEL RISE(M)
CARIBEAN	1.4	-5	0.5-0.6
NORTHERN TROPICAL PACIFIC	1.4	1	0.5-0.6
SOUTHERN TROPICAL 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 Fifth Assessment Report 2014)

CONTRIBUTION OF GREENLAND ICE SHEET IN SEA LEVEL RISE:

An ice sheet is a mass of glacial land ice extending more than 50,000 square kilometers (20,000 square miles). The two ice sheets on Earth today cover most of Greenland and Antarctica. During the last ice age, ice sheets also covered much of North America and Scandinavia. Together, the Antarctic and Greenland ice sheets contain more than 99 percent of the freshwater ice on Earth. The Antarctic Ice Sheet extends almost 14 million square kilometers (5.4 million square miles), roughly the area of the contiguous United States and Mexico combined. The Antarctic Ice Sheet contains 30 million cubic kilometers (7.2 million cubic miles) of ice. The Greenland Ice Sheet extends about 1.7 million square kilometers (656,000 square miles), covering most of the island of Greenland, three times the size of Texas. Ice sheets form in areas where snow that falls in winter does not melt entirely over the summer. Over thousands of years, the layers of snow pile up into thick masses of ice, growing thicker and denser as the weight of new snow and ice layers compresses the older layers. Ice sheets are constantly in motion, slowly flowing downhill under their own weight. Near the coast, most of the ice moves through relatively fast-moving outlets called ice streams, glaciers and ice shelves. As long as an ice sheet accumulates the same mass of snow as it loses to the sea, it remains stable. The Antarctic Ice Sheet covers an area larger than the U.S. and Mexico combined. Ice sheets contain enormous quantities of frozen water. If the Greenland Ice Sheet melted, scientists estimate that sea level would rise about 6 meters (20 feet). If the Antarctic Ice Sheet melted, sea level would rise by about 60 meters (200 feet). The Greenland and Antarctic ice sheets also influence weather and climate. Large high-altitude plateaus on the ice caps alter storm tracks and create cold down slope winds close to the ice surface. In addition, the layers of ice blanketing Greenland and Antarctica contain a unique record of Earth's climate history. The mass of ice in the Greenland Ice Sheet has begun to decline. From 1979 to 2006, summer melt on the ice sheet increased by more than 30 percent, reaching a new record in 2017. At higher elevations, an increase in winter snow accumulation has partially offset the melt. However, the decline continues to outpace accumulation because warmer temperatures have led to increased melt and faster glacier movement at the island's edges. However, the Antarctic Peninsula, which juts out into warmer waters north of Antarctica, has warmed 2.5 degrees Celsius since 1950. A large area of the West Antarctic Ice Sheet is also losing mass, probably because of warmer water deep in the ocean near the Antarctic coast. In East Antarctica, no clear trend has emerged, although some stations appear to be cooling slightly. Overall, scientists believe that Antarctica is starting to lose ice, but so far the process has not become as quick or as widespread as in Greenland In a study on Ice-dynamic projections of the Greenland ice sheet in response to atmospheric and oceanic warming, author has been able to conclude that continuing global warming will have a strong impact on the Greenland ice sheet in the coming centuries. He further says that during the last decade (2000–2010), both increased melt-waterrunoff and enhanced ice discharge from calving glaciers have contributed 0.60 mm per yr to global sea-level rise, with a relative contribution of 60 and 40% respectively. The author has used a higher-order ice flow model, spun up to present day, to simulate future ice volume changes driven by both atmospheric and oceanic temperature changes. For these projections, the flow model accounts for runoff-induced basal lubrication and ocean warming-induced discharge increase at the marine margins. For a suite of 10 atmosphere and ocean general circulation models and four representative concentration pathway scenarios, the projected sea-level rise between 2000 and 2100 lies in the range of +1.4 to +16.6 cm. (J. J. Fürst etal 2015).In an another study on tipping point in refreezing accelerates mass loss of Greenland's glaciers and icecaps this has been found that melting of the Greenland ice sheet (GrIS) and its peripheral glaciers and ice caps (GICs) contributes about 43% to contemporary sea level rise. While patterns of GrIS mass loss are well studied, the spatial and temporal evolution of GICs mass loss and the acting processes have remained unclear. Here the author has used a novel, 1 km surface mass balance product, evaluated against in situ and remote sensing data, to identify 1997 (±5 years) as a tipping point for GICs mass balance. That year marks the onset of a rapid deterioration in the capacity of the GICs firn to refreeze meltwater. Consequently, GICs runoff increases 65% faster than melt water production, tripling the post-1997 mass loss to 36±16 Gt−1, or ~14% of the Greenland total. In sharp contrast, the extensive inland firn of the GrIS retains most of its refreezing capacity for now, buffering 22% of the increased melt water production. This underlines the very different response of the GICs and GrIS to atmospheric warming (B. Noel 2017). In addition to increased atmospheric global surface temperatures, which melt the ice sheet from above, warmer ocean water surrounding the island continent is also melting Greenland's glaciers from around its edges. This melting is happening at the ice faces that sit below sea level up inside the fjords (A fjord is a deep, narrow and elongated sea or lake drain, with steep land on three sides. The opening toward the sea is called the mouth of the fjord, and is often shallow. The fjord's inner part is called the sea bottom. If the geological formation is wider than it is long, it is not a fjord. Then it is a bay or cove) and that melt velocity will determine, to a large extent, what the future will hold as far as sea level rise from Greenland. Because the seawater around 400 meters (1,312 feet) deep is 3 to 4 degrees Celsius (5 to 8 degrees Fahrenheit) warmer than the water floating near the sea surface, it's the bathymetry (the measurement of depth of water in oceans, seas, or lakes) around Greenland that controls where and how much of that warmer, saltier, subsurface Atlantic Ocean layer is able to reach far up into the fjords and increase ice loss at the glacier's edge. In one of the studies on mass balance of the ice sheet and melting of ice sheet this has been found that the Greenland ice sheet plays a crucial role globally and locally, impacting the surface energy budget and climate and weather and contributing to current and future sea level rise. This has been estimated the spatial extent of surface melt across the Greenland ice sheet (GrIS) are derived from brightness temperatures measured by the Special Sensor Microwave Imager/Sounder passive microwave radiometer (Mote 2007). In 2016 found that annual ice losses could be more extensive than previously thought (Joost 2017).The year 2016 was not a record-breaking year in terms of melt extent and duration; it extends the overall increasing melting trend. The updated trend for melt extent over the period 1979-2016 over the whole Greenland ice sheet is+15,824km2/yr. In 2016, there was an early start to the melt season on April 10th, with melt extent in April reaching values typical of early June. The melt onset date in 2016 is ranked second, by only a few days, to the melt onset day in 2012 on April 4th. Periods of extensive melt (exceeding two standard deviations above the mean) were also recorded in mid-May and in June .The melt extent for the period June through August (JJA) 2016 was above the 1981-2010 average on 66% of days, compared to 54% of the days during the same period in 2015. The anomaly of the number of days when surface melt occurred with respect to the 1981-2010 period reached its peak in the northeast region .The number of melt days was also anomalously high along the west and southwest regions, though not as pronounced as in previous years (J. Richter-Menge 2016) There has been a substantial loss of ice mass also as through GRACE satellite this has been observed that gravity estimates obtained since 2002 (Velicogna and Wahr 2014),indicate that between April 2015 and April 2016 (the most recent period of available data) there was a net ice mass loss of 191 Gt .This is about the same as the April 2014-April 2015 mass loss (190 Gt) and smaller than the average April-to-April mass loss (232 Gt) over the period of record. The trend of total ice mass loss for the 14-year is 269 Gt/yr (J. Richter-Menge 2016)

