Need for Development of Adaptive Geostrategies to Address Climate-change: An Indian and an Israeli Perspective

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Abstract

The issue of climate change continues to hog the lime-light. Even though there is no unanimity in the scientific community about the rate at which climate change is actually occurring, there is no doubt that climate change is actually happening as we speak. Currently, climate change is confined to the field of climatology/ meteorology alone, however, it has implications in many other processes, some of which are natural and some man-made. As the Earth warms up due to climate change, it is resulting in events such as melting of ice. This in return is resulting in the rise of sea levels, droughts, floods, etc. What is however not known is just how much and how fast will climate change affect the planet. This thus, is disallowing accurate prediction of the associated changes. What is known for certain is the fact that the resulting climate change has a direct bearing on issues of *human health, water, food, economy, infrastructure and security* of nations and its people. The resulting security risks pose a multifaceted obstacle that does not fit neatly for many countries into any particular department portfolio and hence is not solvable by one country alone. This necessarily means that a cooperative mechanism between countries needs to be established that would allow some radical steps to be taken to counter the threats being posed by climate change.

The article aims to look at the climate change issues that affect the world in general and the Indian Ocean and the Israeli region in particular. It further aims to look at how these changes affect the geopolitics of the neighboring countries of the region and what geostrategies need to be implemented by India and Israel to ensure the well-being of its people. The article would further explore common areas where collaborative mechanism between India and Israel can be established.

Keywords: Climate-change; geopolitics; geostrategy; security; collaboration.

Introduction

In the recent years, there has been an increased discussion on climate change. While scientific facts have made enormous progress in increasing our understanding of climate change, and how it has changed the weather of a place, there are others, like President Donald Trump, who believes that "*The concept of global warming is a hoax and has been created by and for the Chinese in order to make U.S. manufacturing non-competitive.*"[1]

So, which one of them is right? What is this climate change and what does it have to do with the weather of the place where we live in? To understand this better, let us first develop our understanding of scientific facts as "*facts are stubborn things; and whatever may be our wishes, our*

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1 Donald Trump's Tweet at 12:45 AM on 07 November 2012. Quartz Digital News Outlet, New York, USA. https://qz.com/948182/scary-and-laughing-at-us-donald-trumps-thinking-on-china-is-remarkably-consistent-across-five-years-and-more-than-300-tweets

inclinations, or the dictates of our passions, they cannot alter the state of facts and evidence" (Adams, 1770).

To develop the requisite understanding, three definitions are considered important. First, the *weather*, which is nature's way of balancing the forces of precipitation, clouds, winds, humidity, temperature, etc. in the atmosphere. Second, *climate*, which is the statistics about the weather and is usually the average weather pattern over a long period of time, say 100 years, and finally, *climate change*, which is the significant change in the statistics of weather patterns, glaciers, sea level rise over years, decades, or even centuries, say 100,000 years.

In recent years, enormous knowledge and understanding has been developed about climate change and its causes. This has provided humanity a clearer picture of the current and future impacts and of the possible actions necessary to limit the magnitude of climate change and allow adapting to its impacts. However, since these changes are expected to continue, it is definite that in many respects the climate of the future will be different from the climate of the past. Similarly, another accepted fact is that climate change is capable of creating a stress on the economic, social, and political system of a nation state. When the institutions and governments of these States are unable to absorb the applied stress, these States and societies would face a long term security risk both internal and external that would eventually have an impact on the overall stability of the world (DoD, 2014).

This has thus allowed various nation-states to move on from the traditional view of military security to a far more holistic approach of maritime security, which is defined as freedom from threats arising in – or from – or through the sea.[2] These threats could be due to causes that may be natural, man-made, or interplay of one with the other. Sometimes when these threats address the regional fabric itself, nation-states find themselves increasingly enmeshed in a complex web of regionally focused security interdependence, with a robust regional initiative as a logical outcome (Chauhan, 2018).

Since *military* maritime security incorporates an interlinked military, political, economic, societal and environmental dimension of security, none of them can be adequately addressed in isolation. Thus, threats to human-security, such as religious extremism; international terrorism; drug and arms smuggling; demographic shifts — whether caused by migration or by other factors; human trafficking; environmental degradation; energy, food and water shortages; all now figure prominently as threats that are inseparable from military ones (Chauhan, 2018), and are all as a direct result of climate-change. Ironically, despite their utter pervasiveness across both space and time, the security-impacts of climate-change are amongst the least studied in most nation-states including India. Consequently, genuine mitigating and/ or coping strategies are either absent in their entirety, or are hopelessly inadequate.

It is with this understanding that this article aims to look at the issues of climate change that affect the world in general and the Indian Ocean and the Israeli region in particular. It further aims to look at how each of these affects the geopolitics of the countries in the region and what geostrategies need to be implemented by India and Israel to ensure the well-being of its people. The article will further explore common areas where collaborative mechanism between India and Israel can be established.

Background

Of all the issues on the global political agenda, global warming and the associated, climate change, are topics that do not require an introduction because they are so well-known (Halden, 2007). Climate change has always happened on Earth, which is clearly seen in the geological records of the Earth. However, it is the rapid rate and the magnitude of these changes occurring presently, which are of great concern worldwide (Loehle, 2004). The Intergovernmental Panel on Climate Change (IPCC) report of 2013 (IPCC-Sum, 2013) shows that global warming has been accelerated by anthropogenic activities, and is likely to have massive impacts by altering the basic conditions of life on Earth (Behnassi & Ibn, 2013). There is a growing understanding that, among other things, the international legal system, access to essential resources and the integrity of critical infrastructure are all at risk. Hence, like all global problems, the climate-change-related issue will need global solutions (Paskal & House, 2007). Today, the understanding and effect of climate change varies according to the existing economic, political and social structures of a nation in different world regions (Halden, 2007). One of the main misconceptions is regarding the use of the term 'climate change' when in fact it means 'environmental change'. This

2 Address by Dr Manmohan Singh, erstwhile Prime Minister of India, inaugurating the Indian Ocean Naval Symposium (IONS), Seminar at New Delhi, 14 February, 2008. http://archivepmo.nic.in/drmanmohansingh/speech-details.php?nodeid=633

complexity is due to the fact that the detection of changes in such a complex phenomenon is far from easy to analyze. This is because of the need for necessary averaging and adjustment of various data sources (Loehle, 2004). However, environmental geostrategies are being evolved due to climate change as they appear to be the new way a growing number of governments and non-state actors are starting to adapt to its complex consequences (Behnassi & Ibn, 2013).

It is now an accepted fact that economic and socio-political interactions between countries can have major impacts on transboundary conservation decisions and outcomes. Hence, successful transboundary collaboration in the field of climate change depends on meeting different environmental objectives and enhancing the economic ties and necessary political cooperation and will between nations (Levin, Beger, Maina, McClanahan & Kark, 2018). But, there are roadblocks to finding effective answers. For example, as the result of a long-standing trust deficit, many leaders in the developing world are suspicious when the West pushes for global emission cuts. Some see it as hypocritical, and a way to impede growing economies. Furthermore, some partners in the West are less willing than others to look at solutions (Paskal & House, 2007).

Climate change is part of today's reality (see Figure 1). During the 21st century, significant changes are expected in the climate around the world. The Earth's temperature has risen by an average of 0.6-0.3^{o}C since 1860 and is expected to rise by another 1.8^{o}C by 2100 (IPCC-SR, 2013). Changes of such nature lead to significant harm to flora, fauna, and live-stock including human beings. Today, there is a global consensus that climate change is indeed taking place, it is man-made and its effect on individual regions will vary over time and with the ability of different societal and environmental systems to mitigate or adapt to change. It is pertinent to mention that global economic loss due to an increase in temperature of 4^{o}C is estimated at approximately 5 percent of the world's annual GDP, while the economic cost of reducing GHG emissions is currently about 1 percent of the global annual GDP. However, this cost is expected to increase over time if disregard for the environment continues as usual either by both 'natural' and 'anthropogenic' (human-induced) factors.

As the human population and disregard push the boundaries of the carrying capacity of the planet, as seen in Figure 2, a small degree of environmental variation has larger implications (Paskal & House, 2007) resulting in significant exacerbation of the existing problems. It is understood that climate change is unlikely to lead to an increase in conflicts in the short- to medium-term, but, a long-term development marked by unmitigated climate change could very well have serious consequences for international security (Halden, 2007).

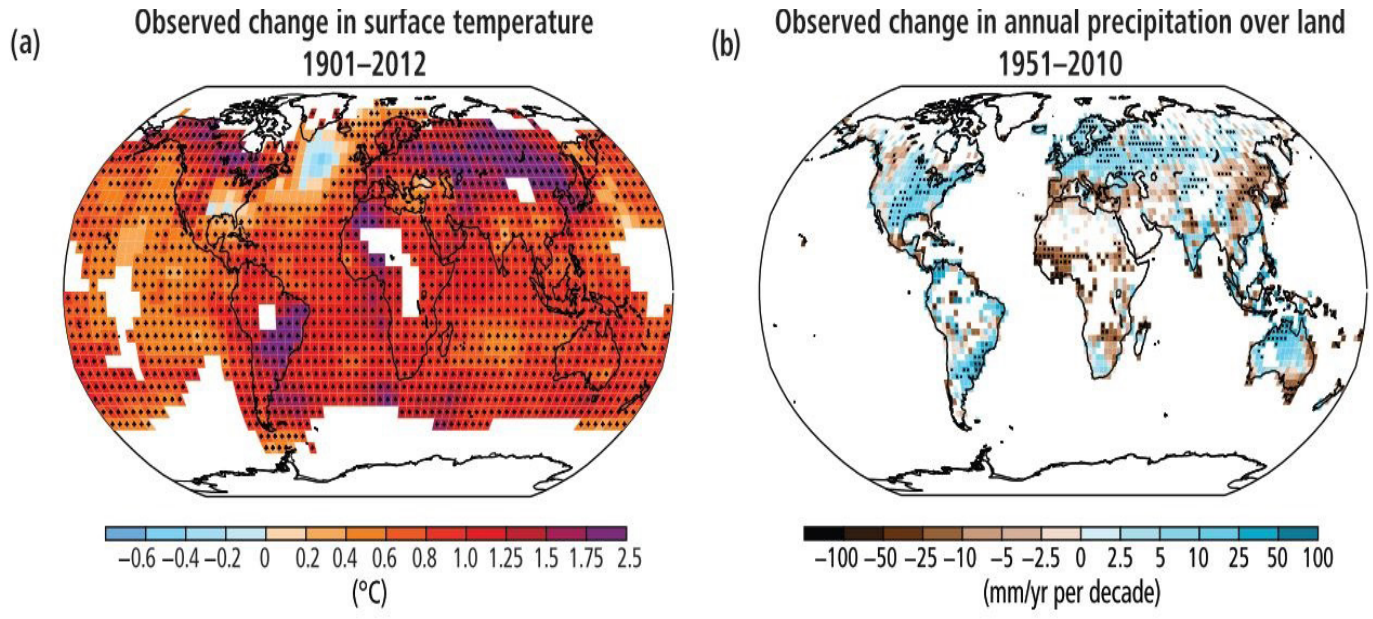

Figure 1: (a) Map of the observed surface temperature change, from 1901 to 2012; (b) Map of observed precipitation change, from 1951 to 2010 (IPCC, 2014).

