



Climate Change & **Security** in South Asia

Cooperating for Peace

GMACCC Paper n° 2 | May 2016



GLOBAL MILITARY
ADVISORY COUNCIL ON
CLIMATE CHANGE

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Key Messages:

Climate change could undermine peace and security in South Asia - a region which is already politically unstable and particularly vulnerable to further impacts. Rising temperatures, floods and irregular rain patterns will hit particularly hard in Bangladesh, India and Pakistan, and are expected to exacerbate livelihood insecurity in the region.

Climate-related natural disasters will cause unprecedented large-scale migration both within and from the region. In 2009 and 2010, unprecedented floods caused the largest displacements ever recorded in Bangladesh (almost one million people), India (1.5 million people in the State of Assam), and Pakistan (over 20 million people). Such displacement of people - both in-state and across borders - can cause severe pressures particularly where countries have historically been wary of their neighbours. To ensure stability in South Asia, countries need to proactively collaborate on a joint strategy for dealing with climate refugees - including the long-term legal implications for the region.

Water scarcity increases the likelihood of conflict between countries. Regional cooperation on water sharing will be key to peace and stability in South Asia. Glacier melt in the Himalayas, Karakoram and Hindukush will intensify as climate change accelerates, adding pressure to the rising water scarcity and depleting ground water resources in the region. While Bangladesh, India, and Pakistan already have some effective trans-boundary agreements in place - which guarantee effective resolution of disputes - the scope of such agreements must be revisited to address new challenges from effects of activities in the watershed of the Tibetan plateau.

Food insecurity can drive violent conflict between communities within a country. Longer summers and shorter winters are creating severe adaptation challenges for South Asia's agriculture sector, making it difficult for the industry to provide food to the 2 billion people home to the region. Without public and private investments in climate resilient agriculture, the lack of food supply could lead to (violent) conflict in the medium to long-term.

Military and humanitarian organisations will need forward looking strategies to deal with these impacts. Due to an increase in climate-induced disasters and humanitarian operations in this context, rising sea levels and related threats to military installations (including nuclear facilities), and their own carbon 'boot-prints', South Asian militaries will need to develop effective long-term climate adaptation and mitigation strategies to ensure damage control, quick relief and effective cooperation to restore/preserve stable conditions.

Environmental degradation is a major result of militarization of glaciers. India and Pakistan spend millions of dollars each year to have military presence in high glaciers such as Siachin, leading to human suffering and ecological degradation. In order to protect the glaciers and the environment, de-militarization of glaciers should be considered as an urgent action by all actors concerned.

New climate strategies will need to be evolved. These should cover areas such as disaster risk reduction and resource allocation and will need to be supported by investments in climate-proof infrastructure and agriculture which lift people from poverty. Bangladesh, India, and Pakistan have no credible working arrangement in place that promotes coordination between the three countries when a disaster such as a flood or earthquake hits a particular country. While climate conscious political leadership is vital, a cooperative disaster response framework is crucial. It is imperative that a robust and reliable mechanism for exchange of data (e.g. on water flows generally considered as 'sensitive data', temperature shifts, etc.) is established between the three countries - which could possibly serve as an early warning system for mitigation of disasters at a large scale.

Continuous dialogue is the key: The countries in the region need to set up a cooperative mechanism or specific forum to discuss common climate change issues and impacts more vigorously and beyond political limitations. New strategies will need to focus on cooperation and understanding between nations and institutions so as to drive long-term peace. The nature of the climate challenge urgently calls for regional collaboration in South Asia which surmounts political sensitivities. While South Asia has a long history of regional instability, continuous dialogue and cooperation on a common challenge as climate change can act as a catalyst for long term peace in the region.

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AP Photo/K.M. Chaudary - Pakistan army soldiers evacuate a baby in district Shorkot in Jhang, Pakistan, Sept. 2014. The Pakistani military stepped up rescue efforts as floods wreaked havoc in more districts of the country's eastern Punjab province, leaving hundreds of thousands of people homeless.

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1. Introduction

1.1. Emerging threats

The wider South Asia region, stretching from the Tibetan Plateau and the Himalayan-Hindu Kush mountain range southward includes the countries of Afghanistan, Pakistan, India, Bangladesh, Nepal, Bhutan, Sri Lanka and the Maldives - the countries of the South Asian Association for Regional Cooperation (SAARC). The region comprising less than 4% of the world's land area and home to more than 1.7 billion people representing 21% of the world's population is already one of the most environmentally challenged parts of the world.

With the impacts of on-going climate change, pollution of air, water and soils, depletion of ground-water, deforestation, over-grazing of grasslands, over-hunting of wildlife and over-fishing of marine resources, the environmental challenges are bound to increase, with potentially serious consequences for security, both human security and (eventually) also national security.

The impacts of climate change and other forms of environmental degradation are now accepted as non-traditional security threats in the security studies literature.

These threats emerge when it becomes difficult to solve competition over scarce natural resources such as fertile land, drinking water, shelter against weather events, hunting and fishing grounds, by cooperation. Failure may result in violent conflicts when a so-called zero-sum situation is reached, *i.e.* a situation in which cooperation on sharing a scarce resource is impossible or is considered to be impossible and when recourse to violence is seen as the only option to secure the use of the resource.

1.2. Structure and aim of the briefing

After a description of the main environmental characteristics of the South Asia region - also as impacted by climate change - and the drivers and perceptions of environmental security change within the region, this briefing focuses on the need and options for (diplomatic) cooperation on three geographical levels: transboundary river basin cooperation, regional cooperation and multi-lateral cooperation.

Then the signs and impacts throughout the region - of climate change in particular - are summarised followed by discussion of the consequences of these impacts which can lead to important security challenges.

The next section outlines some of the responses which are already being undertaken and needed at the national, bi-lateral and regional levels including with reference to the role of the military.

Finally, the paper concludes with recommendations for national action and for regional and international cooperation specifically for the security sector to address and, where possible, to prevent climate-induced environmental developments which might lead to security issues in and beyond South Asia. Mainstreaming climate change in the security strategies of the countries is a vital precondition for this cooperation.

1.3. Characteristics of the South Asia environment

From an environmental perspective South Asia is an incredibly diverse region: it stretches from the highest mountains in the world in the majestic ecosystem of the Himalayas to the lowest lying countries in the world, Bangladesh and the Maldives.

The Tibetan Plateau together with the Himalaya-Hindu Kush mountain range with its snow peaks and glaciers is also known as the "Third Pole", as it contains the largest amount of snow and ice on the planet after Antarctica and the Arctic.

This "Third Pole" is therefore also called the Water Tower of Asia with the rivers originating from its glaciers,



Figure 1: Major Rivers sourced in Tibet

mountain springs and lakes providing the water for the great rivers of Asia,¹ serving hundreds of millions of people, fauna and flora downstream, and guaranteeing water, food and energy security. For many, the rivers also have spiritual values.

Parts of the region are arid and susceptible to desertification, while in other parts there are still lush tropical rainforests with all their biodiversity. The Sundarbans, shared by India and Bangladesh, is the largest mangrove forest in the world and provides an essential defence of the coastal communities against the sea level rise which affects the environmental security of the coastal zone throughout the region.

In many places in South Asia groundwater depletion, which is often irreversible, will pose risks for water security in the (near) future.

Traditionally the monsoon could be counted on to bring rain to large parts of South Asia at predictable moments. It is now expected that the seasonality will change due to climate change leading to more precipitation extremes and risks of flooding in the coming decades, as has been extensively described in the 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).²

This will affect water security and territorial safety throughout the region with all the associated human and possibly national security impacts.