CONTRIBUTION OF ANTARCTICA IN SEA LEVEL RISE:

Antarctica, the planet's largest desert, is home to 90% of the world's ice and it is enough to raise global sea levels by at least 60 meters. So what happens to its ice and snow is a matter of serious concern to all of us. One school of thought has just predicted that, by 2050, the rate at which the ice shelves melt will double and this issue gets further compounded by the fact that the powerful winds are not just shifting Antarctica's snow,but are also blowing 80 billion tones of it away, into the sea or the atmosphere and these two cases exemplify the challenges of climate research and the construction of projections for the future. In a study on extensive summer melt in West Antarctica favored by strong El Niño this has been observed that the unusual extent and duration of the melting are linked to strong and sustained advection of warm marine air toward the area, likely favored by the concurrent strong El Niño event. The increase in the number of extreme El Niño events projected for the twenty-first century could expose the WAIS to more frequent major melt events (Julien P. Nicolas 2017). If more extreme El Niños occur, ice shelves such as the Ross Ice Shelf on the West Antarctic Ice Sheet will melt and be weakened. Sometimes, those ice melts can lead to dramatic rivers and waterfalls that leak off of the ice structure. Though the rains are very infrequent but whenever it occurs it makes it slushier with ice. The weird weather patterns observed over the two-week period in 2016 painted a potentially worrisome picture for the future. The ice melt from 2016 wasn't as dramatic. It was more of slush on top of the ice; even if the melted slush and water refreezes they can leak into cracks and damages the inner structure of the ice. The ice sheets consists of massive networks of ice and they can't really be thought of as one homogenous, unchanging object and once these shelves are weakened, they could crack and break off, and that would open the floodgates literally. Once the ice is in the ocean, it could cause sea levels to rise dramatically and rapidly and here "rapidly," of course implies something completely different on a geological time scale which could not be predicted. For many critical components of the climate system, we can identify just how fast our understanding is changing. Successive IPCC reports have been reticent on key climate system issues ,for example, in 2001, the IPCC projected no significant ice mass loss in Antarctica by 2100 but , in the 2014 report, said the contribution to sea level rise would "not exceed several tenths of a meter" by 2100. In reality, the Amundsen Sea sector of the West Antarctic Ice Sheet has been destabilized and ice retreat is unstoppable for the current climate state. It is likely that no further acceleration in climate change is necessary to trigger the collapse of the rest of the ice sheet, with suggestions of a 3–5 meter sea-level rise within two centuries from West Antarctic melting (Spratt 2017) The 2007 IPCC report projected sea levels were projected to rise up to 0.59 meter by 2100. The figure was widely derided by researchers, including the head of NASA's climate research (Hansen 2007) as being far too conservative. By 2014, the IPCC's figure was in the range 0.55 to 0.82 meter, but they included the caveat that "levels above the likely range cannot be reliably evaluated." In reality, most scientists project a meter or more. The US Department of Defense uses scenarios of 1 and 2 meters for risk assessments, and the US National Oceanic and Atmospheric Administration provides an "extreme" scenario of 2.5 meters sea level rise by 2100 (NOAA 2017). In 2007, the IPCC reported that summer sea-ice was "projected to disappear almost completely towards the end of the 21st century", even as it was collapsing that year. In 2014, the IPCC had ice-free projections to 2100 for only the highest of four emissions scenarios. In reality, Arctic sea ice has already lost 70% of summer volume compared to just thirty years ago, and expectations are of sea-ice-free summer within a decade or two. In a study carried out on Antarctic ice sheet mass loss and future sea level rise this has been observed that sea-level rise above the, 1 meter is expected by 2100 is possible if ice sheet response begins to exceed present rates. Moreover, ice losses from Antarctica have an amplified impact on the coastlines of North America and Europe,because of the resulting redistribution of water due to the changed gravitational field near the ice sheet.(Ted Scambos 2015) In yet another study of assessment on the Collapse of the West Antarctic Ice Sheet after local destabilization of the Amundsen Basin this has been reiterated that the Antarctic Ice Sheet is losing mass at an accelerating rate, and playing a more important role in terms of global sea-level rise. The Amundsen Sea sector of West Antarctica has most likely been destabilized. Results showed that if the Amundsen Sea sector is destabilized, then the entire marine ice sheet will discharge into the ocean, causing a global sea-level rise of about 3 meter (Johannes Feldmann 2015). Another very important study was carried out on Increased West Antarctic ice discharge and East Antarctic stability over the last seven years by using Land sat 7 & 8 imagery spanning 2013-2015 and then compares it to earlier estimates derived from synthetic aperture radar, revealing heterogeneous changes in ice flow since ~2008. The new mapping provides complete coastal and inland coverage of ice velocity with a mean error of <10 m yr-1, resulting from multiple overlapping image pairs. The new mapping provides complete coastal and inland coverage of ice velocity with a mean error of <10 m yr-1, resulting from multiple overlapping image pairs and it was found that ice ice discharge from Antarctica is 1932 ± 38 Gigatons per year (Gt

yr-1) in 2015, an increase of 35 ± 15 Gt yr-1 from the time of the radar mapping. Flow accelerations across the ice discharge from Antarctica is 1932 ± 38 Gigatons per year (Gt yr-1) in 2015, an increase of 35 ± 15 Gt yr-1 from the time of the radar mapping. Flow accelerations across the 20 grounding lines of West Antarctica's Amundsen Sea Embayment, Getz Ice Shelf and Marguerite Bay on the western Antarctic Peninsula, account for 89% of this increase. In contrast, glaciers draining the East Antarctic Ice Sheet have been remarkably stable over the period of observation. Including modeled rates of snow accumulation and basal melt, the Antarctic ice sheet lost ice at an average rate of 186 ± 93 Gt yr -1 between 2008 and 2015. The modest increase in ice discharge over the past 7 years is contrasted by high rates of ice sheet mass loss and distinct spatial patters of elevation 25 lowering. This suggests that the recent pattern of mass loss in Antarctica, dominated by the Amundsen Sea sector, is likely part of a longer-term phase of enhanced glacier flow initiated in the decades leading up to the first continent wide radar mapping of ice flow (Alex S. Gardner 2017 from down load) . On the Antarctic Peninsula, the warming has been far greater and that's why a Delaware-size iceberg just broke off the Larsen C Ice Shelf in 2017 and smaller ice shelves on the peninsula have long since disintegrated entirely into the waters of the Weddell Sea. But around the Amundsen Sea, a thousand miles to the southwest on the Pacific coast of Antarctica, the glaciers are far larger and the stakes far higher. They may affect the entire planet. The Pine Island Ice Shelf is the floating terminus of the Pine Island Glacier, one of several large glaciers that empty into the Amundsen Sea. Together they drain a much larger dome of ice called the West Antarctic Ice Sheet, which is up to two and a half miles thick and covers an area twice the size of Texas. The ice sheet is draped over a series of islands, but most of it rests on the floor of a basin that dips more than 5,000 feet below sea level. That makes it especially vulnerable to the warming ocean. If all that vulnerable ice were to become unmoored, break into pieces, and float away, as researchers increasingly believe it might, it would raise sea level by roughly 10 feet, drowning coasts around the world. The ice sheet is held back only by its fringing ice shelves and those floating dams, braced against isolated mountains and ridges of rock around the edges of the basin, are starting to fail. They themselves don't add much to sea level, because they're already floating in the water. But as they weaken, the glaciers behind them flow faster to the sea, and their edges retreat. That's happening now all around the Amundsen Sea. The Pine Island Ice Shelf, about 1,300 feet thick over most of its area, is a dramatic case: It thinned by an average of 150 feet from 1994 to 2012. But even more worrisome is the neighboring Thwaites Glacier, which could destabilize most of the West Antarctic Ice Sheet if it collapsed. In a research on mass balance (MB) of the east Antarctic ice sheets (EAIS),west Antarctic ice sheets (WAIS), Antarctic ice sheet(AIS) and Greenland ice sheets(GIS) as determined by a range techniques and studies, this has been found that a low temperatures in Antarctica produce no surface runoff, recent satellite observations of ice discharge have challenged the notion that the ice sheet changes with eternal slowness,for example, using measurements of time-variable gravity from the Gravity Recovery and Climate Experiment (GRACE) satellites, Velicogna and Wahr (2006) determined that the Antarctic ice sheet mass decreased significantly, at a rate of 152 ± 80 km/yr of ice, equivalent to 0.4 ± 0.2 mm/yr of global SLR, during the period 2002-2005, with most of this loss from the WAIS. The EAIS exhibits the smallest range of variability among recent mass balance estimates however losses from the WAIS more than offset any growth occurring in the EAIS, leading to a net loss for the AIS as a whole. Thus most of the dynamic changes in the AIS are driven by losses in the WAIS. In another research on Recent Sea-Level Contributions of the