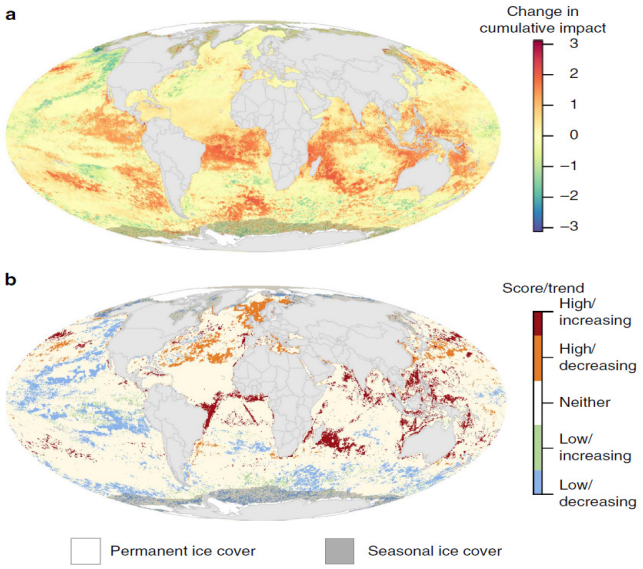

Figure 2: Change in cumulative human impact on marine ecosystems. (a) Change in human impact between 2008-2013 based on 12 anthropogenic stressors; (b) Combinations of cumulative impact and impact trend (Halpern, 2015).

Understanding geopolitics and geostrategy

With global climatic changes, a growing number of governments and non-state actors are beginning to adapt to the complex consequences of climate change. As a result, new approaches are being developed that focus on strategic thinking and an understanding of how climate change is resulting in tensions, armed conflicts, etc. However, many countries do not have a national maritime strategy based on scientific conclusions about climate change and its impacts on nations and states. Since climate change occurs 'fast' and in some cases are unpredictable, they alter the balance and 'order of things' on which the security of nations is based. Today, such changes have taken a dimension of being a powerful strategic force that needs to be fully understood. This in return is strongly influenced by international relations, future conflicts, and wars, etc. needing one to understand how and when new tensions and armed conflicts can arise through the convergence of environmental, social, political, and economic tensions. For example, an enhanced interest in the strategic implications of water scarcity in the Eastern Mediterranean may initiate the next 'battle for resource' in the coming years and start a new 'all resources race' in the region.

It is hence essential, before delving into the details of the adaptive geostrategies to address climate change, that we clearly understand the terms 'geopolitics' and 'geostrategy' and their relations with each other.

To understand these terms, it is essential to understand that the holistic-security of a nation is a function of two main features. The first comprises the policies, strategies, organizational structures, and the delivery-mechanisms that guide and shape her internal politics and determine her internal stability as a coherent *geopolitical* entity. The second feature consists of elements that define and shape the nation's interaction and interface with external structures — supranational and international organizations, nation-states, and, non-State entities, any of which may, at given points in time, be either supportive or inimical to a nation's geopolitical endeavors. Such geopolitical endeavors are known as the nation's *geostrategy*. These two features have numerous causal linkages with each other. Their infirmities as well as their strengths significantly impact each other. Hence, while considering geopolitics, it is a major conceptual error to place geopolitics, geoeconomics and geostrategy at the same hierarchical level. The correct conceptual hierarchical formulation to the conceptual level is as seen in Figure 3.

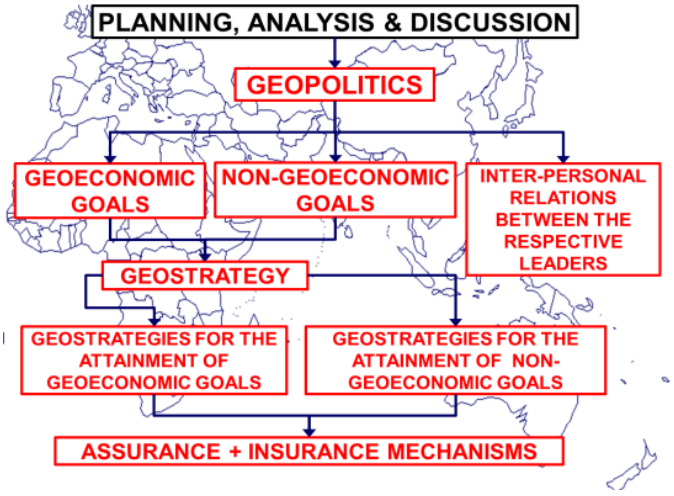

Figure 3: The correct hierarchical formulation of geopolitics, geoeconomics and geostrategy

Components of climate change

Climate, as experienced at the surface of the earth, is a result of the interaction of five major components: the atmosphere, the hydrosphere, the cryosphere, the lithosphere and the biosphere. These interactions result in a balanced energy budget for the Earth. The resulting climate system evolves as a result of the influence of its internal

dynamics and external forces such as volcanic eruptions, solar variations and anthropogenic forces. A balanced energy budget occurs when the incoming energy equals that of the outgoing. In case there is an imbalance, the Earth would experience heating or cooling depending on whether the incoming energy is greater or lesser than the outgoing energy respectively. This imbalance in the energy budget occurs if there is a change in the total radiative solar flux or the spectral distribution of the solar radiation or if there is a change in the concentration of the trace constituents in the atmosphere that affect the transfer of the radiative energy throughout the atmospheric column. Such a change in the energy budget results in a change of climate that is commonly known as 'climate change'.

It is an incontrovertible fact that adding energy to the Earth system will warm up the Earth, rising temperatures, melting ice, resulting in raising of sea levels, droughts, floods, etc. What is not known is just how fast or how much the planet will warm. Consequently, the multitude of associated changes that will take place cannot be accurately predicted. That said, global scientific consensus does exist on five 'climate certainties' due to anthropogenic activities that are in abundant evidence:

1. Enhanced emission of Green House Gases (GHG)
2. Higher surface, tropospheric, and ocean temperatures
3. Precipitation extremes leading to floods or droughts
4. Melting of mountain glaciers, Arctic sea ice, and ice sheets
5. Rising sea levels

Enhanced emission of Green House Gases (GHG)

Green House Gases (GHG) are those that absorbs and emit radiant energy within the thermal infrared range. The main GHG in the Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone. Without GHG the Earth's temperature would be -18^{o}C. However, due to an imbalance in the number and quantity of these gases in the atmosphere, the temperature is +15^{o}C (Cohn, 2008; PWC, 2007).

This GHG is an overarching climate certainty, for it directly contributes to the remaining four climate certainties mentioned above. It has been accepted that as long as CO_2 emissions continue (even if they do not accelerate any further), the temperatures will continue to rise as seen in Figure 4 and Figure 5.

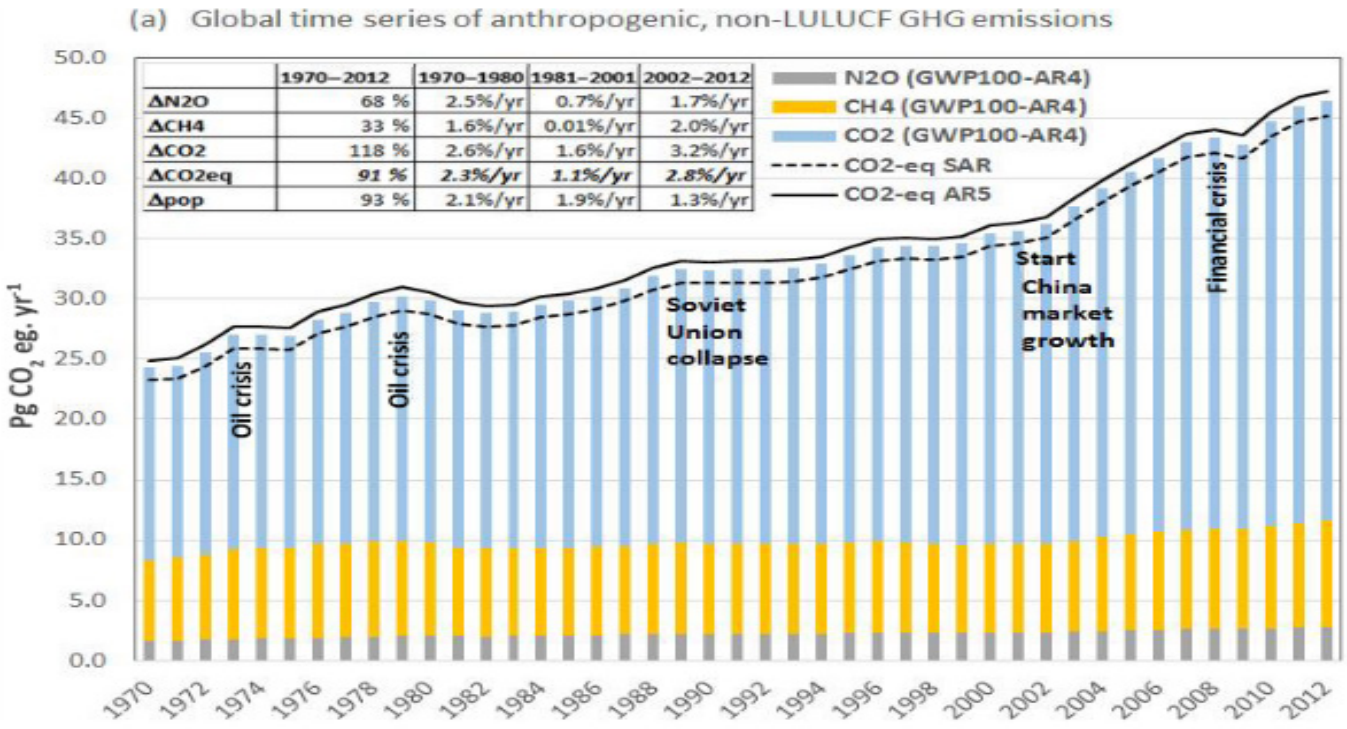

Figure 4: Global time series of anthropogenic. Non-LULUCF GHG emissions 1970–2012 (Janssens-Maenhout et al., 2019)