In the last decade Pakistan has moved from being a water-affluent country to a water-stressed country and elevated temperatures will increase evapotranspiration rates and will compound water shortages.

According to Matt Rodell and colleagues at NASA, beneath the densely populated cities of Jaipur and New Delhi, India, the groundwater has been disappearing as it is being pumped and consumed by human activities -- principally to irrigate cropland -- faster than the aquifers can be replenished by natural processes. They based their conclusions -- published in the August 20 2009 issue of *Nature* -- on observations from NASA's Gravity Recovery and Climate Experiment (GRACE).

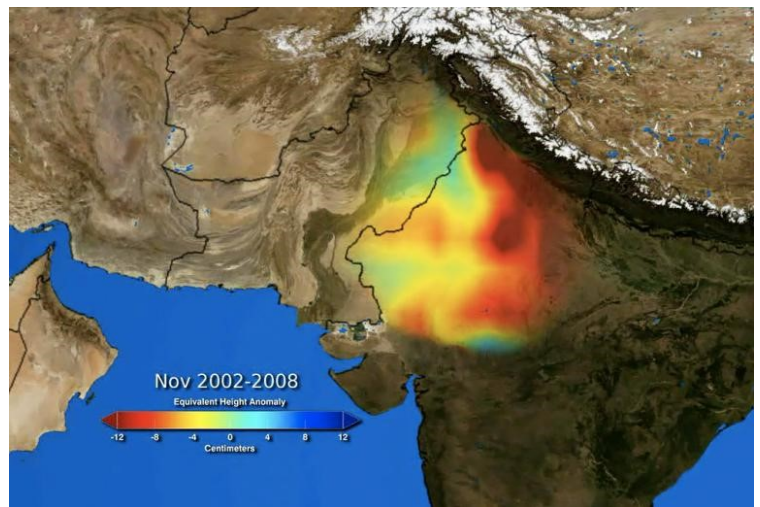
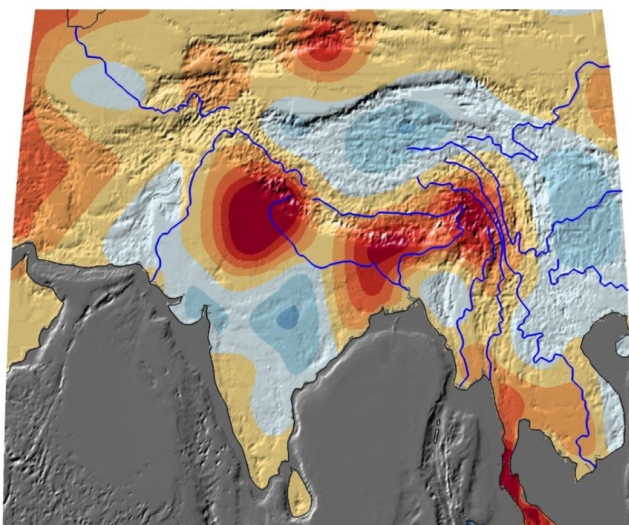


Figure 2: Groundwater Storage Variation in North Western India 2002-2008

The loss is particularly alarming because it occurred when there were no unusual trends in rainfall. In fact, rainfall was slightly above normal for the period (2002-2008). The map above shows that groundwater storage varied in north western India between 2002 and 2008, relative to the mean for the period. These deviations from the mean are expressed as the height of an equivalent layer of water, ranging from -12 cm (deep red) to 12 cm (dark blue).

NASA's GRACE satellites have measured losses of freshwater across large portions of South Asia. The map to the left provided by NASA's Jet Propulsion Laboratory shows cumulative total freshwater losses from 2002 to 2015. Groundwater depletion in India and Bangladesh has been a major factor behind those trends.

GRACE TWS trends: increases & decreases over 13 years (2002-2015)



Inches of water
-15 -12 -9 -6 -3 0 3 6 9 12 15

Figure 3: Vanishing Groundwater in South Asia 2002-2015

1.4. Drivers and perceptions of environmental security change

Changes in environmental security also in the field of climate are driven everywhere by basically three sets of factors:

- demographics (growth and composition of the population age-wise and rural vs urban),
- consumption patterns (life-styles including diets, private vs public transportation, etc), and
- the technology with which the consumer goods and services are produced, e.g. centralised coal vs decentralised solar, large-scale agriculture vs small-scale organic farms.

Demographics in South Asia can be summarised by the following quote from the Climate Change, Agriculture and Food Programme of the Consultative Group for International Agricultural Research (CGIAR):

“A large human population, continuing high rate of population growth, and poverty characterize South Asia. The region has shown tremendous progress in last four decades in food production and availability, yet 1/4th of the world’s hungry and 40% of the world’s malnourished children and women live here. The region is prone to climatic risks such as floods, droughts, cyclones, heat waves; and these are projected to increase in future”.³

Growing demand as a result from population growth, the need to abate poverty, changing life-styles with increasing urbanisation, confronted with a shrinking resource base, will bring environmental zero-sum situations in South Asia closer-by.

All actors - political, military, economic, academic and technological - will have to come together to analyse and discuss this threat in order to design and implement measures to prevent the violent conflicts, which will erupt when these drivers continue to operate unabated.

Part of these measures will also have to deal with the fact that the risk of resource scarcity has both an objective and a subjective dimension. Lack of insight in new technologies which may alleviate or delay scarcity may prompt the perception of an upcoming zero-sum situation and cause premature pre-emptive action.

Also, the perception that others competing for the same resource may not be willing to cooperate for fair sharing or the application of new cost-effective technologies may have a similar effect.

In this respect South Asia as a region - already prone to conflict between nations, between non-state actors and nations, and within non-state actors themselves and with its history of territorial issues, ethnic and religious differences - presents a complicated picture.

Conflicts colour perceptions, which may hinder solutions especially now that the additional variable of climate change aggravates the existing configuration of conflicts.

2. Levels of cooperation

2.1. Transboundary river basin cooperation

As several of the major river basins in South Asia are transboundary (Indus: Tibet, India, Pakistan; Kabul River: Afghanistan, Pakistan; Ganges: India, Bangladesh; Brahmaputra: Tibet, India, Bangladesh) regional cooperation on basin level is essential.

A special case here is Bangladesh which shares 57 rivers with its neighbours, of which 54 with India and 3 with Myanmar. With only the Ganges Water Sharing Treaty of 1996 in place, there is obviously a need for a comprehensive transboundary water-sharing mechanism to manage the distribution of water between Bangladesh and India.

As to the Indus basin there is the fortunate situation that there is a formal framework for cooperation between India and Pakistan as provided by the Indus Waters Treaty concluded in 1960 with a major role by the World Bank.⁴

Basically the Treaty gives control over the Eastern tributaries to India and over the Western tributaries to Pakistan and provides rules and institutions for the settlement of disputes, in which a prominent role is given to the Permanent Court of Arbitration (PCA), established in 1899 at the First The Hague Peace Conference and housed in the Peace Palace in The Hague. (In **Annex 1** the latest ruling by the PCA on the Kishanganga Hydro-electric Dam in the Indus tributary of the same name is summarised.)



Figure 4: Two Cheers for Indus Waters Treaty

The treaty is far from perfect as it is only about the division of waters and not about integrated management of the basin, but it has continued to operate despite several wars and is considered the best given the circumstances. Hence an analysis of the treaty cannot give it Three Cheers, but only “Two Cheers”.⁵

Improving and modernising the Indus Waters Treaty is necessary and negotiating and concluding similar treaties for the other river basins in South Asia is essential for environmental security in the region.