Antarctic and Greenland Ice Sheets this has been estimated that their combined imbalance is about 125 gig tons per year of ice, enough to raise sea level by 0.35 millimeters per year. This is only a modest contribution to the present rate of sea-level rise of 3.0 millimeters per year. However, much of the loss from Antarctica and Greenland is the result of the flow of ice to the ocean from ice streams and glaciers, which has accelerated over the past decade. In both continents, there are suspected triggers for the accelerated ice discharge—surface and ocean warming,

respectively—and, over the course of the 21st century, these processes could rapidly counteract the snowfall gains predicted by present coupled climate models (Andrew Shepherd and Duncan Wingham 2007) In a study on Simultaneous disintegration of outlet glaciers in Porpoise Bay (Wilkes Land), East Antarctica, driven by sea ice break-up this was found that there are few high temporal resolution studies on glacier calving particularly in east Antarctica This reveals a large near-simultaneous calving event in

January 2007, resulting in a total of 2900 km2 of ice being removed from glacier tongues. It was also observed that the start of a similar large near-simultaneous calving event in March 2016. These observations suggest that both of these large calving events are driven by the break-up of the multiyear sea ice which usually occupies Porpoise Bay. However, these break-up events appear to have been driven by contrasting mechanisms. The 2007 sea ice break-up is linked to atmospheric circulation anomalies in December 2005 weakening the multi-year sea ice through a combination of surface melt and a change in wind direction prior to its eventual breakup in January 2007. In contrast, the 2016 break-up event is linked to the terminus of Holmes (West) Glacier pushing the multi-year sea ice further into the open ocean, making the sea ice more vulnerable to break-up. In the context of predicted future warming and the sensitivity of sea ice to changes in climate, these results highlight the importance of interactions between land fast sea ice and glacier tongue stability in East Antarctica (Bertie W. J. Miles 2017)

CONTRIBUTION OF ARCTIC ICE AND OTHER GLACIERS IN SEA LEVEL RISE:

During the 20th century, glaciers and ice caps have experienced widespread mass losses. These losses (excluding those around the ice sheets of Greenland and Antarctica) are estimated to have contributed 0.50 ± 0.18 mm/yr in sea level equivalent (SLE) between 1961 and 2003, and 0.77 ± 0.22 mm/yr between 1991 and 2003. Snow cover has decreased in most regions, especially in spring. Satellite observations of the Northern Hemisphere snow cover from 1966 to 2005 show a decrease in every month except in November and December, with a stepwise drop of 5% in the annual mean in the late 1980s. In the Southern Hemisphere, the few long records or proxies mostly show either decreases or no changes in the past 40 years or more. Decreases in the snow pack have also been documented in several regions worldwide based upon annual time series of mountain snow water equivalent and snow depth. Permafrost and seasonally frozen ground in most regions display large changes in recent decades. Temperature increases at the top of the permafrost layer of up to 3°C since the 1980s have been reported. Permafrost warming has also been observed with variable magnitudes in the Canadian Arctic, Siberia, the Tibetan Plateau and Europe. The permafrost base has been thawing at a rate ranging from 0.04 m/yr in Alaska to 0.02 m/yr on the Tibetan Plateau. Summarizing each of these contributors the average rate of global mean SLR from 1961 to 2003, estimated from tide gauge data, is 1.8 ± 0.5 mm/yr. Thermal expansion's contribution to SLR over this period was 0.42 ± 0.12 mm/yr (about one-quarter of the total observed SLR). A few years ago a study on "sea ice free summer Arctic within 30 years: An update from climate models (CMIP5)" was carried out and this was predicted that loss of sea ice due to increased anthropogenic reasons and loss of ice from arctic. Applying the same technique of model selection and extrapolation approach to CMIP5 as was used in the research paper, the interval range for a nearly sea ice free Arctic is 14 to 36 years, with a median value of 28 years. Relative to a 2007 baseline, this suggests a nearly sea ice free Arctic in the 2030s. "Nearly" is interpreted as sea ice extent less than 1.0 million km2. (Muyin Wang and James E. Overland, 2012) New estimates indicate that Arctic soils hold about 50% of the world's soil carbon. While thawing permafrost is expected to contribute significantly to future greenhouse gas emissions, the amount released over the past 60 years has been relatively small. The impacts of Arctic changes reach beyond the Arctic. In addition to the Arctic's role in global sea level rise and greenhouse gas emissions, the changes underway appear to be affecting weather patterns in lower latitudes, even influencing Southeast Asian monsoons. Changes will continue through at least mid-century, due to warming already locked into the climate system. Warming trends will continue. Models project that autumn and winter temperatures in the Arctic will increase to 4–5°C above late 20th century values before mid-century, under either a medium or high greenhouse gas concentration scenario. This is twice the increase projected for the Northern Hemisphere. These increases are locked into the climate system by past emissions and ocean heat storage, and would still occur even if the world were to make drastic near-term cuts in emissions. The loss of land ice is expected to accelerate after the middle of this century. New projections of glacier changes since 2011 provide more regional detail, showing for example that some glaciers in northeastern Russia, Siberia, and the Kamchatka Peninsula could completely disappear by mid-century. Global sea-level rise is expected to accelerate, although uncertainties about the Greenland ice sheet's response to ongoing warming hamper scientists' ability to project the rate and magnitude of the increase. A recent analysis developed for SWIPA estimates that the Arctic will contribute 19–25 centimeters to global sea-level rise by the year 2100. The SWIPA analysis estimates that when all sources of sea-level rise are considered (not just those from the Arctic), the rise in global sea level by 2100 would be at least 52 cm for a greenhouse gas reduction scenario and 74 cm for a business-as-usual scenario. These estimates are almost double the minimum estimates made by the IPCC in 2013. After the Greenland ice sheet, the largest Arctic contributions to sea level rise will come from glaciers in the Canadian Arctic, Alaska, and the Russian Arctic, along with glaciers surrounding the Greenland ice sheet. (The Snow, Water, Ice and Permafrost in the Arctic Assessment, SWIPA 2017)