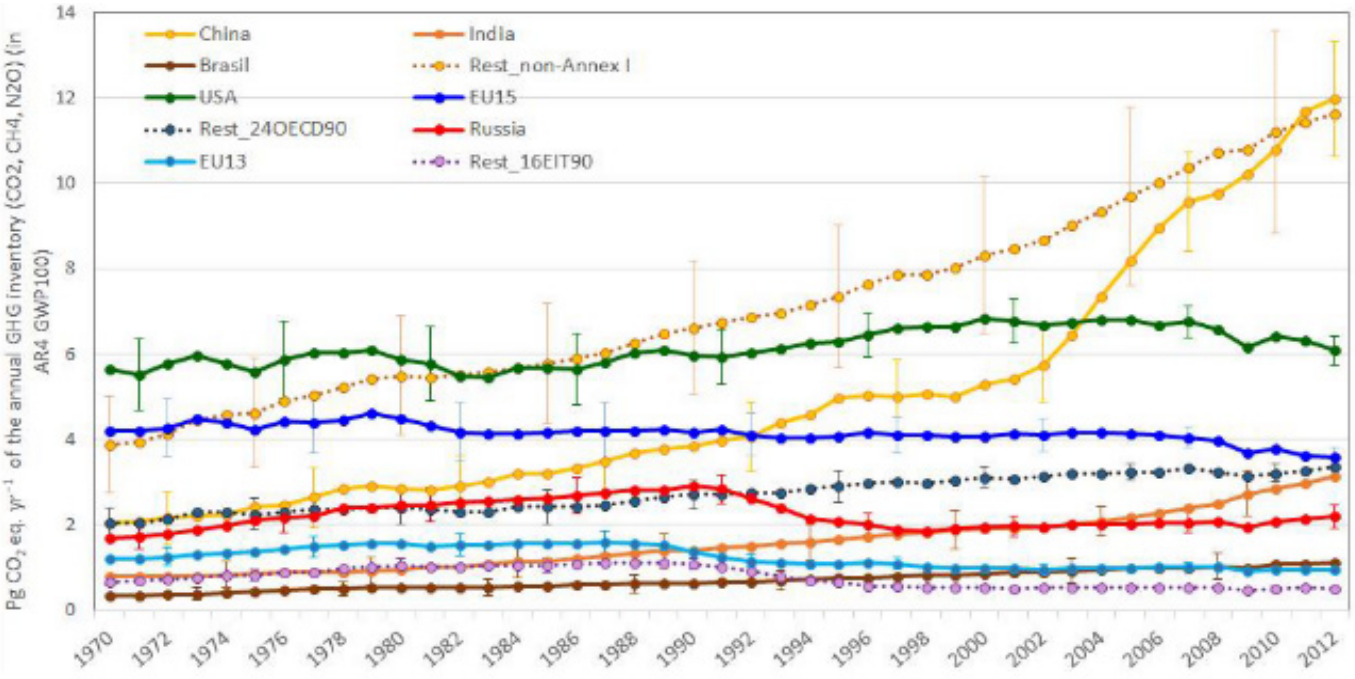

Figure 5: GHG emission trends for the different types of world countries (1970–2012) (Janssens-Maenhout et al., 2019)

As per the World Meteorological Organization (WMO), 16 of the 17 warmest years on record have occurred in this current century and 2011-2015 was the hottest five-year period on record. 2016 was even hotter, with a global average temperature of 1.2°C above the long-term average as seen in Figure 1. It is hence appropriate to dilate upon just how each of the remaining four of these climate certainties impacts the geopolitics of nations and hence the holistic security in general and the maritime security in particular, thereby creating a need for adaptive geostrategies.

Higher Surface, Tropospheric, and Ocean Temperatures

Both, human beings and crops have very limited tolerance for heat. If GHG (Janssens-Maenhout et al., 2019) and surface temperatures continue to rise (IPCC, 2014) as shown in Figure 1, people in several countries of West Asia, and some in South Asia as well as the likes of Afghanistan and north-western Pakistan, will begin to experience intolerable levels of heat stress. This will generate a significantly reduced work-efficiency and a corresponding risk of heat-stroke for people especially those who routinely work outdoors. This would result in migration as a response to recurring situations such as drought and desertification that destroy agriculture and other natural resources upon which communities depend for their livelihood. Such waves of heat-induced human migration will be a significant factor in the context of both, internal security (due to migration internal to the country) and external security (due to migration across the borders) and hence the associated strategies to cope with such migration will be an important geopolitical driver.

Water Stress or Drought

An immediate result of widespread heat-stress and a decrease in precipitation is the scarcity of water that is used to sustain life and livelihood and is referred to as 'water-stress' (Jacox, 2019; Trenberth, 2011). Although thresholds for water stress are largely arbitrary, thresholds of 'moderate', 'chronic' and 'extreme' water-shortage are widely used, based on the per-capita availability of water. Studies indicate that the number of people exposed to extreme water shortage is projected to double, globally, by the middle of the current century due to population growth alone (WRI, 2015), as seen in Figure 6.

One of the most commonly encountered security-impacts of temperature-rise and water-stress has been the occurrence of protracted and frequent *droughts*. Drought is a major challenge for people, agriculture and economies across the world. Though drought is a difficult phenomenon to predict in terms of the occurrence, frequency and impact, one ubiquitous consequence of drought is that it causes crops

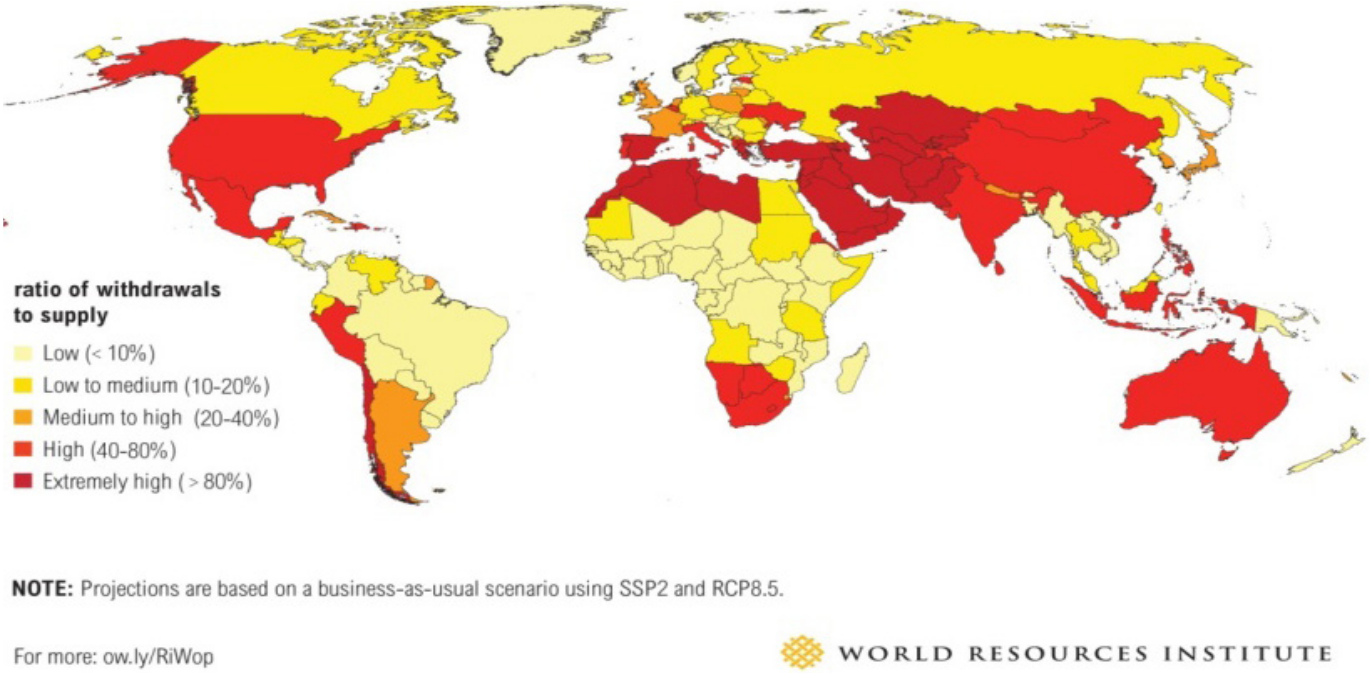

Figure 6: Water stress (as a function of water withdrawals to water-supply) in 2040 (Source: *WRI*, 2015)

that are already under heat stress to undergo more extensive withering and food-security to plummet as a consequence of large-scale crop failure.

Such droughts contribute to instability throughout the world, as populations migrate across borders, creating conditions for social or political upheaval along the way. More immediately, it will promote violent actions by an increasing number of malevolent non-State actors and terrorist organizations and would exacerbate other socio-political and socio-economic causes. For instance, although it cannot be said that climate-change created ISIS, its rise in 2011 was certainly facilitated by the preceding four years of drought in Syria that sent hundreds of thousands of Syrians into extreme poverty and food insecurity and generated a huge exodus from the rural areas of Syria towards Damascus (Selby, Dahi, Fröhlich, & Hulme, 2017). The resulting brutal actions by the security forces were repressive and draconian that resulted in the rise of the *Daesh/ Islamic State* (IS) (Adelphi, 2016). Similarly, the food and water shortages resulting from the drought conditions caused by climate change, made worse by incoherent and ineffective policies by weak governments of Chad, have provided a ripe recruiting ground for the *Boko Haram* terrorist group operating out of Nigeria (Krinninger, 2015). These very conditions similarly facilitated the rise of the *al-Shabaab* terrorist group in Somalia and subsequently as sea-pirates from Somalia into the maritime domain (Ro, 2019; UNDP, 2013).

Closer to India, Afghanistan, a country with negligible food security and more than half of all her local conflicts being over arable-land and water, diminishing rainfall and advancing desertification is likely to spark further violent clashes between nomads and pastoralists over access to pastures, water and food. Farther south, Pakistan, too, is extremely vulnerable to heat and water stress and the possibility of climate change and environmental factors destabilizing Karachi is now recognized as being real and temporally proximate if not imminent.

As the climate-driven migrant population from Afghanistan pushes into Pakistan, this would force subsequent migration of Pakistan's own population, thereby increasing the strain upon India to a point where the 'weaponization' of water — despite agreements such as the Indus Water Treaty of 1960 — could become a cause for serious conflict. The present treaty is increasingly strained as both sides pursue hydro-development projects to mitigate water and energy shortages; and to take pre-emptive action against flooding or drought, which are becoming more frequent and intense with climate change. Climate change is expected to further challenge water distribution and hydro-development in Pakistan and India, thereby significantly impacting security, especially as this inherent suspicion and mistrust between the two States is used by terrorist groups to provoke anti-Indian sentiment in Pakistan, providing fertile ground for conflict.

Water Surfeit or More Precipitation or Floods

If heat- and water- stress constitute one face of the adverse security-impact of climate change, water surfeit is its opposite face, but it, too, has an equally adverse security-implication. An increase in rainfall can be a blessing for a country that can capture, store, and distribute the additional water, but is a curse for a country that does not have adequate land management practices or infrastructure. Even where it is a blessing, the 'blessing' is likely to be a mixed one, because regions that benefit from additional rainfall will also need to cope with waterborne health issues and an influx of migrants from water-scarce areas, thereby aggravating existing national and/ or inter-State tensions.