2.2. Regional cooperation

There are serious *lacunae* in the Indus Treaty: China, which administers the Tibet Autonomous Region where the Indus rises, is not a Party to the Treaty and has built a dam near Ladakh, which might be purely for electricity production and not for irrigation, so its impact downstream may be relatively low, but with growing demand for Indus water in India and Pakistan all actors affecting the flows in this basin have to be brought to the cooperation table.

This includes Afghanistan, administering most of the Basin of the Kabul River, which empties into the Indus in Pakistan.⁶

Formally involving China, is even more important when one considers the plans for hydro-electric dams in the Brahmaputra in Tibet and especially the infrastructure development to divert part of the waters of the river towards the Yellow River in the North-East of China which suffers from a severe lack of water for irrigation, drinking water, industry and navigation.

While there is discussion about the downstream impacts of these plans in India and Bangladesh – if indeed executed – the need for transparent consultation and effective cooperation with China on the management of the shared basins is obvious, with as possible ultimate goal the negotiation of a “Brahmaputra Waters Treaty”, modelled upon a modernised Indus Waters Treaty.⁷



Figure 5: Indus River Drainage Basin

2.3. Multilateral cooperation

If the global climate keeps changing, as it will because of the amounts of CO₂ already committed to the atmosphere, sea levels will continue rising, the Tibetan Plateau glaciers will keep on melting at an accelerated pace, the frequency of extreme droughts and floods will increase and temperatures will become unbearably high. The region of South Asia is one of the most vulnerable to the impacts of climate change in the world. As detailed in the section on security consequences below, global climate change, including factors from the region itself, affects environmental security with its impacts on human and national security in South Asia.

UN Framework Convention on Climate Change

Therefore, a crucial level of consultation and cooperation for South Asia - both internally and externally - is through the **UN Framework Convention on Climate Change** (UNFCCC or Climate Convention). All countries of South Asia are Party to the convention as is China which is so important for the region. All these countries – including India as well as China which are both major greenhouse gas emitters - with large sections of their populations and their environments vulnerable to the impacts of climate change, have over the past years actively participated in the negotiations during the Conferences of the Parties (COPs) of the convention, with the last COP 21 producing the landmark Paris Agreement in December 2015.⁸

In the COPs and associated technical meetings in between negotiators are able to continually take stock and discuss who is going to do what with respect to mitigation (reducing and preventing greenhouse gas emissions) and adaptation to existing and inevitable climate change - always as-

sessing how the losses and damages due to the impacts of climate change will be recognised and compensated by whom and how.

Intensive debates are on-going concerning financial assistance for countries in need of such assistance and about the transfer of technology to support mitigation and adaptation.

The importance of the interactions within the convention is greatly enhanced by the fact that it is underpinned by one of the best scientific bodies in the world, the Intergovernmental Panel on Climate Change (IPCC), presenting every five to six years a seminal report on the state of the climate, the impacts of climate change and the options for mitigation.

While binding commitments to achieve greenhouse gas emission reductions to reach the globally accepted goal of a maximum temperature increase of 2 Degrees Celsius compared to the pre-industrial level of 1750, could not yet be negotiated, the agreements of a binding nature on the formats and periodicity of reporting on emission reductions and on progress with the so-called Nationally Determined Contributions (NDCs) should not be under-estimated.⁹

These decisions should be a boost for regional consultations within South Asia, since such a global forum - with clear procedures, recognised by all Heads of State and the UN at the highest level, based upon the best of science and monitoring - should facilitate the convening of actors from various backgrounds, actors who, in principle, should share strong common objectives to accomplish peace, stability and sustainability in their part of the world.

One can imagine that think tanks from the security communities in the region can play a leading role here because of their insights in how to prevent conflicts in situations with mixed interests.¹⁰

A role for the Security Council?

While the Climate Convention would be a crucial framework for ensuring environmental security with its ramifications into the other dimensions of security in South Asia, one may also wonder whether there would be a (dedicated) role of the Security Council which did have climate on its agenda in 2007 and in 2011 and has since held several meetings on the subject under the "Arria Formula",¹¹ which allows Members of the Council to have informal exchanges with non-members and relevant personalities on selected subjects.¹²

While in 2007 from the side of the G-77 reservations were voiced about the Council "encroaching" upon a subject that would belong more to ECOSOC, the security dimension of climate change now has been recognised by many states as warranting discussions also in the Security Council.¹³

At a panel discussion in Paris on 13 January 2016 reflecting upon the COP21 negotiations and outcome, one of the authors of this paper asked Mrs. Laurence Tubiana, main negotiator under Foreign Secretary Laurent Fabius Presidency at the COP, where the security aspect of climate change should be discussed. She answered that it should be the Security Council, not the Climate Convention.¹⁴

The issue of migration - that other major cross-border phenomenon in the region - is not mentioned at all in the Paris Agreement of December 2015, while especially in South Asia environmental distress due to climate change will create pressure on populations to migrate to safer locations in search of livelihood. As population grows and more areas are degraded more people will be displaced.

For instance, a large number of environmental refugees could come to India from Bangladesh, thereby altering the demographic balance in the Indian states, overburdening the environmental carrying capacity and thus creating social tensions. Migrations would also take place from Sri Lanka, the Maldives and Nepal.

Within Pakistan, the 2010 floods resulted in the displacement of over 20 million people, many of them going to the urban centres, changing the dynamics there and very likely to trigger unrest countrywide.

Large-scale climate change-induced cross border migration will therefore add to already existing internal and external security complexities in South Asia. One should not forget that the region includes two nuclear powers, and has many interfaces with a third nuclear power, China, as described above. If South Asia indeed might be heading towards environmental zero-sum situations, it would be wise to put climate change also in relation to migration prominently on the agenda of the Council.

It would be the art of both the climate and the security diplomacy to bring both fora together: insights from the Convention into the impacts of climate change and into options of mitigation and the needs for adaptation will help in identifying the where and when of security issues. Vice-versa, discussion of these issues in the Council should help and motivate constructive negotiations in the Convention.¹⁵

3. Signs and impacts of climate change in the region

In the previous sections the climate and security issues facing South Asia have been addressed in a more general way to flag the need for cooperation on various levels, from the transboundary, within the region, to the global.

Here the leading signs and impacts of climate change in and on South Asia are described more specifically, leading to recommendations for the military and security sectors, the target audience of this paper.¹⁶

3.1. Rising temperatures

The World Meteorological Organisation reported on 21 March 2016 that “Many countries saw intense heatwaves. The most devastating ones in terms of human impact were in India and Pakistan. Asia, as a continent, had in 2015 its hottest year on record, as did South America”.¹⁷

In southern Pakistan in June 2015 about 2,000 people died from dehydration and heat stroke, mostly in Sindh Province and its capital Karachi,¹⁸ following a separate heatwave in India that killed 2,500 people in May that year.¹⁹ In the Indian States of Rajasthan, Punjab, Gujarat, Odisha and Bihar the death toll due to heatwaves from March to May *each year* has been on the rise in the last five years.

In April of this year (2016) in India, ground-based measurements recorded temperatures 4-5 degrees Celsius (8–10 degrees Fahrenheit) above normal. At least 300 people are reported to have died from heat-related complications during the month.²⁰

Former Director-General of the Pakistan Environmental Protection Agency, Asif Shuja, has mentioned the lack of sophisticated weather prediction technology as a contributing factor to such casualties. It is imperative that a mechanism for exchange of data (e.g. on water flows generally considered as ‘sensitive data’, temperature shifts, etc.) is established between countries – which could serve as an early warning system for mitigation of disasters on a large scale.