The cryosphere is the portion of Earth that is frozen, which includes glacial and periglacial environment on land, where ice, permafrost, or snow cover dominates, as well as ice-covered sea. Geographically, arctic regions and the higher elevation portions of alpine regions at lower latitudes are included. It has been observed that the retreat of glaciers, the loss of ice, is emblematic of the recent, rapid contraction of the cryosphere. In a study on the retreat of glaciers in the other parts of the world this has been seen that all the glaciers across the world receding very fast Examples of ice loss are abundant and welldocumented. Since 1974, investigators at the BPCRC have monitored glaciers in South America, Africa, and Asia. In Tanzania, total surface area of the ice fields on top of Mount Kilimanjaro decreased by 88.3% from 1912 to 2013; however, the rate of retreat has recently accelerated from 2000 to 2013 they decreased by 40%. The three remaining ice fields on its summit and slopes are also losing volume vertically at a rate of 0.5 m/ year. In Papua, New Guinea, several small glaciers exist in the vicinity of Puncak Jaya. From 1850 to 2005, their total surface area decreased from 19.3 km2 to 1.72 km2, representing a 91% loss .From 2000 to 2002 alone, surface area decreased from 2.326 km2 to 2.152 km2, or by 7.48% .The rate of retreat accelerated from 1988 to 2005, even while precipitation (partly as rain) actually increased .When ice contracts in area and thickness, the ice within the glacier can also be affected by melting. Snow pits and cores at the Quelccaya ice cap in southern Peru reveal that since the late 1970s the seasonal oxygen isotopic (d18O) variations have been homogenized by melt water percolating through the top 20 to 30 m of firn. This homogenization compromises the long-term seasonally resolved record of past climate variations. This finding is consistent with analyses of shallow cores throughout the Cordillera Blanca of northern Peru. Radiocarbon dates from wetland plants exposed by the retreating margins of Quelccaya ice demonstrate that, for >~6,300 years, this ice cap has not been smaller than it is today. Rapid retreat of the ice margin continues to expose such evidence. (A. Patrick Burkhart2017) PRESENCE OF VOLCANOES:

A very recent study on the presence of volcanoes under west Antarctica has widened the understanding in the area of enhanced glacial flow in case of their eruptions therefore, raising the sea level. This study also emphasizes on the stabilization of ice sheets on account of volcanic edifices. Volcanic edifices, whether active or not, stand as significant protuberances which may act geometrically as stabilizing influences on ice retreat. Numerical models used to project potential rates of WAIS retreat show that, once initiated, ice retreat will continue unabated as long as the ice bed is smooth and down slopes inland, but that any increase in roughness or obstacle in the bed can act to delay or stem retreat. Authors have identified a number of volcanic edifices sitting within the WAIS' deep basins; these edifices, which are likely to owe their existence to volcanism, could represent some of the most influential pinning points for past and future ice retreat. Looking ahead, the thinning and potential removal of ice cover from the WARS volcanic province could have profound impacts for future volcanic activity across the region. Research in Iceland has shown that with thinning ice cover, magma production has increased at depth as a response to decompression of the underlying mantle .Moreover, there is evidence that, worldwide, volcanism is most frequent in deglaciating regions as the overburden pressure of the ice is first reduced and then removed .Unloading of the WAIS from the WARS therefore offers significant potential to increase partial melting and eruption rates throughout the rifted terrain. Indeed, the concentration of volcanic edifices along the WARS could be construed as evidence that such enhanced volcanic activity was a feature of Quaternary minima. This raises the possibility that in a future of thinning ice cover and glacial unloading over the WARS, sub glacial volcanic activity may increase and this, in turn, may lead to enhanced water production and contribute to further potential ice-dynamical instability (Maxmillan Van Wyk De Vries 2017.)

DISCUSSION:

Before we get into the different aspects of 52 small islands developing states and why they are on the brink of being inundated in the surging sea, let us find out some of the example of island states which are already under sea. We will see the states across the board.

SUNDARBANS, INDIA:

Seas are rising more than twice as fast as the global average here in the Sundarbans, a low-lying delta region of about 102 islands in the Bay of Bengal where some 13 million impoverished Indians and Bangladeshis live. Tens of thousands people have already been left homeless, and scientists predict much of the Sundarbans could be underwater in 15 to 25 years from now. That could force a singularly massive exodus of millions of "climate refugees," creating enormous challenges for India and Bangladesh that neither country has prepared for. If all the people of the Sundarbans have to migrate, this would be the largest-ever migration in the history of mankind. The largest to date occurred during the India-Pakistan partition in 1947, when 10 million people or more migrated from one country to the other. On their own, the Sundarbans' impoverished residents have little chance of moving before catastrophe hits. Facing constant threats from roving tigers and crocodiles, deadly swarms of giant honeybees and poisonous snakes, they struggle to eke out a living by farming, shrimping, fishing and collecting honey from the forests.Each year, with crude tools and bare hands, they build mud embankments to keep saltwater and wild animals from invading their crops and each year swollen rivers, monsoon rains and floods wash many of those banks and mud-packed homes back into the sea. Most of them struggle on far less than Rs 60-75 a day and with 5 million people on the Indian side and 8 million in Bangladesh, the Sundarbans population is far greater than any of the small island nations that also face dire threats from rising sea levels. Losing the 26,000-square-kilometer (10,000-square-mile) region -an area about the size of Haiti - would also take an environmental toll. The geography of the country will change once for all besides the human population of the Sundarbans region is teeming with wildlife, including the world's only population of mangrove forest tigers. The freshwater swamps and their tangles of mangrove forests act as a natural buffer protecting India's West Bengal state and Bangladesh from cyclones. With rising temperatures melting polar ice and expanding oceans, seas have been rising globally at an average rate of about 3 millimeters a year , a rate scientists say is likely to speed up the entire area will be wiped out from the Indian map. The latest projections suggest seas could rise on an average of more than 1 meter (3.3 feet) this century. This would be proper to discuss two islands in sundarbans which have been on the verge of complete annihilation one, is Ghoramara and other is Lohchura. Ghoramara, one of the fertile islands of Sundarban delta in the South of West Bengal in Bay of Bengal, is ready to be gulped by the raging sea sooner than predicted. Two decades ago, the land inhabited by 40,000 people has shrunk and it can now shelter only 3,500 now. The high tides everyday swallow portions of their land from all sides of the island and take them deep into the sea. The inhabitants of the vanishing land run inward on the island for temporary safety so that they can again rebuild their washed away huts after water recedes. Most of them have moved out for fear of being drowned, but those left behind are waiting for help to cross the sea. Those who have money can cross the sea. Those who don't, wait to get drowned. Even if the people get to the mainland, they remain refugees with no homes, no identity and no community. The villagers are simply fighting a lost battle, and they keep on building and rebuilding constantly their huts every time a high wave washes it away as they shift inward but nothing can hold the fury of the river. The sea level is rising as never before and frequent cyclones and storms are increasingly eroding inhabited lands. Residents have nowhere to go except quietly sneak into mainland taking the first ferryboat and look for alternate place of shelters. And nowhere in the country is the impact of sea level rise so blatant. Most of the people from Ghoramara are destined to live as climate refugees in India without even being acknowledged as one. Sundarbans, the large collage of mangrove islands, home to the Royal Bengal Tiger and several rare and endangered animals, is the real face of climate change hitting the country. Many of these islands are disappearing, slowly swallowed by the deep sea and the rising tides. Thousands of inhabitants who live in the Sundarbans have lost their homes in recent decades. In the delta where saltwater from the Bay of Bengal mixes with freshwater from three of India's major rivers, the Ganges, the Brahmaputra and Meghna and water from the distributaries Muri Gonga rises and falls dramatically drowning one third of the land that keeps disappearing and reappearing every day. Lohachura, another nearby island that has been completely gulped by the sea now. The high tide water had entered the village and destroyed crops, broken the bamboo fence and washed away portions of many of the mud houses that had been recently rebuilt at Mandirtola, Kheya Ghat. This isn't unusual. But this has become too frequent to rebuild homes easily on the island. Once, the ferry run by the government every day, that came in with supplies to Kheya Ghat could not reach the banks because of severe turbulence in the region with high silt in the river delta. The island remained water-locked from all sides for the whole of the week. People wait for the high tide in this region so that the ferries can float and come but with high tides come the gush of water that washes away our land every time. The best way to keep a track is through the Hindu calendar. During days of full moon and no moon, the water rises high and recedes equally low making it severely difficult for the residents to cross over to the mainland. In the last three decades, the island has lost 7.6 square kilometers of land. Now it exists in just 3.3 square kilometers. Those who had shifted had found shelter in the nearby Sagar islands about 25 kms away in the sea. People were ferried in boats on several dreadful mornings after the floods to the barren settlement. Kamalpur, Colony, in Sagar islands thus became home to many of the climate-affected migrants from Ghoramara and Lohachura islands. Known as the Ghoramara refugee colony, people have again returned to rebuilding their lives. Fishermen have turned carpenters, boatmen cart pullers. Sea levels in the Sundarbans delta are rising fast; well above the global average. Several small inhabited islands have been completely submerged in the past few decades and Ghoramara is amongst the most vulnerable ones, local residents explain that more than 80 sq. kms , little less than half the size of Kolkata, has submerged in the past three decades in the Sundarbans delta. The causes are complex and besides the natural fury, it can be attributed to human behavior. The predictions for Ghoramara had been there for the last two decades but it has grown severe recently. And one of the most important factors is man-made climate change. This makes not just Ghoramara, but the nearby mainland and cities equally susceptible and vulnerable to rising temperature and sea level. In a field research on sea level rise and submergence of Sundarbans the author has analyzed that sundarban is a fragile ecosystem which has a total area of about 9630 sq. km., out of which the Reserved Forest occupies nearly 4260 sq. km. At present, out of 102 islands of the Indian Sundarban region, 54 are inhabitated with a population of about 4.2 million (2011 census) and the rest of 48 islands are Reserved Forest with mangrove vegetation. The Sundarban mangrove ecosystem in the deltaic complex of the Rivers Ganga, Brahmaputra and Meghna is shared between Bangladesh (62%) and India (38%) and is the world's largest coastal wetland. The study showed that while a few islands were undergoing gradual erosion but it also revealed continuous emergence of a few more new islands. The present study has tried to establish that other factors like destruction of mangrove vegetation, sediment deposition, natural subsidence and lack of fresh water flow can have more impact on the dynamics of Sundarban islands than the single factor of sea level rise (A.K.Raha 2014)

THE FIVE ISLANDS OF PACIFIC HAS VANISHED INTO THE SEA:

A study was carried out on the Solomon islands taking Interactions between sea-level rise and wave exposure on reef island dynamics and it was revealed that Solomon Islands in the Western Pacific comprise over 1000 predominantly volcanic islands, many reaching over 500m elevation. The human population of 56,0 000 is spread across 28 ,000 km2 making it amongst the most sparsely populated of Pacific Island nations. Despite this low population density, the majority of human settlements are located in low-lying coastal areas, and reef islands are becoming increasingly densely populated due to restricted flat land adjacent to the coast. Rates of sea-level rise in the Solomon Islands over the past two decades are amongst the highest globally, averaging 3mmyr−1 since 1950 and 7–10mmyr−1 since 1994 (Simon Albert 2016). Further, the author having used time series aerial and satellite imagery from 1947 to 2014 of 33 islands, along with historical insight from local knowledge, identified five vegetated reef islands that have vanished over this time period and a further six islands experiencing severe shoreline recession. Shoreline recession at two sites has destroyed villages that have existed since at least 1935, leading to community relocations. Rates of shoreline recession are substantially higher in areas exposed to high wave energy, indicating a synergistic interaction between sea-level rise and waves. The following table shows how the top five islands have been inundated into the ocean on account of sea level rise and others are at the brink of being sunken into the water.

TABLE-4 ISLAND AREA AND LOSS OVER TIME

SITE	ISLAND AREA IN SQUARE METER						
	1947	1962	2002	2011	2014	AREA LOST SINCE	OVERALL LOSS IN %age
KALE	48890	43070	12572	509	00	48890	100
RAPITA	45700	21250	00	00	00	45700	100
REHANA	38330	21800	00	00	00	38330	100
KAKATINA	15150	3580	ND	00	00	15150	100
ZOLLIES	12240	4980	00	00	00	12240	100
HETAHETA	251700	239380	ND	104300	95910	155790	62
SOGOMOU	203250	199670	122070	98210	92320	110930	55
NUATAMBU	28660	30080	ND	20520	13980	14680	51
SOGOMOU ITE	139660	132950	115970	ND	107300	32360	23
SASAHURA-ITE	47040	48320	40010	36670	36130	10910	23
SASAHURA-EA	162770	174780	152960	135860	130040	32730	20

SOURCE :(Simon Albert 2016).

THE NINE MOST ENDANGERED ISLANDS IN THE WORLD:

Specifically, the Intergovernmental Panel on Climate Change listed the "Marshall Islands, Kiribati, Tuvalu, Tonga, the Federated States of Micronesia and the Cook Islands (in the Pacific Ocean); Antigua and Nevis (in the Caribbean Sea); and the Maldives (in the Indian Ocean)," as the most vulnerable nations to the effects of climate change. The United Nations Framework Convention on Climate Change agreement in Paris said that countries "recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change" and provided a framework for governments to begin reducing greenhouse gases. However, there continues to be debate over who will pay the costs sustained by island nations. Here it is important to note that the Paris agreement doesn't set any binding reparations for international climate aid, it only stated that such details must be ironed out by 2025. The leaders of a multilateral meeting with island nation leaders in December emphasized the need of climate change in SIDS as they said that, "some of the SIDS could disappear entirely, and as weather patterns change, we might deal with tens of millions of climate refugees in the Asia-Pacific region." If rising sea level trends continue, many residents of these island nations plan to flee to neighboring countries, creating a subsequent refugee crisis for which many governments remain woefully underprepared.

1. Marshall Islands

Located halfway between Hawaii and Australia, the Marshall Islands (population 70,000+) are already being negatively impacted by sea level rise. Most of the islands that make up the island nation "are less than six feet above sea level." Islanders are regularly experiencing monthly tidal flooding that residents envision will make the country "unfit for human habitation within the coming decades."