Within India, extensive flooding caused by heavy rainfall has become endemic in large portions of the country. In 2017, Gujarat, Bihar, J&K, Maharashtra (including Mumbai) and even parts of Rajasthan of India were unable to handle increased rainfall, requiring the intervention of the defense services for in-country Humanitarian-Assistance and Disaster-Relief (HADR) operations in aid of civil power. Where the rainfall is both heavy and unseasonal, the call for HADR from the defense services is even more strident, as was the recent case in Uttarakhand (2013), J&K (2014), Tamil Nadu (2015), Kerala (2018) and Orissa (2019).

This inability to deal with increased rainfall extends across much of India's neighborhood, with Sri Lanka, Nepal and, further afield, the Philippines, all offering recurring examples. In the civilian world, 'humanitarian logistics', which forms the core of HADR operations, is less well-established than 'commercial logistics' while that of the defense services is better established thereby experiencing a sharp increase in 'operational stretch' precisely because of the increased demand for HADR. As the adverse effects of climate change increase, the operational load on security forces due to HADR would increase thereby having an increasing impact on other facets of national security that they are actually expected to provide (Gemenne et al., 2019).

Another security-impact of climate change that is grossly underestimated is that caused by changing/ stronger disease vectors that arrive in its wake and cause water-borne and vector-borne diseases, such as malaria and dengue fever (Patz, Campbell-Lendrum, Holloway, & Foley, 2005). Conversely, many airborne diseases thrive in those areas that become arider due to drought and higher temperatures. Further, the shortage of food and/ or fresh drinking water renders human populations more susceptible to illness and less capable of rapid recovery. The risk of a pandemic is heightened too when deteriorating conditions prompt human migration (Black et al., 2011).

The resulting security impact on the geopolitical landscape is not hard to imagine. It is easy enough to comprehend the threat posed to human security by more frequent and vigorous outbreaks of diseases, epidemics and pandemics. In the face of an epidemic, it is not uncommon to find countries imposing varying degrees of restrictions upon the free movement of people from affected countries into their own. However, should these restrictions or total bans be applied to merchandise that is traded in bulk, and form a significant part of a country's GDP, the geopolitical ramifications can be very serious.

Glacial Lake Outburst Flood (GLOF)

When talking of glacial lake outbursts, the first thing that strikes the mind is the polar ice caps. Though this is not directly applicable to the Asian continent, what is relevant is the Himalayan range that has a spread of over 2,900 square kilometers and feeds all the major water bodies of the continent, and supports nearly 1.3 billion people that account for over 20 percent of the world population.

The security impact upon India due to the receding of the Himalayan glaciers as a result of climate change is evident in Nepal, where frequent, devastating floods are seen as a result of the bursting of glacial lakes. A glacial lake outburst flood (GLOF) is a result of a combination of increased heat from the emission of greenhouse gases, and a sudden water-surfeit causing flooding due to a glacier retreat and the conversion of the residual ice sheet into water (Mool et al., 2001; Karki, 2007).

Several GLOFs have trans-boundary impacts. Many floods in Nepal have originated in Tibet, while floods from Nepal have run into India and even Bangladesh[3]. A GLOF event destroys downstream settlements, dams, bridges, and other infrastructure with waves nearly 15 meters high. Where Nepal is concerned, this puts further stress on a country

3 Glacial Lake Outburst Flood, India Environment Portal, Retrieved from http://www.indiaenvironmentportal.org.in/content/350795/glacial-lake-outburst-flood

already struggling to preserve a fragile peace and reintegrate tens of thousands of the Maoist insurgents — the failure of which could destabilize much of India and even South Asia at large (Upreti, 2006). Further, China's geopolitical game-plays in Nepal too act as a source of frequent Sino-India tension and have security implications at the strategic level of very significant proportions.

Melting of the Polar Ice-Sheet

There have been speculations about the impact upon the maritime security of the melting of the Arctic ice-sheet and the potential opening of new routes for maritime trade as a result of this melting. Since the Arctic is warming at twice the rate of anywhere else on earth, due to high carbon concentration, the resulting ice-melt could well result in an ice-free Arctic Region in the latter half of the present century (NAS, 2015). The opening of the Northern Sea Route (NSR) will certainly affect seaborne trade and International Sea Lanes in the northern 'east-west' reaches of Eurasia, although the effect upon the southern 'east-west' stretch of the Eurasian littoral will be far less. As a consequence, the geopolitical importance of ports such as those in the Koreas and in Japan will significantly increase. Since China has both components of this geography in large measure, it is frantically developing port-infrastructure in its relatively under-developed coast north of the Yangtze River. Such export-oriented northern Chinese ports, catering to shipping along the NSR would save about 25 percent in transit time — provided they were trading with northern Europe, which at present is just under 3 percent of her total international trade. Asia's big exporters — Japan, South Korea and China — are all investing in ice-capable vessels. So, quite clearly, changes in shipping patterns may be expected over the medium to long term. Every such new 'International Sea Lane' would need to have intermediate ports and shore-based multi-modal transportation infrastructure to provide access to hinterland areas thereby redefining the geopolitics of the region (Melai et al., 2017).

Sea–level Rise

Turning to the impact upon the maritime security of the melting of the polar ice sheets, the situation is gradually approaching criticality. The percentage contribution of the melting of land ice to sea level rise is some 52 percent, while another 38 percent is contributed by the thermal expansion of the oceans as a result of surface and tropospheric warming (NAP, 2012). Rising sea levels are thus a far more immediate problem than most Indian analysts realize. India was ranked 'Number One' in 2008 and is projected to retain this dubious honor even in 2050 (Wheeler, 2011) based on the total number of people who would be at severe risk from a rise in sea level.

An immediate impact of sea-level rise in areas close to the coast is that of salinization of freshwater as seen in Figure 7. While this impact may not be noticed on the surface, it would affect groundwater. This will result in the loss of arable land, and hence desertification leading to the migration of coastal population causing both, internal and external ramifications (Stapleton et al., 2017).

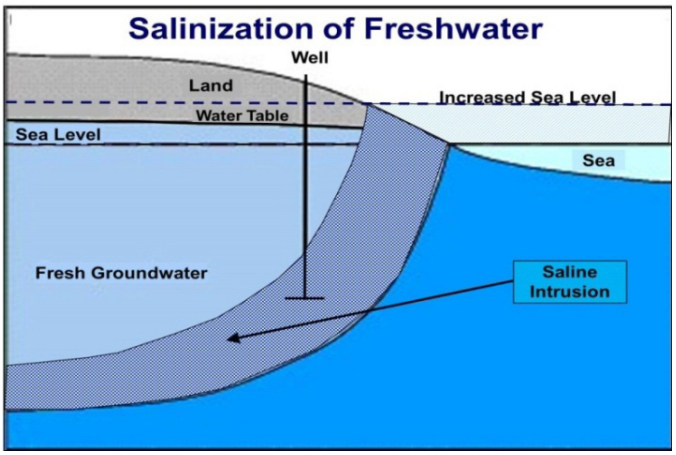

Figure 7:[4] Immediate impact of sea-level rise on the salinization of freshwater

Impact on Maritime Forces

As seen in the developing world, even a relatively small climatic-shift can trigger or exacerbate food shortages, water scarcity, destructive weather events, the spread of disease, human migration, and natural resource competition, and, perhaps most ominous of all, can lead to partial or total 'State-failure'. Since whatever happens on the land has a direct bearing on what happens at sea, several security-related risks inherent to climate change come to the fore. Issues relating to maritime security may be direct or indirect. These are:

4 Saline intrusion, Australian Online Coastal Information, Retrieved from https://ozcoasts.org.au/indicators/coastal-issues/saline_intrusion/

1. **Indirect Security Issues**. The security-impacts of climate change are felt particularly strongly within the maritime domain — upon, below and above the seas, as also within the coastal areas of littoral countries. Rising surface temperatures have a direct effect of increasing the frequency, severity, and path-unpredictability of cyclones for the coastal areas. Future projections based on high-resolution dynamical models indicate that GHG-induced surface warming will cause globally averaged intensity of tropical cyclones to decidedly shift towards stronger storms, with intensity increases of 2 to 11 percent by 2100 (Knutson et al., 2010). These increased frequencies of disasters due to climate-change-induced cyclones and floods, would increase the already high operational strain upon the maritime forces and on the defense and naval budgets. This would inevitably impact the readiness to meet other maritime threats and challenges, including those arising from other State challengers, and/ or malevolent State-sponsored non-State actors.
2. **Direct Impact on naval missions**. A range of naval missions and war-fighting capabilities are impacted by the changing salinity of the oceans due to climate-change. This salinity of seawater has changed measurably from 1950 to 2000.[5] The consequences of such a change upon a submarine and anti-submarine operations are both, obvious and significant. Apart from naval combat due to inter-State armed conflict, climate change will significantly strain military transportation resources and supporting force structures in respect of coastal security, anti-piracy and counterterrorism, and HADR missions (Podesta & Ogden, 2007).

'Hot-Spots' for Climate change and Human Impact

The Indian Ocean

The Indian Ocean is the warmest ocean of the world. Studies of the Indian Ocean for the period 1901-2012 reveals that the Indian Ocean is warming at a rate much larger than any other ocean in the Tropics. This warming scenario and the related climate dynamics are factors to be vigilant of, while assessing long-term climate change (IITM, n.d) as the Ocean drives the region's climate, including extreme events such as cyclones, droughts, severe rains and waves. To add to this the Asian continent is a diverse continent with complex geography, economy, demography and political characteristics. This in return influences the different climates within Asia that vary from dry deserts to wet and humid tropical regions; hot and warm continental temperatures to cold polar and mountainous temperatures (Krishnamurthy et al., 2015).

Figure 8: Climate-related risks in Asia.
Source: modified from Krishnamurthy et al., 2015

Evidence indicates that annual temperatures in the Asian continent have increased with increasing warm days and warm nights. These temperatures are expected to continue to rise and will lead to accelerated glacier melts, a higher risk of droughts and lower rainfall periods. Such extreme weather events will result in significant loss and damage in a larger part of Asia as seen in Figure 8. The resulting 'climate certainties' in this region include:

1. **Droughts**, those that occur as a result of a combination of insufficient rainfall and high temperatures impact agricultural production. The currently available models suggest higher intensity and duration of drought in parts of South Asia, Indonesia, and the Philippines.
2. **Floods** have become more frequent and intense in this region since the 1960s as a result of heavy precipitation events. More frequent and intense floods are expected in large parts of Asia. Glacier melt, sea-level rise, and more intense tropical storms are likely to increase the risk of floods.