With inevitable further rising temperatures, urbanisation with cities being “heat islands”, and massive relocation to cooler parts of the region not a viable option, at least not on the short term, environmental and human security in urban areas where heatwaves strike most intensively, will be seriously challenged.

In the Indian State of Gujarat the Municipality of the commercial centre Ahmedabad, together with national and international scientists is preparing a Heat Action Plan, which should be helpful to find answers and build the urban tools to cope with these challenges.²¹

Temperature increase as such also has a direct impact on food security: a rise of 1° - 2° C would lead to considerably lower yields in wheat and rice in agriculture in India and Pakistan. Food security and poverty are of course closely related.

3.2. Extreme weather events

Closely related to the impact of rising temperatures is the increased incidence of extreme weather events in the form of hurricanes, tornados, blizzards, heavy rain and snowfall, floods, dust storms and droughts. They will affect South Asia more than any other region in the world, both because of its ecological vulnerabilities and its population numbers and densities.²²

Extreme weather events have been taking place in South Asia over many years. After low rain-falls in 2014 threatened food security in Pakistan, heavy monsoons rains and floods in September caused 367 deaths and destroyed over 1 million acres of cropland.²³ The floods also hit the Jammu and Kashmir states in India, killing 150 people.²⁴ India was that year also hit by Cyclone Hudhud in October causing deaths and destroying villages.²⁵

While one cannot postulate a one-to-one causal relationship between on-going climate change with its rising temperatures and extreme weather events and in 2016 also the El Niño impact being a factor, the 5th Assessment report of the IPCC and other studies show that anthropogenic climate change increased the likelihood of extreme weather events in 2014 and countries like Bangladesh, India and Pakistan are expected to remain among the 10 most affected countries by extreme meteorological events.

3.3. Glacier melting

Dramatic impacts of climate change in South Asia will be caused by the melting of glaciers and snow caps in the Tibetan Plateau/Himalaya-Hindu Kush ranges. In **Annex 2** an overview is given

of the glaciers in this region which produces the largest river run-off from any single location in the world. The rivers that drain these mountains influence the lives of about 40 per cent of the world's population meaning that 1.3 billion people could be exposed to risks of increased water shortages. An additional threat of glacial melting is Glacial Lake Outburst Floods (GLOFs) which can generate large flood waves in communities in the region such as in Nepal. Monitoring and early warning can prevent loss of life but damage to infrastructure can be significant.²⁶

The rivers are already prone to large regional and seasonal variations and tensions between upper-, mid- and lower-riparian countries will inevitably ensue.

Climate change-induced conditions have led to rivers and other sources not having enough water

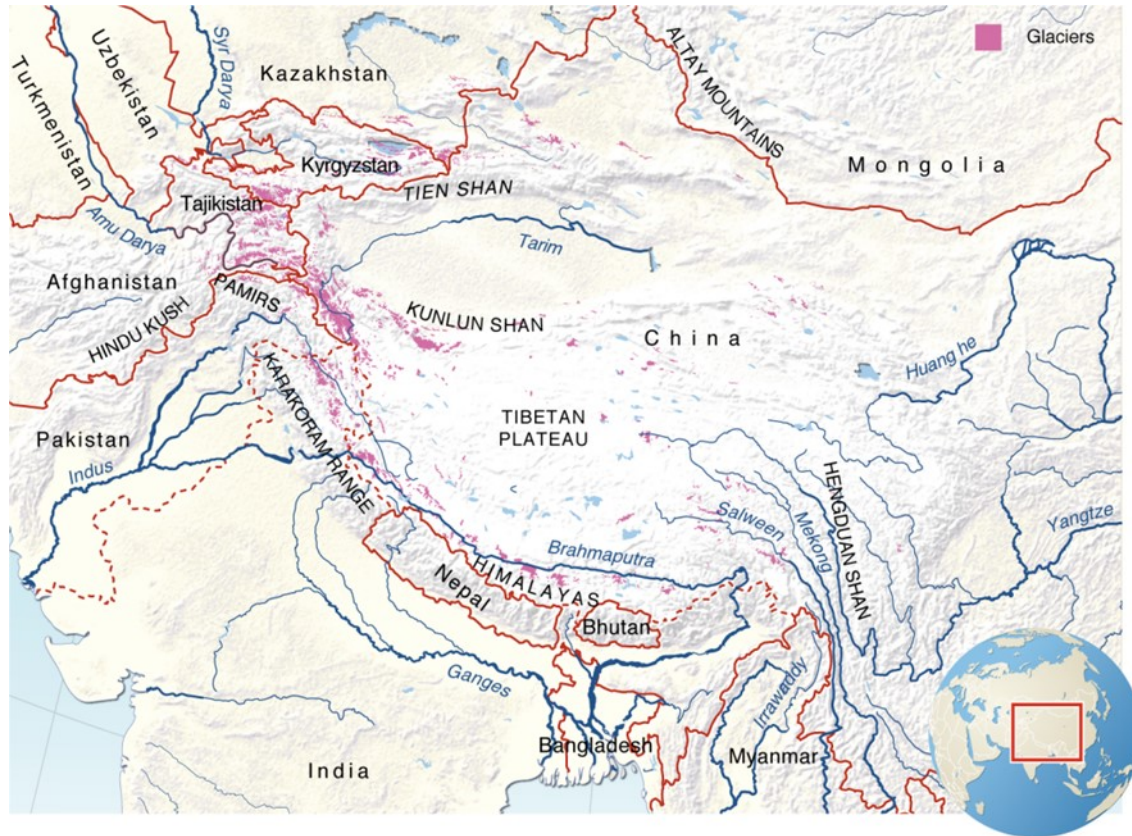


Figure 6: Rivers and bordering Mountain Ranges in Tibet

to supply the population; and this has prompted many Bangladeshis to depend more on groundwater, which has higher concentrations of arsenic. An article in *The Lancet*, a British medical journal, notes that half of the population of Bangladesh, up to 77 million people, have been exposed to arsenic contamination from water sources.²⁷

Recent articles, based upon refined measurements, speak of “dramatic loss of glacier accumulation area on the Tibetan Plateau” and the associated ranges.²⁸ The Brahmaputra and Indus basins may be most susceptible to reductions of flow.²⁹

As the “Third Pole” the plateau and the mountain ranges are subject to accelerated warming of the atmosphere above the poles, which is an accepted, but not yet fully explained observation. This will compound the water security downstream with all its ramifications in the other security domains in the coming period.³⁰

3.4. Sea level rise

Not only will the accelerated retreat of glaciers affect water security in the basins, it also contributes to that other serious impact of climate change in the region, sea level rise.³¹

The maps below show the projected impact of sea level rise in Bangladesh, for example. The loss of fertile land, the intrusion of salinity, and more frequent and intense cyclones hitting the sea side areas drives people away from the coastal zones. In Bangladesh it is mainly the capital Dhaka, receiving also these internal climate refugees – already amounting to 2,000 per day.³²

In the city the population is exposed to heatwaves (see above) and cities like Dhaka will also suffer from lack of adequate drinking water supply as their groundwater is being depleted.