2. Kiribati

The 103,000 citizens of Kiribati risk homelessness if the rising tides can't be reversed. "Atolls are very small islands, barely two meters above sea level. And so, unlike most countries, if the sea level rises, we don't have anywhere to move back toward, we don't have any high ground to move toward. And so we're so vulnerable," Kiribati president Anote Tong told. He further added that ". Most recently, the government of Kiribati, has looked for help from the United Arab Emirates to construct artificial islands as part of its climate adaptation plan.

3. Tuvalu

Tiny Tuvalu located in the South Pacific has long anticipated sinking into the ocean. Scientists currently predict the island will become unlivable within 50 years. In 2002, the country threatened to sue Australia and the United States for their failure to act on climate change. In the years since, they've pivoted from litigious action to focusing their efforts on adaptation and getting other countries to lower their greenhouse gas emissions.

4. Tonga

Situated in the South Pacific Ocean, the majority of the residents of Tonga (population 90,000), live on the coastline, which makes their population seriously vulnerable to even slight increases in sea level rise. Samoa, Fiji and New Zealand were the nearest countries to the sinking island, but none of them would be

a "viable" alternative to his native land so the question arises where would the local residents go? The sheer thought of landlessness make them refugees and without identifications.

5. Federated States of Micronesia

The nation of the Federated States of Micronesia, comprised of 607 low-lying coral atolls in the Pacific Ocean, faces extreme climate hazards in the years to come. It has adopted some of the strongest legislation in Oceania to fight global warming, "making it compulsory for state sectors, including those responsible for the environment, disaster management, transportation, infrastructure, health, education and finance, to mainstream climate adaptation in all policies and action plans." Micronesia president Peter Christian recently told the General Assembly of the United Nations that "stronger ocean currents and more frequent typhoons, continued to wash away shorelines and topple trees."

6. Cook Islands

The Cook Islands are a chain of 15 small islands situated on the northeast coast of New Zealand and have been increasingly worried about their threatened existence. The Pacific Regional Environment Program has assisted the nation in "improving (its) sea walls and drainage system," but shifting weather patterns and severe weather continue to plague the beleaguered nation.

7. Antigua

The popular Caribbean country Antigua is at severe risk from climate change impacts. The UN has estimated that if oceans rise at least one meter, islands like Antigua in the Caribbean will sustain

149 multi-million dollar tourism resorts damaged or lost from coastal flooding fueled by sea level rise. Even more of an increase would significantly impact sea ports, airports and even threaten critical wildlife habitats.

8. Nevis

Located in the West Indies, the island nation of St. Kitts and Nevis has shrunk by over a quarter in sizes. According to Government statistics the island state has suffered the greatest percentage of land area lost since 1961. With an already depleted coast, flooding from tropical storms remains a serious concern for Nevis in the short term. The country has been actively working on adaptation strategies in anticipation of severe weather and significant coastal flooding.

9. Maldives

Time is running out for the Maldives, an archipelago of 1,190 islands located in the Indian Ocean. With even a slight rise in global sea levels, the country will become submerged. With climate change very much on the minds of its leaders, the country pledged to go to carbon neutral in 2009. The government of Maldives has been actively looking for future places to move their 300,000 inhabitants, including "India, Sri Lanka and Australia as possible destinations.

FRENCH ISLANDS

In one of the study on Potential impact of sea level rise on French islands worldwide, author investigated the potential consequences of sea level rise for 1,269 French islands worldwide, by assessing the total number of island that will be totally submerged for three different scenarios (1, 2 and 3 m). Author calculated the number of islands entirely submerged under three different scenarios of sea level rise (~1, ~2 and ~3 m) and two projections homogeneous and heterogeneous. The results indicated that about 5% of islands would be entirely submerged with a globally uniform sea level rise of 1 m and this corresponds potentially to 64 French islands that will be vulnerable to an increase of sea level by 1 meter. The uniform increase of sea level by 3 m will drown about 11% of islands (i.e., 145 islands). Using a spatially heterogeneous sea level rise scenario, showed greater losses ranging from 6% to 12% of submerged islands for scenarios of ~1 and ~3 m, respectively and this last result correspond potentially to 83 and 156 islands that will be at risk of submersion in the future. Globally, the number of islands potentially vulnerable to sea level rise was slightly more important for heterogeneous scenarios, whereas results using homogeneous scenarios were lower. However, for all projections considered, the regions with the most important number of islands potentially threatened were New Caledonia (>30% of the total islands entirely submerged were located in New Caledonia), French Polynesia (>30%) and the Mediterranean (10%), although many islands will also be submerged in other regions such as Caribbean islands, Madagascar and Guyana Consequently, rising sea would potentially threaten a considerable part of French insular biodiversity, especially in New Caledonian region. Considering that at least 5% of the number of islands will be entirely submerged under an increase of sea level by 1 meter, many plants will be endangered by an increase of sea level as well as other species located in these islands. In addition, other islands that are not under French jurisdiction but that are located in these regions could be highly vulnerable to sea level rise, and the potential losses of insular habitat could be very similar at the world scale (Celine Bellard 2013).

FURTHER CLIMATE CHANGE IS INEVITABLE:

Regardless of future emissions, the world is already committed to further warming, largely due to past emissions and inertia in the climate system. Globally, most greenhouse gas emissions due to human activities have come from few countries. It has long been recognized that greenhouse gas emissions from small islands are negligible in relation to global emissions. But as total emissions since 1970 have continued to rise, and emissions between 2000 and 2010 have been the highest yet, the threats of climate change and sea level rise to small islands are very real. The IPCC warns that if global society continues to emit greenhouse gases at current rates, the average global temperature could rise by 2.6–4.8°C by 2100, according to the IPCC's highest emissions scenario. Whether global society continues to emit greenhouse gases at today's rate, or cuts greenhouse gas emissions sharply now, does not make a big difference in terms of climate impacts in the next few decades (IPCC fifth report 2014). The carbon emission worldwide has also been very interesting in a way that 2015 was very important year from the Paris Climate Change treaty point of view and also with the fact that USA under former president had endorsed it. The year 2015 was also historic year for some other reasons first, 2015 was the hottest year since records began in 1880. Moreover, the 16 warmest years recorded are in the 1998-2015 period. Second, top emitter China started to curb its carbon dioxide (CO2) emissions in 2015. China and the United States reduced their emissions by 0.7% and 2.6%, respectively, compared to 2014. Emissions in the Russian Federation and Japan also decreased, by 3.4% and 2.2%, respectively. However, these decreases were counterbalanced by increases in India of 5.1%, in the European Union, where emissions increased by 1.3%, and by increased emissions in a large group of the smallest countries. Third, 2015 closed with the adoption of the landmark Paris Agreement on Climate Change by 194 countries and the European Union. As a result of these changes in national emission totals, global CO2 emissions from fossil fuel combustion, cement production and other processes decreased in 2015 by 0.1%. Taking into account the uncertainty in the trend we conclude that, in 2015, global CO2 emissions for these sources stalled. This conclusion confirms that the slowdown in the growth in global CO2 emissions from fossil fuel combustion in the last years was not random, but due to structural changes in the economy, global energy efficiency improvements and in the energy mix of key world players(TRENDS IN GLOBAL CO2 EMISSIONS 2016 Report) On the contrary the SIDS are vulnerable countries to climate change as a small rise in temperature may doom the very existence of these small island states. The SIDS have a very specific demographic distribution with populations, agricultural lands and infrastructures tending to be confined in the coastal zone, therefore, any rise in sea level will have significant and profound negative effects on settlements, living conditions and island economies in particular. These climate characteristics, combined with their particular socioeconomic situations make SIDS, among which are 9 least developed countries (LDCs), and they are most fragile in economy and ecology. Their total population is somewhere around 65 million and contributing to less than 1% of global GHG emissions. What does it mean? This means that they are suffering not because of their need but because of our greed, dominance in economy and having followed a very unsustainable growth for decades the developed and emerging markets of the world have put the lives of entire 65 million people in peril.America under new administration has walked out of Paris Climate treaty and relied on coal for power generation and it is understandable to certain extent that the new USA administration tried to address its constituencies to provide them more jobs and money despite realizing fully well that what will be its impact on the GHG emission across the world. Their emphasis was on " Adding $3.3 trillion in stock market value to our economy, and more than a million private sector jobs".