5 At some places the sea has become saltier while at others it has become less salty, *See*, Clue to Climate Change in Ocean Salinity, S&TR December 2015 Ocean–Climate Connection, Lawrence Livermore National Laboratory, Retrieved from https://str.llnl.gov/december-2015/durack

3. **Tropical storms**, that have the potential to devastate large areas will become less frequent but more intense under climate change as suggested by climate models.
4. **A climatic shift** that occurs due to changing rainfall and temperature patterns is expected over large parts of Asia, including the Mekong basin and parts of South Asia. Such shifts may render traditional, climate-sensitive livelihoods such as farming and fishing unsustainable.
5. **Glacier melt**, which feeds water to rivers in the Indus and Ganges-Brahmaputra basin when accelerated due to increased temperature would result in non-availability of water and hence droughts in the long run and floods in the short-to medium-term.
6. **A sea-level rise** that is another serious area of concern is expected to rise by 57-100 cm by the end of the century, thereby exacerbating coastal flooding risk as well as the impact of storm surges.

The Mediterranean Sea

The Mediterranean Sea is a marine biodiversity hotspot and the surrounding region is undergoing a rapid local and global climatic changes (Behnassi & Ibn, 2013; Coll et al., 2010). Currently, the main climate changes in the Mediterranean Region consist of a pronounced decrease in precipitation and an increase in air and sea warming. This region, which has been identified as a 'hotspot' for climate change, is expected to experience environmental impacts that are considerably greater than those in many other places around the world (Durrieu de Madron et al., 2011) (see Figure 6). Many of these impacts have already influenced the water, food, environmental and political security of the region and can potentially lead to conflicts (see Figure 10) caused partly by climate change between and within the Mediterranean countries. All indicators point to an increase in environmental problems in the Mediterranean Sea such as water scarcity, water pollution, destruction of coastline, increase in population density, night-time lights pollution, overfishing, habitats degradation, invasive species, and shipping with negative implications towards current and future sustainability.

Quantification and mapping of the cumulative impact of 22 drivers to 17 marine ecosystems (Micheli et al., 2013) including the Mediterranean and Black Sea, legal mandates and agreements to implement ecosystem-based management and spatial plans provide new opportunities to balance uses and protection of marine ecosystems. Analyses of the intensity and distribution of cumulative impacts of human activities directly connected to the ecological goals of these policy efforts are critically needed. Quantification and mapping of the cumulative impact of 22 drivers to 17 marine ecosystems reveals that 20% of the entire basin and 60-99% of the territorial waters of EU member states are heavily impacted, with high human impact occurring in all ecoregions and territorial waters. Less than 1% of these regions are relatively unaffected. This high impact results from multiple drivers, rather than one individual use or stressor, with climatic drivers (increasing temperature and UV, and acidification reveal that 20 percent of the entire Mediterranean basin and 60–99 percent of the territorial waters of EU member states are heavily impacted, with high human impact occurring in all ecoregions and territorial waters (see Figure 9). This high impact results from multiple drivers of them climatic drivers such as increasing temperature and UV, and acidification are the major contributor. These results show that coordinated management of key areas and activities could significantly improve the condition of these marine ecosystems.

Environmental management by Mediterranean countries is challenging these pressures and needs to evolve to reach the target of increasing population with reliable access to freshwater, food, recreation and tourism etc. Currently, the majority of conservation programs are applied at national and subnational scales (Halpern, 2008), but global and regional coordination is becoming more common. These global regional coordination demand higher transaction costs and resources beyond what is required in national programs (Kark, Levin, Grantham & Possingham, 2009)although currently, the majority of conservation programs are applied at national and subnational scales. Nevertheless, multinational programs incur transaction costs and resources beyond what is required in national programs. Given the need to maximize returns on investment within limited conservation budgets, it is crucial to quantify how much more biodiversity can be protected by coordinating multinational conservation efforts when resources are fungible. Previous studies that compared different scales of conservation decision-making mostly ignored spatial variability in biodiversity threats and the cost of actions. Here, we developed a simple integrating metric, taking into account both the cost of conservation and threats to biodiversity. We examined the Mediterranean Basin biodiversity hotspot, which encompasses over 20 countries. We discovered that for vertebrates to achieve similar conservation benefits, one would need substantially more money and area if each country were to act independently

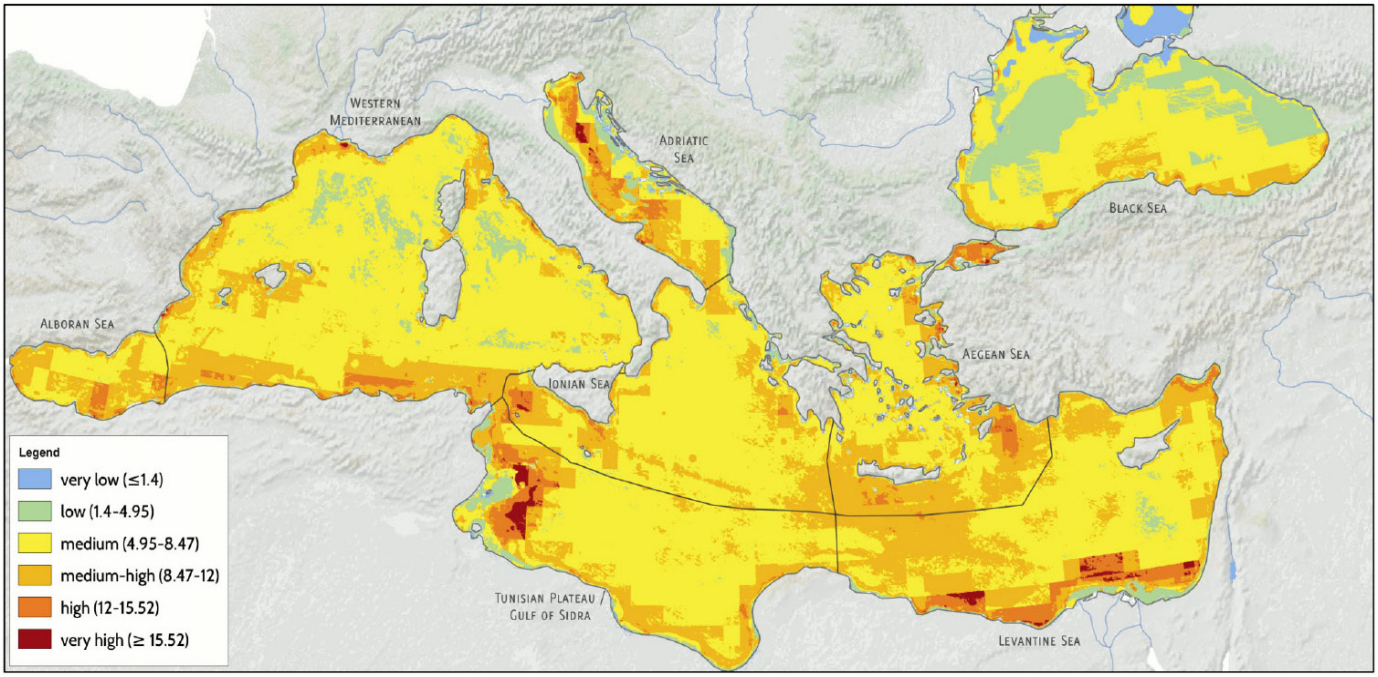

Figure 9: Spatial distribution of cumulative impacts to marine ecosystems of the Mediterranean (Micheli et al., 2013)

as compared to fully coordinated action across the Basin. A fully coordinated conservation plan is expected to save approximately US$67 billion, 45% of total cost, compared with the uncoordinated plan; and if implemented over a 10-year period, the plan would cost approximately 0.1% of the gross national income of all European Union (EU. The Mediterranean countries have different perspectives, towards economic development, social structure, climate change and its rates, and the state's ability to adapt to changes, such as the availability of water, infrastructure, and various other daily resources. However, in many regions as a whole, rapid social and environmental changes are taking place. These changes have negative consequences on the current and future human stability and security both within the country and the entire Mediterranean region, for which solutions have not been worked out. This is especially true for the food and water security of the Mediterranean region, where, according to forecasts, pressure and impact on water, soil and natural resources increases in the face of climate-change and various conflicts.

The inherent geopolitical complexity and disputes over marine borders and jurisdictions (see Figure 10) have raised obstacles to transboundary collaboration efforts in the Mediterranean. This situation poses both, a challenge to large-scale conservation planning in the Mediterranean region and a unique opportunity for the development of coordinated regional conservation efforts. The integration of Mediterranean-wide and local conservation efforts, the facilitation of transboundary collaboration, and the establishment of regional funds for conservation will further enhance opportunities for marine conservation in this region (Katsanevakis *et al.*, 2015).

How climate change is altering the geostrategy of a nation

India

India is amongst the most vulnerable country to climate change because of its large population that depends on natural resources for their livelihoods. By 2020, pressure on India's water, air, soil, and forests is expected to become the highest in the world with water resources having the largest impact. The potential mechanism that is likely to cause this is:

1. **Glacial recession**. The Himalayan glaciers are the water source for Asia in general and India in particular. As the Earth's temperature increases, these glaciers experience increased melting resulting in increased water content in the rivers. However, over the time as these glaciers disappear there would be a lack or no water for the people currently dependent on them. This would lead