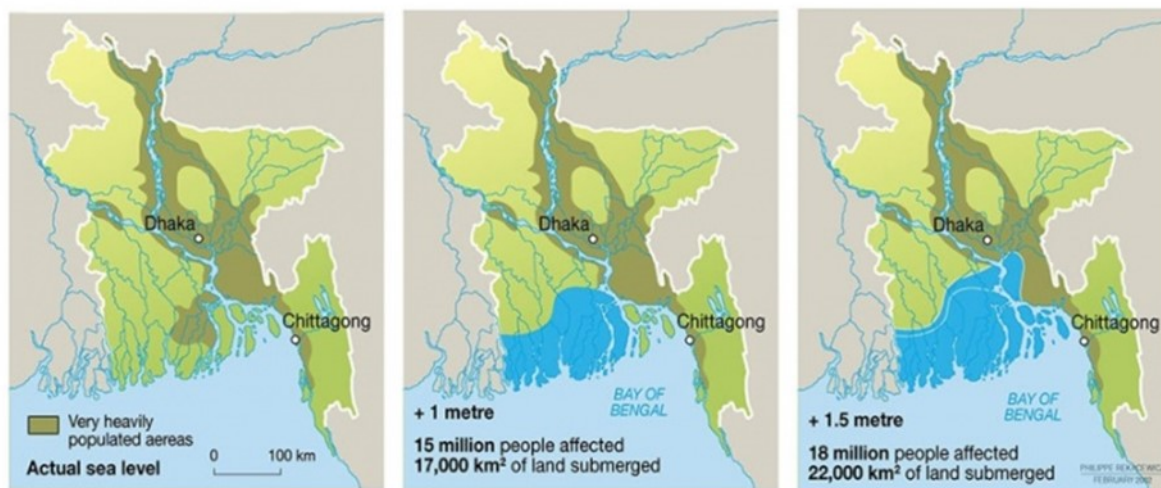


Figure 7: Impact of Sea Level Rise in Bangladesh

Those who remain in coastal areas have to walk hours more to get fresh water, reducing their availability to produce food.

The impacts of sea level rise will be felt from Balochistan in Western Pakistan to coastal regions of Myanmar in the East.

3.5. Infectious diseases

Rising temperatures and growing populations moving around on larger areas combined with ever increasing international traffic will contribute to the spread of infectious diseases.

In a 2013 paper by Sudhakar Patra of the Ravenshaw University Cuttack, Odisha, India, the author analyses the direct and indirect effects of climate change on human health through a complex set of interdependent interactions in South Asian Countries like India, Sri Lanka, Pakistan, Bangladesh, Nepal and Bhutan and provides techniques for management of and adaption to health related effects. The paper highlights changes in the pattern and distribution of disease spreading insects, virus, bacteria and increasing rate of deaths during previous decade due to greater frequency and severity of heat waves and other extreme weather events. Warmer and wetter conditions will lead to more vector-borne diseases like malaria, dengue and schistosomiasis fever and deaths. The rise in temperature and increasing frequency of heat waves will increase the incidences of illness and death in all South Asian countries. In India and Sri Lanka, the seasonal pattern of malarial transmission will change and the areas bordering the non-endemic wet zone are likely to become more vulnerable to malaria. The sub-tropical and warm temperate regions of Nepal will be more vulnerable to kalaazar and malaria. In Pakistan, long warm spells are likely to become more frequent due to increase in carbon dioxide. The mountain regions of South Asia will be more affected by temperature rise and climate sensitive problems.³³

3.6. Black carbon

A summary under the title *South Asia's Greenhouse Gas Footprint* including options to reduce emissions (mitigation) in line with development and poverty abatement needs is given by the World Bank.³⁴ Furthermore all countries have presented their iNDCs (intended Nationally Determined Contributions) to the COP21, the Paris Climate Summit in December 2015.³⁵

One of the major set of issues of great relevance to South Asia, is that of the short-lived climate pollutants, the hydrofluorocarbons (HFCs, which fall under the Montreal Protocol), black carbon soot, tropospheric ozone and methane. They may be short-lived, but are a much more potent global warming factor than CO₂ which is long-lived and stays for centuries in the atmosphere. If there is constant supply of these pollutants climate change will be accelerated and therefore they need urgent attention of the climate policy-makers and implementers.

While global warming must be the primary cause of glacier retreat, which is occurring on a global scale, observed rapid melt rates suggest that other factors may also be involved. To investigate the possible role of black soot in causing glacial melt, a team of scientists from Chinese research institutes extracted ice cores from five locations on the Tibetan Plateau. They found that black soot, which includes black carbon (BC) and organic carbon (OC), absorbs sunlight and can speed glacial melting if BC reaches values of order 10 ng/g (nanograms per gram) or larger. The ice core data revealed that BC reached values of 20-50 ng/g in the 1950s and 1960s for the four sta-

tions that are downwind of European pollution sources. BC and OC amounts decreased strongly in the early 1970s, probably because of clean air regulations in Europe. However, the ice cores also reveal that in the past decade BC and OC began to increase again, even on the Zuoqiupu glacier which is mainly subject to Asian sources. The data suggest that increased black soot arises from Asian sources, especially the Indian subcontinent.³⁶

The image below shows the source of black carbon deposits on glaciers in the southeast Tibetan Plateau (marked with a white square). Black carbon warms the atmosphere and increases melting rates when deposited on snow. By matching the colors on the image to the scale, researchers can determine the amount of black carbon from a particular region that travelled to the glaciers.

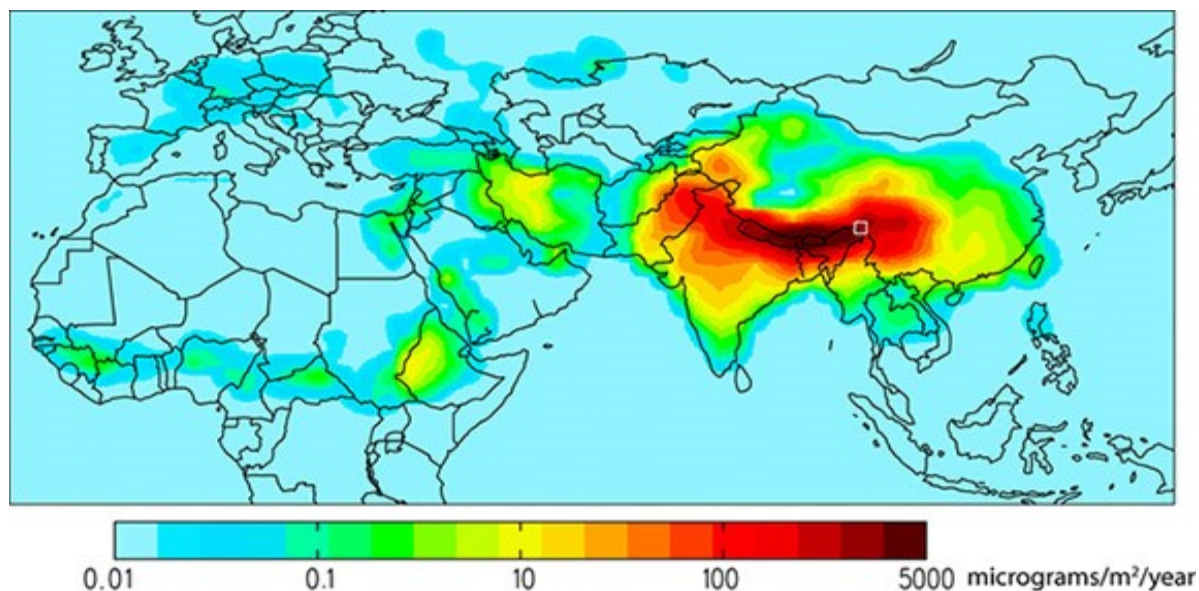


Figure 8: Sources of Black Carbon Deposits on Glaciers in the Southeast Tibetan Plateau