COAL CONSUMPTION IN POST PARIS CLIMATE ACCORD:

If we analyze the post Paris climate treaty the coal consumption by the three big players are different. The US, China and India combined produce about two-thirds of the coal mined worldwide, and the latter two nations also import coal to meet demand. India's production expanded even during coal's global downturn. China, the United States and India have boosted coal mining in 2017, in an abrupt departure from last year's record global decline for the heavily polluting fuel and a setback to efforts to rein in climate change emissions. Mining data show that production through May is up by at least 121 million tons, or 6 per cent, for the three countries compared to the same period last year. The change is most dramatic in the US, where coal mining rose 19 per cent in the first five months of the year, according to US Department of Energy data. Coal's fortunes had appeared to hit a new low less than two weeks ago, when British energy company BP(2017) reported that tonnage mined worldwide fell 6.5 per cent in 2016, the largest drop on record. China and the US accounted for almost all the decline, while India showed a slight increase. The reasons for this year's turnaround include policy shifts in China, changes in US energy markets and India's continued push to provide electricity to more of its poor, industry the fuel's popularity waned over the past several years as renewable power and natural gas made gains and China moved to curb dangerous levels of urban smog from burning coal. Whether coal's comeback proves lasting has a significant implication for long-term emission reduction targets, and a glimmer hope that China and India could emerge as leaders in battling climate change. While the US reversal is expected to prove temporary, analysts agree that India's use of coal will continue to grow. Industry representatives say the mining resurgence underscores coal's continued importance in power generation. If we look at those three countries, everyone else is irrelevant in the scheme of things. Burning coal for power, manufacturing and heat is a primary source of the carbon dioxide emissions. Reducing such emissions was a critical piece of the 2015 Paris climate accord that Americans announced this month to exit. Almost every other nation continues to support the deal, including China and India. China, India and the US produce almost half of global greenhouse gas emissions. Coal accounts for almost half of greenhouse emissions from burning fossil fuels, according to the Global Carbon Project (2014). China is by far the world's largest coal user, consuming half the global supply. China has committed to capping its greenhouse gas emissions by 2030 but the way they are going is more than enough reason to make us believe that the future of SIDS is very precarious or else the only option left is stop completely the coal consumption by the Asian countries and America but they will not do it under any circumstances. China's production rose more than 4 per cent through May, according to government figures, compared to a drop of more than 8 per cent for the same period a year earlier. Hundreds of mines shut down in China last year and the government forced others to cut back hours in a bid to reduce an oversupply of coal and boost prices. The government has since relaxed that policy and production is rebounding. Also, as China continues to recover from a 2015 economic slowdown, it's seeing increased manufacturing and new investments in roads, bridges and other projects. That creates more demand for electricity, most of which continues to come from coal even after huge Chinese investments in wind and solar power. Despite the announced cancellation or suspension of 100 coal plants, others remain under construction, meaning consumption of coal for power will continue to rise, Zhou said. Indonesia, Malaysia, Vietnam and Pakistan also are building new plants. In India, where 70 per cent of electricity comes from coal, production has long been increasing in defiance of global trends. The country has long argued it has both a right and an obligation to expand power generation as it extends electricity access to hundreds of millions of people who still have none. India also is seeking to reduce its reliance on imported coal by mining more of its own reserves. It has been found that mining among state-owned companies, which comprise the overwhelming majority of the nation's production, grew 4 per cent in the first five months of this year. The other economic parameters of our country have been so week that investment in renewable energy (RE) has become a tough proposition altogether. Government of India held a first RE-invest mega event in 2015 having invited all big national and international players in the field of RE and many of them had promised to establish huge electricity generation capacity by 2022 but many of them are not anywhere close to their call. This would be proper to cite a few examples, American major in RE Sun

Edison promised to establish 15,200 MW capacities by 2022 but it sold out its Indian assets to another company to pay down its huge debt. Another example is of Welspun Renewable Energy which promised to establish 11,001 MW capacities installation by 2022 but this also sold out its properties in the year 2016 to Tata Power as they were not able to cope with the market and policies. The third example is of Essel Infraprojects which had promised to establish 12,000 MW capacities installation by 2022 but till date the company has been able to establish only 650 MW capacities only. Hindustan Clean Energy is the fourth example which had promised to establish 10,000 MW but could establish only 600MW till today. The entire issue could seen in the light of the narrative of what happened in the first edition of global RE-invest meet held in Delhi where against the government's target of 1.75 lakh MW, participants committed 2.75 lakh MW of RE generation in the country. The question arises when the tax is lowered on coal from 8% to 5% in the GST landscape and government of India enhances coal production then where does RE stand a chance in its economics and why should we worry for Sundarbans islands being submerged on account of sea level rise. The government of India is not able to find sponsor for second edition of RE-invest meet proposed in December 2017. Manufacturing in India has not grown as quickly as hoped, and though transmission is steadily expanding to reach more households, 260 million Indians are still off-grid. As a result, the country's power plants are running at below 60 per cent of capacity on average, down from 2009, when India was using 75 per cent of its capacity In the US, the bulk of the increase occurred in major coal-producing states including Wyoming, Pennsylvania and West Virginia. Prices for natural gas, a competing fuel in power generation, edged up in early 2017, helping coal. China now has more renewable energy than any other nation. Its Communist Party leaders have vowed to invest $360 billion in the sector through 2020

LOSS OF BIODIVERSITY IN SMALL ISLANDS DEVELOPING STATES:

The biological diversity and the high degree of endemism of many species on Small Island developing States are well known. Over 4, 00 species of plants and animals are endemic to Small Island developing States SIDS. Because of their small size and the endemic nature of many species, the biological diversity of Small Island developing States is extremely fragile. One consequence of the relative isolation of Small Island developing States is the large incidence of unique biological adaptations and that is, flightlesseness in birds, gigantism and dwarfism in other groups, and many modifications of form, diet and behavior. Restrictive habitats and small populations often generate unique features and adaptations to prevailing environmental and climatic conditions, but under such circumstances species often lack the ability to adapt to rapid changes.