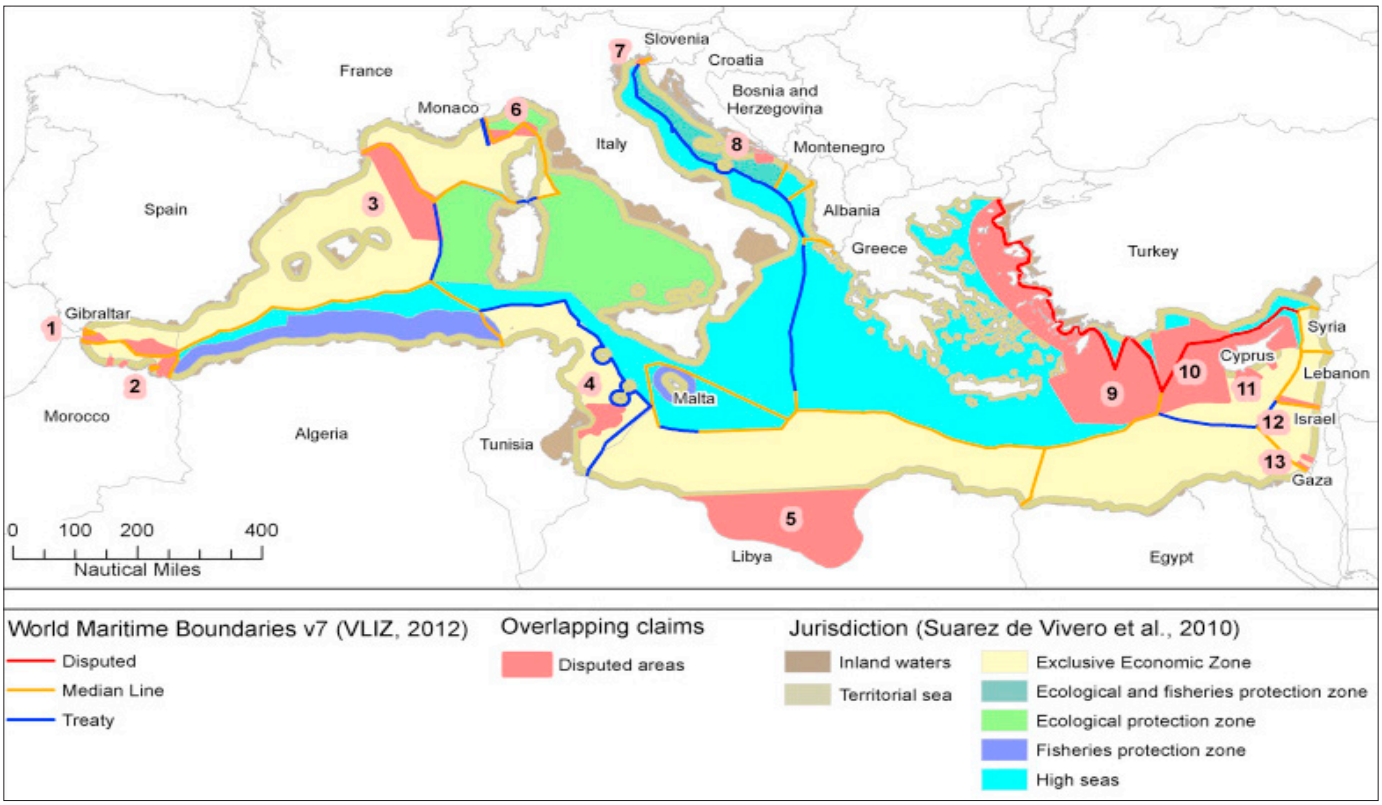

Figure 10: Marine boundaries and disputes in the Mediterranean Sea (Source: Katsanevakis et al., 2015).

to the Himalayan river system to end up as seasonal, monsoon-fed rivers, making water availability for human sustenance round the year critical.

2. **Rising sea levels**. The rise in sea levels in this region will result in the submergence of low-lying areas, river deltas, coastlines and small islands. In this region, the highly populated cities of Karachi, Dhaka, Mumbai, Kochi and Mangalore face the maximum risk due to submergence with the coastline advancing inland in many populated parts of Bangladesh, Sri Lanka, Myanmar, Pakistan and several parts of India. This would lead to forced migration leading to food and water stress and security issues to the regions where these people will migrate to.
3. **Extreme weather**. Climate-change would worsen the impact of natural disasters by increasing their intensity and frequency and make adaptation efforts difficult.

Such changes would change the dynamics of conflict with little or no respect for political frontiers as States will be forced to react with self-interest that will complicate the existing unresolved inter-State disputes. Some of these are as shown in Table 1.

Table 1: Impact of climate change in the Indian subcontinent

Conflict region	Water scarcity	Rising sea levels	Extreme weather	Resulting effect
Jammu and Kashmir	High	-	Medium	Risk of war with water being the prime cause
Indo-China border	High	-	Medium	Risk of natural disasters
Bangladesh	High	High	High	Mass migration
Pakistan	High	Medium	Medium	Ethnic conflict
Sri Lanka	-	High	Medium	Risk of mass migration and ethnic conflict
Nepal	High	-	High	Risk of natural disasters and mass migration

Source: Pai, 2008

The estimated impacts of climate change on the geostrategy of the Mediterranean nation are still under investigation and not clear for most countries of the region. In the short- and medium-term, climate change is unlikely to significantly change and affect the geostrategy and nation security structures. However, depending on the severity of climatic changes in any specific area or site, these conditions may change and affect long-term prospects as they have a direct and serious impact on security perspectives.

Israel

The three main areas of concern for Israel as a result of climate change are: water scarcity (evident), the approximate rising of sea level by 6-8 cm since 1960

The impact affects a wide range of geostrategic issues depending on a number of geographic areas: the inner circle (Israel), the circle of neighboring countries, the circle of Muslim-Arab countries adjacent to neighboring countries, and other countries. Among the most important points in this regard are: a change in the geostrategic balance of forces in the Middle East, water management problems, increasing energy consumption, the food sector. The main conclusion is that Israel must turn fears and threats from climate change into a lever for advancing projects that Israeli society must promote. These include increasing water supply (desalination), completing the construction of dividing fences between Israel and all its neighbors to prevent illegal immigration, enhancing the protection of existing and potential agricultural land to ensure food supply. The resources that are presently being challenged by climate change are:

1. **Energy**. Climate change trends observed throughout the world in recent decades are mainly reflected in changes in the temperature of air and water, rain patterns and an increase in the frequency and intensity of extreme weather events, including seawater heat waves. These scenarios have a major impact on various areas of the Israeli energy sector. Among the problems that the energy system is already facing is the need to cope with the growing losses in production and transmission due to rising temperatures, unexpected waves of jellyfish, and damage to the energy infrastructure on the coastline along which more than 80 percent of all Israel's electricity is produced (see Figure 11).

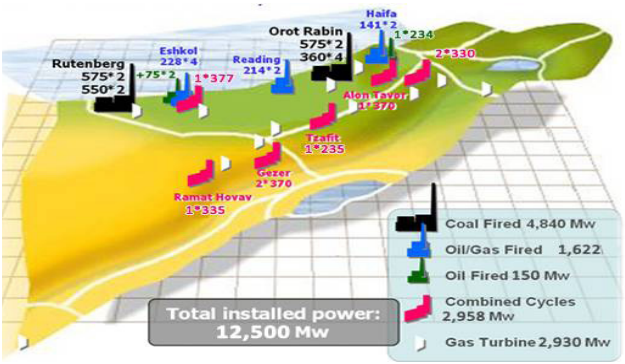

Figure 11: Location of Israel power stations.
Source: Israel Electric Company Limited[6]

2. **Biodiversity**. In terms of biodiversity, climate change is one of two major threats in Israel. The second threat is, accelerated growth of the population of Israel, especially along the coastline. In most cases, the effects of climate change are slower than those directly related to human activity, and therefore the impact of human activity on natural systems is more rapid. This is particularly noticeable in the coastal zone, where developmental pressures leading to habitat destruction and competition for water resources put freshwater habitats under threat. Therefore, the most important tool for biodiversity conservation is to manage policies aimed at reducing sources of harm that are not related to climate-change.
3. **Maritime Policy**. For several decades, marine spaces (EEZs) have been undergoing significant geopolitical and environmental/ climatic change. Demographic growth and rising standard of living, has increased the pressure on humanity to generate resources and facilitate a shift away from the oceans and from terrestrial resources with a realization that investing in preparing for climate change will cost much less today than in the future, and that such a preparedness will bring much greater benefits and reduce damage. With this understanding, the Israeli Planning Administration, responsible for determining the national planning policy, identified the need to formulate an integrated policy for the preservation and development of the maritime space (Spinat, 2018). This requires a clear policy both at the central government level and at the local government level to minimize economic and social damage on a large scale, for developing technological innovations and as a source for exporting knowledge and technologies to countries at

6 See https://www.iec.co.il/businessdevelopment/pages/datahebrew.aspx

risk of climate-change, including developed countries. As of 2019, there is still no regulated government body that will manage Israel's EEZ.

4. **Water resource and supply**. Since the establishment of Israel, the water sector has been confronted with the need for reliable water supply, its quality and quantity. The water sector in Israel has been built over many years due to water shortages, population growth and a significant reduction in the drainage basin of the Sea of Galilee which led to the development of extensive knowledge in the field of water and the development of technologies in the field of land reclamation, desalination, etc. As a result of climate change, increased temperature leading to increased evaporation of surface water bodies, dehydration of springs and streams, and much more are creating a higher water stress on the already scanty water resource for Israel. While desalination and advanced wastewater treatment for agricultural reuse are helping to close the gap between the water supply and demand in Israel (see Table 2), they are expensive and energy intensive, resulting in increased emissions of pollutants (Lotan, 2018) and greenhouse gases. However, Israel's energy sector is more reliant on natural gas (Hamed & Bressler, 2019), from 12 percent in 2004 to 54 percent in 2017, while renewable energy constitutes 3 percent for 2017 (The Electricity Authority, 2017).

   Table 2: Desalination plants in Israel and their production (2019)

Location	Annual water supply (mcm/year)
Ashqelon	115
Palmachim	90
Hadera	127
Sorek	150
Ashdod	100
Eilat	20

   Source: Desalination facilities in Israel[7]

5. **Coastal Infrastructure and Sea Level rise**. The impact of climate change on Israeli infrastructure is complicated to quantify, but it is expected that the impact will increase in extreme events like sea storms and floods on land as a result of the inability of drainage systems to accept rain volumes. Currently, most of the Israeli cities located on the Mediterranean coastline are not prepared for climate change impacts such as rising sea levels and increase sea storms. Unless protection measures are taken, rising sea levels are expected to increase the rate of:

   a. *Salinization of the coastal aquifer.* The coastal aquifers of Israel have already been damaged by the infiltration of the intermediate aquifers to the east, and any further eastward progress will only worsen the situation.

   b. *The retreat of the coastline*. The retreat of the coastline will harm tourism, vacation and kite activity and will necessitate diverting activities and structures eastward to the current coastline.

   c. *Reinforcing coastline*. Due to receding coastlines, resources and efforts would need to be invested in protecting coastal buildings and elevation of ports.

   d. *Reduced river flow gradient*. Due to increasing sea levels, the flow gradient would reduce which would increase the sedimentation rates in rivers deltas. This would require investment to rectify the situation.

   e. *Loss of coastal sand*. The natural resource of coastal sand is expected to be lost to an extent of 2-100 meters for each 10 cm rise in sea level.

Need for Geostrategies to counter Climate change

There is global unanimity in the understanding that South Asia will be among the hardest hit by climate change. Higher temperatures, more extreme weather, rising sea levels, increasing cyclonic activity in the Bay of Bengal and the Arabian Sea, as well as floods in the region's complex river systems will complicate existing development and poverty reduction initiatives. Coupled with high population density levels in this region, these climate shifts have the potential to create complex environmental, humanitarian, and security challenges.

The impact of this increased frequency of cyclones, a higher storm activity, and the *extensive attendant flooding* will be particularly severe upon Bangladesh and upon India's east coast. This would radically alter living conditions and seriously undermine livelihoods. The increase in the frequency of such extreme events and deteriorating conditions is likely to force many to leave their homes temporarily or even permanently and become climate-induced human migrants.

7 See, http://www.water.gov.il/Hebrew/Planning-and-Development/Desalination/Pages/desalination-%20stractures.aspx

When considering the *rise in Mean Sea levels*, the Republic of the Maldives seems to be the most affected. With an average elevation above the current Mean Sea Level of just five feet (the highest elevation is a mere 2.4 m (eight feet)) and with the 5th report of the Intergovernmental Panel on Climate Change (IPCC-AR, 2013), predicting a global rise by 52-98 cm (20.47 to 36.22 inches) by the year 2100, the country is extremely susceptible to the dangers of increasing sea levels because of global warming. This would be disastrous for Maldives whose 336,000 people could suddenly become 'boat people'!