Flying over Northern India and the Himalayas the then Commander-in-Chief of the India Air force, Air Marshal Singh (Ret.) and his colleagues were among the first to flag the relation between black carbon generated by burning of postharvest agricultural waste and the soot deposits on the Himalayan glaciers adding to the melting process. Since, these processes have been intensively further researched.³⁷

The issue was flagged by Air Marshal Singh along with one of the other authors of this paper, Lieutenant General Tariq Waseem Ghazi (Ret.), former Defence Secretary of Pakistan, in their article in the Pakistan newspaper *Dawn* of 30 October 2015.³⁸

They refer to Prof V. Ramanathan at the University of California, San Diego, who calculates that cutting HFCs and other short-lived climate pollutants, including black carbon soot, tropospheric ozone, and methane, can slow warming by 0.6°C by 2050, compared to cuts to carbon dioxide, which also must be done, but which would slow warming by only 0.1°C.³⁹

As Professor Ramanathan, together with Jessica Seddon Wallack, wrote in *Foreign Affairs* already in 2009, the black carbon issue involving a more limited regional set of actors, should maybe not wait for global answers with the full Climate Convention, but could be negotiated on a shorter term as a regional subset of the UNFCCC.⁴⁰

In Paris the European Union organised a special side-event on the need to deal urgently with short-lived climate pollutants, pointing to the impact of black carbon on the Arctic and the Himalayas, but also highlighting the importance of these forms of air pollution to human and environmental health.⁴¹

For in-depth analysis, trends and policy options in the field of short-lived climate pollutants see the website of the Institute for Governance and Sustainable Development (IGSD), directed by Dr Durwood Zaelke in Washington D.C.⁴²

Climate Change and Security in South Asia

South Asian Association for Regional Cooperation (SAARC)

Territorial disputes

- Administered by China but claimed by India
- Administered by India but claimed by China
- Administered by Pakistan but claimed by India
- Administered by India but claimed by Pakistan

Disputed borders

 Cease-fire line or line of control between India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Climate change indicators

- Region where vulnerability to climate change is high to very high
- High density of melting glaciers and fragilized glacial lakes potentially dangerous for human communities downstream
- Climate change hotspot



Sources : IPCC; UNEP/Grid-Arendal; Environmental Change and Security Program, Wilson Center; World Rivers Review (WRR) 2009, 2010 and 2015; SAARC; IJSS; SIPRI; The Economist; Centre for Defence and Strategic Studies (CDSS), Australian Defence College (ADC), 2015; The Economic Times; The Times of India; The World Bank; Foreign Policy; Foreign Affairs; Asian Development Bank.

Disclaimer: to the extent possible guidelines of the Geospatial Information Section of the United Nations have been followed in the creation of this map. The boundaries, names and symbols on this map do not imply formal acceptance or recognition of them by GMACCC / IES.

4. Security consequences of the impacts of climate change for the region

The countries and peoples of South Asia – including Bangladesh, India and Pakistan – will be affected sometimes in similar ways and sometimes the consequences will be felt more strongly in different parts of the region.

4.1. Water security

The waters in the rivers in South Asia are showing large regional and seasonal variations, thereby affecting very large numbers of people across national boundaries. While upper riparian countries would have to contend with and explain the resultant negative effect on lower riparian countries, the mid riparian countries like India are in very precarious state as flow changes caused by upper riparian countries results in reduced flow. To illustrate, if China the upper riparian state, reduces water flow due to over-utilisation or diversion of a river such as the Brahmaputra, this would have a devastating effect on Bangladesh, the lowest riparian state. However, the tension would grow between India-Bangladesh and not China-Bangladesh, as India would find it very difficult to explain the consequences due to the lack of bi/trilateral transparent mechanisms of information sharing on river water levels/flows, between nations in the region. Similarly, any maladministration of unmanageable melting of glaciers on the part of an upper riparian country will lead to flooding down slope and again cause exacerbation of regional tensions.

As cited above, in the last decade Pakistan has moved from being a water affluent country to a water stressed country. South Asia as a whole will face high water shortage by 2060 if steps are not taken to conserve the water. Adding to the growing water shortage is the challenge of climate change. Future projections, presented in a recent UNDP study on Pakistan's climate challenge, show a "decrease in the glacier volume and snow cover leading to alterations in the seasonal flow pattern of IRS [irrigation water requirements]; increase in the formation and burst of glacial lakes; higher frequency and intensity of extreme climate events coupled with irregular monsoon rains causing frequent floods and droughts; greater demand of water due to increased evapotranspiration rates at elevated temperatures."⁴³

In India in the spring of 2016 armed guards had to protect dams in India to ensure fair division of the little water remaining. According to the press reports, "Desperate farmers from a neighbouring state regularly attempt to steal water from the Barighat dam, forcing authorities in central Madhya Pradesh to protect it with armed guards to ensure supplies".⁴⁴

Earlier in 2016 protesters in the Northern State of Haryana cut off the water supply by the SyL Canal to Delhi until their demands were met, showing the power of control over scarce natural resources.⁴⁵

4.2. Food security

In Bangladesh climate change could lead to loss of substantial tracts of cultivable land to the sea. This, together with increased salinity of soil and water, could threaten agricultural production. In addition, monsoon patterns have changed as a result of increasing temperatures, and this has already had a negative impact on food production, seriously threatening the livelihoods of many Bangladeshis.⁴⁶ Agricultural scientists predict that the impacts of climate change will cause Bangladesh's rice production to decrease by 8 per cent and wheat by 32 per cent by 2050.⁴⁷ Food such as vegetables, pulses and fish are also expected to be adversely affected by climate change and global warming.⁴⁸ Bangladesh is already highly food insecure: nearly 30 million women and 12 million children under 5 suffer from micronutrient malnutrition.⁴⁹ The growing pressures from the climate change-related impacts discussed here mean that these numbers are set to increase further.⁵⁰

In Pakistan climate change is likely to increase desertification affecting major areas over the next five decades. In the present context, Pakistan is suffering from food insecurity affecting about 48.7% of the population. Future climatic changes will not only impact food security but also the livelihoods of people in rural areas.⁵¹ As a result of decreased production of crops such as rice, wheat and cotton, thousands of farmers will be unemployed resulting in increased poverty and economic instability.

In India, after two consecutive years of weak monsoons drought has affected 330 million people in India this year, according to government figures.⁵² With no water for irrigation, the drought has been devastating for farmers who make up 68% of the country's 1.3 billion population. In the western state of Maharashtra, one of the worst-hit regions, 9 million farmers have little or no access to water.⁵³

The Indian State of Maharashtra is one of the worst-hit regions in terms of droughts and water shortages: 9 million farmers have little or no access to water.⁵⁴ Many therefore migrate to the capital Mumbai, where there are no homes or jobs for them and different local languages are spoken. This rural exodus is becoming a burden for authorities in Mumbai and it will aggravate tensions in the city.

India has called for SAARC countries to cooperate in addressing the impact of climate change on the farm sector adding that farmers in South Asia are fighting against economic disparity and instability, and SAARC countries should work jointly for the betterment of farmers and agriculture sector.⁵⁵

Food insecurity in South Asia will result in rising tensions. Due to lengthening summers and shrinking winters, the agriculture sector across South Asia is facing severe adaptation challenges. The region is home to almost one-fourth of humanity (2 billion people). The public and private sector need to invest more in climate resilient agriculture to meet increasing demand.

4.3. Natural disasters

Climate change and disasters are linked with national security. Disasters pose many threats and challenges to national security and stability. Sudden changes brought about by natural disasters increase the problems of the population in terms of deaths, non-availability of food, health issues, and the breakdown of law and order, etc. The population, in general, becomes restless with a lower tolerance threshold thus heightening conditions for conflict due to inequality, resource scarcity, social grievances, political tension and distortions.