Small island developing States are not a homogeneous group, although many of them face similar problems with respect to the conservation and management of their natural resources. Deforestation and forest degradation in Small Island developing States have led to extinction of many animal and plants species, resulting in irreversible losses of genetic resources and ecosystems. Considering their limited land area and their relative fragility, strong winds (e.g., hurricanes, cyclones, typhoons) can cause serious and frequently recurring damage to natural and planted forests. The impacts of human activities are usually even more severe. Deforestation and forest degradation have affected the dynamic interactions of ocean, coral reefs, land formations and vegetation. The following table provides opportunities to find out how the flora and fauna have become vulnerable to climate change in SIDS

SUMMARY OF THE STATUS OF ANIMALS AND PLANTS SPECIES (threatened, extinct And endemic)

(A) ISLANDS IN CARIBBEAN SEA

COUNTRY OR AREA	ANIMALS			PLANTS		
	THREAT	EXTINCT	ENDEMIC	THREAT	EXTINCT	ENDEMIC
ANTIGUA AND BARBUDA	06		04	03		01
ARUBA	05	-	02	-	-	-
BAHAMAS	14	02	22	26	-	71
BARBADOS	03	01	03	03	-	02
CUBA	38	06	150	837	25	952
DOMINICA	06	-	04	059	-	097
DOMINICAN REPUBLIC	33	07	37	71	-	54
GRENEDA	05	-	02	05	-	04
HAITI	28	08	46	27	01	26
JAMICA	29	02	72	376	02	382
NETHERLANDS ANTILLES	08	-	04	-	-	03
ST.KITTS AND NEVIS	05	-	-	03	-	-
ST.LUCIA	09	01	09	09	-	03
ST.VINCENT AND THE GRENADINES	05	01	06	08	-	04
TRINIDAD AND TOBAGO	10	-	06	16	-	27
US VIRGIN ISLANDS	06	01	04	06	01	04
SUB TOTAL OFCARIBBEAN ISLANDS	210	29	371	1449	29	1630

(B) ISLANDS IN PACIFIC OCEAN

COUNTRY OR AREA	ANIMALS			PLANTS		
	THREAT	EXTINCT	ENDEMIC	THREAT	EXTINCT	ENDEMIC
AMERICAN SAMOA	13	01	-	08	-	08
COOK ISLANDS	08	14	07	19	-	12
FEDERATED STATES OF	70	03	22	03	-	90
FIJI	22	-	40	30	01	277
KIRBATI	07	-	01	-	-	-
MARSHALL ISLANDS	09	-	-	-	-	-

NAURU	01	-	01	-	-	-
NIUE	01	-	-	-	-	-
NORTHERN MARIANAS	24	-	02	07	-	12
PALAU(BELAU	70	01	12	-	-	-
PAPUA NEWGUINEA	94	02	323	93	-	419
SAMOA	10	01	09	20	-	67
SOLOMON ISLANDS	39	03	81	43	-	37
TOKELAU	04	-	-	-	-	01
TONGA	10	01	03	-	-	03
TUVALU	08	-	-	-	-	-
VANUATU	15	-	15	25	-	24
SUB TOTAL OF PACIFIC	405	26	516	239	1	935

(C) ISLANDS IN ATLANTIC OCEANS

COUNTRY OR AREA	ANIMALS			PLANTS		
	THREAT	EXTINCT	ENDEMIC	THREAT	EXTINCT	ENDEMIC
CAPE VERDE	07	01	13	01	-	114
SAO TOME	15	-	42	01	-	123
SUB TOTAL OF ATLANTIC ISLANDS	22	01	55	02	-	237
(D) ISLANDS IN INDIAN OCEANS						
BAHRAIN	06	-	-	-	-	-
COMOROS	16	-	21	03	-	04
MALDIVES	05	-	-	-	-	-
MAURITIUS AND RODRGUEZ	37	46	19	255	43	289
SEYCHELLES	22	02	38	80	02	78
SINGAPORE	21	-	01	14	01	16
SUB TOTAL OF INDIAN OCEAN	107	48	79	352	46	387
(E) ISLANDS IN MEDITERRANEAN SEA						
CYPRUS	10	-	04	49	-	131
MALTA	10	-	-	15	01	24
SUB TOTAL OF MEDITERRANEAN	20	-	04	64	01	155
GRAND TOTAL OF ALL	764	104	1025	2106	77	3362

SOURCE: UNEP REPORT ON BIODIVERSITY OF SIDS (1998)

CONCLUSION:

The climate change is inevitable and doom of small island states is also a matter of time. The evidence is clear that climate change already poses an existential risk to global stability and to human civilization that requires an emergency response. Temperature rises that are now in prospect could reduce the global human population by 80% or 90%. But this conversation is taboo, and the few who speak out are admonished as being overly alarmist. It has been considered that "a 4°C future [relative to pre-industrial levels] is incompatible with an organized global community, is likely to be beyond 'adaptation', is devastating to the majority of ecosystems, and has a high probability of not being stable" (Anderson 2016). He says: "If you have got a population of nine billion by 2050 and you hit 4°C, 5°C or 6°C, you might have half a billion people surviving". Asked at a 2011 conference in Melbourne about the difference between a 2°C world and a 4°C world, Prof. Hans Joachim Schellnhuber replied in two words: "Human civilization". The World Bank reports: "There is no certainty that adaptation to a 4°C world is possible" (World Bank 2012). Amongst other impacts, a 4°C warming would trigger the loss of both polar ice caps, eventually resulting, at equilibrium, in a 70-metre rise in sea level. The present path of greenhouse gas emissions commits us to a 4–5°C temperature increase relative to pre-industrial .levels. Even at 3°C of warming we could face "outright chaos" and "nuclear war is possible", according to the 2007 Age of Consequences report by two US think tanks (see page 10). Yet this is the world we are now entering. The Paris climate agreement voluntary emission reduction commitments, if implemented, would result in the planet warming by 3°C, with a 50% chance of exceeding that amount. The present path of greenhouse gas emissions commits us to a 4–5°C temperature increase relative to pre-industrial levels. Even at 3°C of warming we could face "outright chaos" and "nuclear war is possible", according to the 2007 Age of Consequences report by two US think tanks . Yet this is the world we are now entering. The Paris climate agreement voluntary emission reduction commitments, if implemented, would result in the planet warming by 3°C, with a 50% chance of exceeding that amount. This does not take into account "longer-term" carbon-cycle feedbacks such as permafrost thaw and declining efficiency of ocean and terrestrial carbon sinks, which are now becoming relevant. If these are considered, the Paris emissions path has more than a 50% chance of exceeding 4°C warming. (Technically, accounting for these feedbacks means using a higher figure for the system's "climate sensitivity" – which is a measure of the temperature increase resulting from a doubling of the level of greenhouse gases – to calculate the warming. A median figure often used for climate sensitivity is ~3°C, but research from MIT shows that with a higher climate sensitivity figure of 4.5°C, which would account for feedbacks, the Paris path would lead to around 5°C of warming

(Reilly et al. 2015). So we are looking at a greater than one-in-two chance of either annihilating intelligent life, or permanently and drastically curtailing its potential development. Clearly these end-of-civilization scenarios are not being considered even by risk-conscious leaders in politics and business, which is an epic failure of imagination. The world hopes to do a great deal better than Paris, but it may do far worse. A recent survey of 656 participants involved in international climate policy-making showed only half considered the Paris climate negotiations were useful, and 70% did not expect that the majority of countries would fulfill their promises (Dannenberg et al. 2017). Human civilization faces unacceptably high chances of being brought undone by climate change's existential risks yet, extraordinarily, this conversation is rarely heard. The Global Challenges Foundation (GCF) says that despite scientific evidence that risks associated with tipping points "increase disproportionately as temperature increases from 1°C to 2°C, and become high above 3°C", political negotiations have consistently disregarded the high-end scenarios that could lead to abrupt or irreversible climate change. In its Global Catastrophic Risks 2017 report, it concludes that "the world is currently completely unprepared to envisage, and even less deal with, the consequences of catastrophic climate change"

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