An even more intriguing set of totally unexplored issues are thrown up by the *loss of arable land* in the deltaic coastal stretches such as those found in Bangladesh. According to a 2013 report of the World Bank, "40 percent of productive land is projected to be lost in the southern region of Bangladesh to a 65 cm sea level rise, by the 2080s" (World Bank, 2013). In such an eventuality, what will happen to the baselines of Bangladesh, which have currently been drawn up in accordance with the principles of UNCLOS? Will they now lie some 30-40 nm to seaward of the receded (new) coastline? If they are to be adjusted, what will happen to the Exclusive Economic Zone of Bangladesh? How will that adjustment affect India? What will happen to the ruling by the International Tribunal on the Law of the Sea (ITLOS)? Is there a mechanism for ITLOS to revise its earlier ruling? What will happen to UNCLOS, which is already facing some robust criticism for the several ambiguities and harshly exposed by the imbroglios in the South China Sea and elsewhere? These are questions that have profound security implications and demand the closest attention and detailed scholarship by concerned departments and agencies of the government as well as maritime-domain experts.

The security implication arising due to the issues discussed herein need little elaboration. President Donald Trump's views cannot be taken as an excuse for inaction. These security implications demand a multi-dimensional contingency-planning at not just the strategic level, but also the operational and tactical ones. Accordingly, some geostrategies that can be considered as a possible way ahead are:

1. **Spread Awareness amongst Governmental Echelons**. Though the 'brains-trust' of governments is a robust and invaluable resource, however, most governmental echelons are beset with innumerable challenges germane to the day-to-day minutiae of their departments and/ or ministries and have little or no opportunity to even become sufficiently aware of the security-implications of climate change. It is hence essential that creating awareness for the whole-of-government, both the central and the state is, therefore, a sine-qua-non for the formulation of mitigating and adaptive strategies against these adverse impacts.
2. **Involve Multiple Stakeholders**. Governmental echelons are not the sole source of the originality and innovation required to determine optimal mitigating and adaptive strategies. It is, therefore, very important to widen the input-base by involving as many stakeholders as possible. It is particularly important to capitalize upon the idealism, exuberance and commitment of the country's youth and, in particular, the female population amongst them.
3. **Commission Focused Studies**. Specialized think-tanks could — and should — be commissioned to undertake a series of focused studies that would formulate specific preventive, curative, mitigating and adaptive strategies to deal with the impact of climate change. While the National Maritime Foundation (NMF) could produce focused-outputs relevant to the impact of climate change upon maritime security, the IDSA, CLAWS and the USI can address holistic land-based security.
4. **Vigorously involve the Private Sector**. India's private sector has deep stakes in adaptive and mitigating strategies designed to protect the investments made by it in national development. There are thus clearly business opportunities in each preventive, curative, mitigating and adaptive strategy. There is also much that can be gained from harnessing the carefully developed efficiencies that can exist within the private sector.
5. **'Brand-position' Climate Change in India's Collective Consciousness**. Without correct 'branding', the disruptive and adverse impacts of climate change upon the day-to-day lives of the citizenry will not garner the requisite public (and hence 'political') support. This branding cannot be sustained as a generalist approach by one or more governmental echelon/ structure and hence requires well-planned publicity and information-plan. It, therefore, requires a specialized professional/ agglomerate.
6. **Create a 'Climate-Change-and-Security Contingency Planning Group'**. The Government needs an inter-ministerial group — perhaps under the rubric of the NITI Aayog, or the EAC to the PMO, or the NDMA (National Disaster-Management Authority) — to evolve

contingency-based coping-and-adaptive strategies, plans, and responses to the security-impacts of climate change.

7. **Vigorously pursue the proliferation of OTEC-LTTD**. Given the high capital, running expenses and environmental issues associated with the Reverse Osmosis (RO), OTEC (Ocean Thermal Energy Conversion)- LTTD (*Low-temperature thermal desalination*) offers a highly viable solution to water-stress in India's Lakshadweep and Andaman and Nicobar Island chains, as also in specific areas along the country's East Coast. The proliferation of OTEC-LTTD plants lends itself admirably to capacity-building at a pan-regional level, especially in water-stressed Small and Developing Island States (SIDS) of the IOR and, must be incorporated as a major thrust line within an Indian geopolitical strategy, under the rubric of SAGAR and IORA.
8. **Build Adaptive and Coping Infrastructure in SIDS throughout the Indo-Pacific**. Heightened regional maritime demands for capacity-building and capability-enhancement in Small Island Developing States of the IOR and the South Pacific, as a function of the IPCC's climate change scenarios, offer an excellent opportunity for India to underscore its position as a net security-provider with particular emphasis on non-traditional security.
9. **Build Adaptive and Coping Infrastructure against GLOF-Events in Nepal**. The positive spin-offs of manifestations of Indian resolve in Nepal by way of coping and adaptive strategies against GLOF (Glacial Lake Outburst Flood) events are likely to be disproportionately large. If this is supported by a strong brand-building exercise, it would greatly help in countering the growing influence of China in Nepal.
10. Tasking of the maritime security forces. Task the maritime security forces (Indian Navy, Indian Coast Guard) to draw-up and submit to the PMO:
    a. Plans to meet the increased strain on its 'capacity' as well as its 'capabilities' due to the strong likelihood of frequent and more complex HADR missions, at both.
    b. A vulnerability-assessment and mitigation-options in respect of coastal (both naval and civilian) installations in the face of anticipated sea-level rise and increased storm-surges.
    c. A detailed assessment of the salinity-changes and the impact of these changes upon ASW surveillance operations, as also naval force-capabilities.
    d. A vulnerability-assessment and mitigation-options in respect of human migration, trafficking and IUU as a likely outcome of climate change.
    e. Plans to address heightened regional maritime demands for capacity-building and capability-enhancement in Small Island Developing States of the IOR and the South Pacific, as a function of the IPCC's climate change scenario.
11. **Ensure increased capacity and financing for adaptation**. Adaptation to climate change helps individuals, communities, organizations and natural systems deal with those consequences of climate change that cannot be avoided. It involves taking practical actions to manage risks from climate impacts, protect communities and strengthen the resilience of the economy. In practice, adaptation should be integrated with sustainable development and this requires both capacity and finance, which needs to be increased in the financial outlays of the country.
12. **Create a global consensus on the principles of equity and common but differentiated responsibilities**. Since right to sustainable development and eradication of poverty is considered a fundamental goal by SDG-2030, poor and developing countries need to be supported by the rich and the developed nations through the principles of equity and common but differentiated responsibilities, thereby needing to provide both finance and technology for achieving this goal.
13. **Updating technology in older equipment**. In order to be able to achieve a reduction in GHG, which is the main cause of climate change, need exists to spread and use new technologies and renewable energy in older equipment to make them more energy-efficient and eco-friendly. To support the cause, the government should:
    a. Encourage consumers and suppliers to use low carbon measures or to deal with low carbon economy.
    b. Enhance energy efficiency policy in power plants to reduce coal dependency and to improve national economy.
    c. Encourage players to set up new and more efficient and clean coal technologies program. This will help to achieve our 20 per cent CO_2 reduction target by 2020.
    d. Encourage fair and adequate public participation in decision-making and implementation.
14. **Creating a regional cooperative mechanism**. Mitigating the deleterious effects of the 'operational stretch' while

dealing proactively with the facet of climate change is, perhaps, best done through regional cooperative mechanisms, in which several countries can contribute, as has been seen from the experience of the United States Pacific Command (PACOM) in building upon the effectiveness of the humanitarian relief by the hospital ship, the USNS Mercy in the aftermath of the tsunami-earthquakes of 2004 (Indo-Pacific) and 2005 (Java, Indonesia). Subsequently, HADR missions, termed "Pacific Partnership" were successfully launched to provide succor and relief across the PACOM 'Area of Operations' (AOR). The USNS Mercy is deployed on these missions every alternate year, while the US Navy deploys an LPD in the 'gap' years. PACOM invites the militaries of all nations within its AOR to partner with it in these annual humanitarian missions. Similar constructs could be:

a. The Indian Ocean Rim Association (IORA) offers an extant and mature structure for the dissemination of political direction with respect to maritime HADR.
b. The Western Pacific Naval Symposium[8] (WPNS) and the Indian Ocean Naval Symposium (IONS) [9] provide the functional instruments through which such regional approaches can optimally be made within the Indo-Pacific.
c. IONS can provide a possible security structure for the maritime domain in the Indian Ocean.

Perspective towards Climate change

India

India has not been a significant contributor to climate change in the past, at present, or likely to be in the near future, as revealed by actual empirical data, and modeling results on future carbon intensities. However, India is among the worst sufferers of climate change caused by industrialized countries (Ghosh, 2007). In per capita terms, India's emissions of greenhouse gases are *one-third* of the global average and far lower than those of richer Western countries like the US or Asian peers such as China (Ebbighausen, 2017). But in absolute terms, it is one of the major emitters, accounting for over 4.5 percent of global GHG concentrations, behind only China, the United States and the 28-nation European Union bloc.

This debate on emission figures, notwithstanding, the topmost priority for India is economic development, poverty alleviation, ensuring energy security and developing infrastructure[10] for its people. Currently, nearly 600 million Indians do not have access to electricity and nearly 700 million use biomass as a primary energy resource for cooking. Ensuring a regular supply of clean energy is essential, for nurturing these priorities, meeting the millennium development goals and raising India's human development index. However, since all these imperatives require energy, it would lead to increased carbon emission and to ensure that the GHG emissions are kept under control is a challenge.

Since India is at the top of the list of nations expected to be worst hit by the adverse effects of climate change, it is striving to overcome the challenges posed by climate change. Hence, it has put the following in place:

1. A number of policies and measures to address both mitigation and adaptation and has prepared a *National Action Plan on Climate Change* (NAPCC) in 2008. This NAPCC has eight subsidiaries "Missions"[11] (see Figure 12); State Action Plans for Climate Change (SAPCC) at the State level with recommendations on how mitigation and adaptation could be mainstreamed into development

8 **WPNS Members**: Australia, Brunei, Cambodia, Canada, Chile, France, Indonesia, Japan, Malaysia, New Zealand, Papua New Guinea, Peoples' Republic of China, Philippines, Republic of Korea, Russia, Singapore, Thailand, Tonga, United States of America, Vietnam. Observers: Bangladesh, India, Mexico, Peru.