Disasters also destroy political and social institutions, threatening political stability. This leads to increased competition over scarce resources, changing power equations between individuals, groups and organisations which can create conflicts and even internal anarchy. The earthquake in Guatemala in 1976 caused a wave of destruction in the rural mid-section of the country that eventually brought an abrupt and violent change of leadership from the 21-year old military government.

Similarly, the cyclone of 1970 in East Pakistan exacerbated existing grievances and tensions within the population leading to violent conflict and the emergence of Bangladesh. Thus, a major disaster is a potential threat multiplier and driver of conflict.

Scientific projections indicate that the region is particularly vulnerable to natural disasters – with an increased intensity expected in floods, landslides, sea-level rise, and cyclones. Pakistan, for example, has been massively affected by floods in the last five years. According to estimates by the Asian Development Bank and the World Bank the damage caused by the 2010 flood was estimated at approximately US\$ 8.74 billion to 10.85 billion which includes estimated costs for relief, early recovery, and medium-to long-term reconstruction.⁵⁶ Factoring in other costs and losses, government officials and other sources have estimated that the total economic impact may have been as much as US\$43 billion.⁵⁷

Several coastal areas remain under risk due to sea-level rise – which according to some assessments could amount to about 40 cm by the end of the 21st century. These assessments leave Karachi – Pakistan's biggest city and economic hub - highly vulnerable due to its location. Disaster events due to a changing climate will also affect transport and energy infrastructure throughout the region. Past experiences show that as a result of floods, roads and highways were badly affected. Irrigation systems as well as water reservoirs remain at risk due to lack of preparedness to deal with this challenge.

There is an urgent need to have a functioning mechanism for predicting and cooperating in response to regional disasters. For example, Bangladesh, India and Pakistan have no working arrangement in place that promotes coordination between countries when disasters such as floods or earthquakes strike.

4.4. Displacement and migration

Disasters also cause displacement often on a large scale. Massive floods caused internal displacement in India of 1.5 million people in the State of Assam (2009), nearly 1 million people in Bangladesh (2009) and over 20 million people in Pakistan (2010). Such movement of people internally or externally could contribute to severe instability in South Asia, where countries have long standing disputes and massive trust deficits. South Asian countries must deliberate upon the long-term legal implications of climate refugees to avoid potential conflict situations in the aftermath of a disaster.⁵⁸

The growing number of climate refugees is a major challenge for the region as a whole. As has

been discussed, the effects of climate change are interlinked. As ocean temperatures increase, sea level rises. This leads to huge loss of land mass, and higher soil salinity. The greater salinity destroys cultivable lands and threatens food security, forcing people to migrate for their own survival. This causes population density to increase in the available land, and leads to even more forced migration as well as the possibility of conflict during the migration.⁵⁹ Women and children are the most affected by these pressures.

In Bangladesh large numbers have been forced to leave their ancestral lands and homes because of radical changes in the environment and in climate conditions,⁶⁰ such as riverbank and coastal erosion, permanent inundation; sea level rise; and other environmental disasters.⁶¹ The IPCC warns that environmental disasters may cause many to become homeless in the near future, and that that will increase the number of climate refugees in Bangladesh.⁶²

The problem is made more acute by Bangladesh's small geographical size and huge demographic pressure. Given these, it is unlikely that the country will be able to absorb the large numbers that will be displaced. The Bangladesh government's national climate change strategy estimates that there will be more than 20 million climate refugees.⁶³ Independent studies give higher estimates: between 30 to 35 million based on the current population size.

Massive displacement of population such as due to floods mentioned above is not only going to change the dynamics in many urban areas but will also likely trigger unrest countrywide. World Bank estimates suggest that climate change could bring 62 million people below the extreme poverty line in the South Asia region by 2030, mostly due to agricultural impacts.⁶⁴

Obviously, it is essential that South Asia countries understand the causes and effects involved in such climate related security challenges and develop effective national, bi-lateral and regional strategies to address them.

Two attributes are central to any study of the impact of climate change on displacement and migration. First is the projection of population growth. As population increases and more areas are threatened by climate change-related impacts, disasters or environmental degradation, more people will be displaced.

The second is the rising sea level, increased frequency of droughts, and floods. It is obvious that a large part of climate change induced migration would ultimately get cloaked in the quagmire of economic terminology. After all, in comparison to the 'climate refugees' rhetoric on migration, the poverty induced migration is somehow more palatable to global policymakers. Is it because it is the bitter truth and no country is willing to accept it? No country in South Asia can boast of resources to be able to adapt to large scale migration from neighbouring countries.

Specifically, larger or more stable economies in the region will come under increasing pressures from such migrations, as populations move to seek better opportunities - creating new social and economic tensions in the host countries

The affect would not be limited to the relatively poorer nations in South Asia but would also be felt by the richer nations in South East Asia, Australia and even Europe. The poverty ridden people forced to migrate without legal means would resort to all sorts of dubious illegal methods and in the process fall easy prey to unscrupulous operators waiting to exploit them and coercing them to participate in terrorism, cross border smuggling and drug running. The influx of climate refugees cannot be stemmed by force giving rise to added security issues.

4.5. Environmental security

Climate change creates chronic economic problems including unemployment which can increase conditions leading to militancy, terrorism and organised crime, giving rise to fresh and aggravating the existing conflicts. As elaborated above, environmental distress due to climate change will create pressure on populations to migrate to safer locations in search of livelihood. For instance, a large number of environmental refugees could come to India from Bangladesh, thereby altering the demographic balance in the Indian states. Migrations will also take place from Sri Lanka, the Maldives and Nepal. Intense water sharing issues will arise between India and China, India and Bangladesh, India and Pakistan.

The question is: When will environmental stress, caused by climate change and/or other factors, lead to security challenges and (potentially) violent conflicts?

In the debate on climate and security and environment and conflict it is a cliché that there are many factors involved which determine whether environmental stress or scarcity⁶⁵ will lead to cooperation or to violent conflict or to any of the in-between situations on the continuum between these two "extremes".

If parties sharing a resource which is becoming under stress because of climate change have a tradition of living peacefully together and of solving common problems in a constructive way, co-operation to improve efficiency of irrigation schemes, rain water harvesting, reforestation to maintain local precipitation cycles, e.g. may prevent tensions over scarce water resources. If, on the other hand, parties have a history of territorial conflicts and are divided by ethnic and religious differences environmental scarcity may trigger violent conflict, by definition of course, if a *de facto* zero-sum situation has been reached as alluded to above.