9 **IONS Members**: South Asian Littorals: Bangladesh, India, Maldives, Pakistan, Seychelles, Sri Lanka and the UK; West Asian Littorals: Iran, Oman, Saudi Arabia and United Arab Emirates. Bahrain, Iraq, Israel, Jordan, Kuwait, Qatar, and Yemen are yet to formally join; East African Littorals: France, Kenya, Mauritius, Mozambique, South Africa, and Tanzania. While Madagascar is an Observer, Comoros, Djibouti, Egypt, Eritrea, Somalia and Sudan, are yet to formally join; South East Asian and Australian Littorals: Australia, Indonesia, Myanmar, Singapore, Thailand and Timor-Leste. Malaysia is currently an Observer; Observers: China, Germany, Japan, Madagascar, Malaysia, Russia and Spain.

10 UNEP/GRID-Arendal, Norway, Mitigation and Adaptation information network for sustainable communities, Climates Changes mitigation in India. https://www.devalt.org/knowledgebase/pdf/CDM_Report.pdf

11 These missions are: National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a Green India, National Mission for Sustainable Agriculture, and National Mission on Strategic Knowledge for Climate Change

policy; and an "Expert Group on Low Carbon Strategies for Inclusive Growth" at the central level.

2. It has established the Indian Network for Climate Change Assessment (INCCA) in 2010 to publish peer-reviewed findings on climate change in India.
3. India is investing massively in renewable energy.
4. It is setting aggressive goals for the automotive market, with plans to allow the sale of only electric and hybrid vehicles starting from 2030.
5. Encourage development and use of Mass Rapid Transit Systems and improving the quality of available fuel.
6. Has been supporting the use and sharing of technology for solar energy with the tropical countries of the region as a founder member of the International Solar Alliance and as a 'globally responsible actor'.
7. Focusing on adaptation efforts that include (PIB, 2015):
   a. Developing sustainable habitats.
   b. Optimizing water use efficiency.
   c. Creating an ecologically sustainable climate-resilient agricultural production system.
   d. Safeguarding the Himalayan glaciers and mountain ecosystem.
   e. Enhancing carbon sinks in sustainably managed forests and implementing adaptation measures for vulnerable species, forest-dependent communities and ecosystems.

Figure 12: Eight subsidiary "Missions" of NAPCC

Despite all these efforts, India has long opposed signing any international moves aimed at imposing a cap on its GHG emissions, arguing that it would hurt its economic development and attempts to pull millions of its impoverished citizens out of poverty. India has repeatedly maintained that its per-capita emissions are lower than those of the advanced countries and that it bears little responsibility for the enormous rise in GHG emissions since the industrial revolution. In order to provide a way ahead, India has argued for the principles of **equity** and **common but differentiated responsibilities** for cuts in GHG emissions and has called on the rich, industrialized nations to support poor countries with US $100 billion (85.86 billion Euros) a year from 2020 to help cope with climate change. Another demand has been to provide green technology transfers from developed countries (Mazumdaru, 2017). In addition, India has declared the following quantifiable Nationally Determined Contributions (NDC) goals (GoI, 2006):

1. Reduce the emission-intensity of its gross domestic product (GDP) by 33 to 35 per cent (vis-à-vis 2005) by 2030.
2. Achieve 40 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030.
3. Create an additional carbon sink of 2.5–3 billion tons of CO_2 equivalent by 2030 through additional forest and tree cover.

Israel

The State of Israel recognizes the presence of global climate change and understands the need to prepare for this (ICCIC, 2014). The State of Israel is already acting to adapt to climate change, by reducing potential damage and exploiting the opportunities and potential benefits associated with climate change. Adaptation to climate change requires a national strategy and action plans between ministries. Willingness and adaptation are long-term processes that require commitment and flexibility to respond to emerging reality and to new information gained from ongoing research.

Organized and institutionalized management of a national climate change adaptation plan and leading technological innovations can lead to an economy to adapt to climate change, promote energy efficiency, green building, and the use of water technology and renewable energy. Currently, most of Israel's energy is produced by coastal power stations that presently use fossil fuel and requires clean seawater to

cool reactors. Some steps that Israel can look at to improve its maritime security in response to climate change are:

1. Develop adopted thresholds for pollution/ impacts at the local level.
2. Monitor entrance of ships with high air/ water pollution history.
3. Undertake research and dedicated development of scientific methods for better understanding the changes and impact of climate change, especially in the marine environment due to the geographical location of Israel.
4. Promote education and discussion of climate change and the environmental impacts of these changes.
5. Establish scientific data base-principles/ methodology of long term analysis of climate change.

As a small, densely populated country characterized by population and economic growth against a backdrop of land and water scarcity, Israel recognizes the importance of preparing for climate change. Israel is sensitive to the potential impacts of the phenomenon due to its location. Thus, it is making efforts to reduce greenhouse gas emissions, while at the same time doing everything possible to reduce the expected damage that would occur if climate change is not stopped (ICCIC, 2014).

The preparation of a vulnerability assessment to climate change and an adaptation plan to confront and minimize the risk is of vital importance to Israel, especially in issues related to the seaside. Therefore, in 2009, Israel's government decided to prepare a national climate change policy and action plan that includes both 'mitigation' and 'adaptation' measures. In the wake of the decision, an Israeli Climate Change Information Center (ICCIC) was set up by the Ministry of Environmental Protection in 2011 to compile the existing knowledge in Israel and abroad, to identify knowledge gaps, and to submit recommendations to the government on national and local adaptation measures. Based on the findings, an interministerial committee on climate change adaptation, which is headed by the Director-General of the Ministry of Environmental Protection, has finished its recommendations on a climate change adaptation plan for Israel, on both the national and local levels (ICCIC, 2014).

Protecting Israel's environment from the impacts of climate change requires regional and international cooperation. Therefore, Israel has partnered with regional and global organizations to better identify the impacts of climate change and to identify options for mitigation and adaptation. The important link between science and policymaking has been especially prominent within the framework of Climate Impact Research and Response Coordination for a larger Europe, in which Israel has been an active member. This regional network has been committed to funding research and sharing knowledge on climate impacts, vulnerability, and adaptation (ICCIC, 2014).

Cooperation between India and Israel to counter Climate change

The importance of global and regional coordination on security risks due to climate change cannot be overlooked. From the foregoing discussions, it is clear that the associated security risks due to climate change pose a multifaceted obstacle that does not fit neatly into any particular department portfolio and hence is not solvable by one country alone. This necessarily means that a cooperative mechanism between countries needs to be established that would allow some radical steps to be taken to counter the threats being posed by climate change. It is essential to mention that multinational programs incur transaction costs and resources beyond what is required in the national programs.

Though, India and Israel have different focus areas as far as the resulting threats from climate change is concerned, the need of the hour is 'global solutions' and not 'local solutions' as the challenge at hand is more global than local. Hence, collaborative mechanisms to counter climate change are essential. Scientific co-operation between the two countries in the field of climate change research needs to be encouraged in the field of sharing information, costs and efforts that can accelerate and facilitate technical change towards more favorable technologies for creating a more appropriate climate. A collaboration between the countries should also encourage governments to intensify their efforts, especially in supporting basic research and development in the field of climate change. Some areas of cooperation that are considered viable are:

1. **Cooperation in desalination**. Both India and Israel are water deficient nations and need to 'produce' water to meet the water requirement of their population. While Israel has made major advancements in developing Reverse Osmosis (RO) technology, India has developed a Low-temperature thermal desalination (LTTD) process for desalination. In order to make the entire process sustainable while moving away from the emission of GHG

both India and Israel need to cooperate to ensure the use and further development of LTTD/ OTEC technology not only for their own use, but also as a means of 'diplomacy' and for projection as 'a global responsible actors' (Maitreyee & Agarwala, 2019).

2. **Cooperation in solar energy technology**. India is a founder member of the International Solar Alliance with a mandate of promoting the use of solar energy as an alternative to carbon fuels for energy. Though the use of solar energy is increasing in West Asia (IRENA, 2019) and Israel (Leichman, 2017), there is a need for concerted efforts in supporting the development and establishing of solar-voltaic plants in these countries. A collaborative arrangement between Israel and India to take advantage of the International Solar alliance would only help the spread of the use of solar energy faster that would ensure that the production of GHG gases in these countries can be reduced. The technology can then be shared with other developing nations to make an impact on the overall GHG produced in generating electricity.
3. **Cooperation in other renewable energy sources**. Reduction of GHG is considered to be an essential step in limiting climate change as GHG affects all the other four 'climate certainties'. It is hence essential that both India and Israel cooperate in developing the necessary technology and studies in other areas of renewable energy that include wind energy, offshore wind energy, tidal power energy to name a few. This would furthermore help Israel to develop its wind energy farms at Golan Heights.
4. **Undertake joint studies**. Though geographically separated, the concerns of climate change are universal. While some of them can be addressed by creating awareness, others need academic and technical collaborations by means of joint studies that develop technology and recommend actionable and doable steps. These studies could provide the necessary inputs to policymakers and the stakeholders that include private and public entrepreneurs.
5. **Undertake joint workshops**. More often than none, the major problem with mitigation of issues related to climate change is lack of awareness, which can only be addressed by conducting workshops and lecture series for a spectrum of people. Towards this a series of joint workshops by the National Maritime Foundation (NMF), India and the Maritime Policy and Strategic Research Centre (HMS), Haifa, Israel, may go a long way in creating awareness amongst the stakeholders and the policymakers.
6. **Technological developments**. Increase technological developments between the two countries in the field of:
   a. *Observation* – For development, improvement and integration of observational systems to manage global and regional climate change.
   b. *Forecasting* – For an assessment of the usefulness of forecasts of future climate changes and their geostrategic consequences.
   c. *Confining* – For the development of scientific methods and tools of how to determine and to anticipate, recognize, avoid and manage global and local climatic changes and their impacts on maritime geostrategy.
   d. *Responding* – To determine what institutional, economic and behavioral changes can enable effective steps towards countries maritime sustainability.
   e. *Innovating* – To encourage innovation in developing technology, policy and social response tools to achieve sustainability due to climate change.

Conclusion

The foregoing arguments in regards to climate change and the effect it has on issues of *Human health, Water, Food, Economy, Infrastructure and Maritime Security* of the region have thrown many questions that need to be contemplated if not answered. The key question however is - how can the capacity to assess and respond to climate-related maritime security risks in the international system continue to be enhanced? Since neither the ownership of the problem, nor the solutions to the problem are simple, they need further introspection and debate. As the point of departure for the policy responses within a government or an inter-governmental organization is often unclear, it complicates the problem further. With the associated security risks due to climate change posing a multifaceted obstacle, that has relevance to more than one country, and at times to more than one working agency in a country, it is clear that climate change is not solvable by one country or one agency alone and hence demands collaboration.

With every passing day the urgency of action to be taken in mitigating the adverse security-impacts of climate change becomes more acute. We are rapidly approaching the point where our coping and adaptive strategies to ensure holistic security for our people will fall under the category of "too-

little-too-late". This is something that resurgent nations like India and Israel cannot afford. It is hence imperative that collaborative mechanisms between countries are explored. To do so, this article has brought out some such collaborative mechanisms between India and Israel and has highlighted some geostrategies of India to address the effect of climate change.

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