Hereunder is a diagram by Homer-Dixon, called the 'Core model of the Causal Links between Environmental Scarcity and Violence'⁶⁶ is shown:

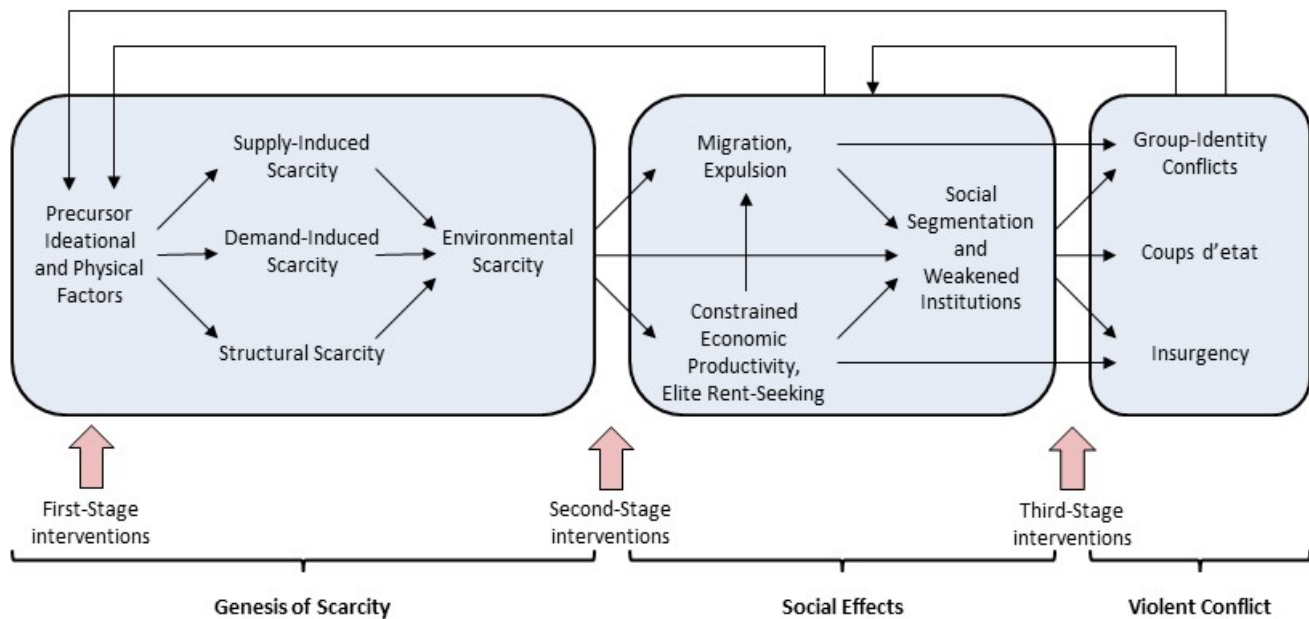


Figure 9: Core Model of the Causal Links between Environmental Scarcity and Violence

In this diagram poverty, so wide-spread in South Asia, is subsumed under “constrained economic productivity”.

It has been said that “poverty is the biggest polluter” as the poor have nothing but their immediate environment to exploit for their livelihoods. As the impacts of climate change will directly affect that environment by droughts, erosion, water shortages, there is increasing risk of over-exploitation, induced migration and growing stress on law and order, resulting in conflicts. The snake would bite in its own tail, if poverty abatement would go at the cost of e.g. forest cover, an essential element in adaptation against climate change.

5. National, bi-lateral and regional responses

5.1. National action

All the ramifications of climate change described above would undoubtedly test the resilience of governments to safeguard the lives of people. Leaders need to be aware of these dangers, steadfastly working towards reducing tensions so that the exacerbating circumstances of climate change do not act as the proverbial last straw. Fighting poverty will become increasingly difficult as the fall in agricultural productivity, increase in health pandemics, and inequalities contribute to the possibilities for social unrest. This has been increasingly seen over the last decade in various regions around the world. Use of technology and leveraging it to inform the people about the pitfalls of climate change is required at a much larger scale than what has even been envisaged so far. Confidence building between countries, using environment change adaptation as an effective tool should be substantially developed.

Each government needs to build an active information campaign aimed at internal and external stakeholders, explaining very clearly how climate change would adversely affect the quality of life for all. The campaign for external stake holders is very important or else the vested interests within the affected countries with easily available mass propaganda tools will spread canards leading to the creation of false impressions through misinformation / disinformation.

The role of track-II diplomacy in the arena of climate change can work wonders in avoiding climate change induced conflicts. Non-governmental institutions need to be provided with opportunities to work in this direction.

Open models of research and development are needed in the areas of agriculture, education and health. These are the areas that would require grass-root changes to cope with climate change and if these are not fast tracked, the potential to cause untold human misery and poverty induced conflicts will be greatly increased.

In countries where national adaptation plans of action to reduce the threat of climate change exist, these plans should be enhanced through comprehensive approaches designed to ensure sustainable development through poverty eradication and greater attention to the well-being of vulnerable groups, especially those living in coastal areas. Moreover, each country needs to develop or strengthen climate change strategies for the proper management of environmental crises – strategies which tackle the severe climate change-related impacts that could lead to crises.

In particular, governments need to not only recognise that the number of internally displaced persons is growing at an alarming rate as a result of the severity of the impacts of climate change; they also need to take the more necessary preventive steps such as the building of coastal polders and cyclone shelters for climate refugees. The governments also need to have rehabilitation plans for the displaced.

While nations across the globe increasingly agree on national security implications of climate change, many developing countries still merely treat climate change as an environmental issue. In South Asia countries it is essential to bring the subject of climate change into the main-stream of security discussions and comprehensive multi-sectoral planning is required. Some current national climate change policies leave out the impacts of large scale migration and internal displacement on national security. Planning should not only be left to the environment and climate change ministries but instead all major government institutions such as the ministries of finance, agriculture, energy, water and defence must work together to devise comprehensive and effective national strategies.

Developed countries, particularly European countries and the United States, have devoted considerable resources for research on climate change. It is important that South Asian countries reach out to them and benefit from available research. This information can be particularly useful in setting up effective early-warning systems and in addressing the need for climate resilient infrastructure.

5.2. Role of the military

As with other state institutions, the military forces in South Asia countries will face increased challenges as a result of climate change. Recognising the military's role in relief and humanitarian activities in response to disasters and the increased possibility of climate related disasters, it is vital that the armed forces in the region conduct re-assessments of their capabilities in various response scenarios and develop revamped Standard Operating Procedures (SOPs) for adapting to climate change. This should also include situations when national forces are asked to engage in international humanitarian operations.

It is essential that more resources are allocated for training of personnel and new equipment for such operations. The armed forces will have to upgrade their response strategy as well as their preparedness levels. All this will also require thorough planning for shifting existing and planning future infrastructures in a way that they are climate resilient and not impacted by extreme weather events themselves.

As a major contributor to GHG emissions, the military may be asked by the government to cut on emissions level. If this happens, the military will have to explore new innovative strategies to fill the gaps as a result of reduced access to certain materials/industrial resources.

In short there is a need to develop new climate change strategies and action plans for crisis management practices and new research on climate change and its impacts on the wider South Asian region. The military working with all other parts of government need to develop contingency and adaptation plans to meet the challenges of climate change induced situations.

5.3. Bi-lateral action

A good recent example of cooperation between two countries in South Asia on a shared natural resource which is of great importance to environmental and human security in the region is the plan by the Indian and Bangladeshi governments for joint action on the protection of the Sundarbans - as mentioned earlier, the largest mangrove system in the world - which safe-

guards the communities against sea level rise and cyclones, maintains spawning grounds for fisheries and also is a habitat for the Bengal Tiger of world-wide significance – all of which is why the area was declared a World Heritage Site.

The ecological balance of this mangrove forest and all its biodiversity is under threat by, amongst others, climate change.

The initiative to work out a joint management plan was taken at the COP21 at a side-event organised on 9 December 2015 by the Observer Research Foundation, with India's Minister of Environment, Forest and Climate Change, Mr Ja-vadekar and Bangladesh's Minister for Environment and Forest, Mr. Manju, as prominent guests.⁶⁷



Figure 10: Map of the Sundarbans

As the Sundarban Delta is situated on the border of India and Bangladesh where the Ganges, Brahmaputra, and Meghna rivers converge in the Bengal Basin, one may also hope and expect that cooperation on the management of the Sundarbans will extend to consultations on the more upstream transboundary basin issues where there is room for improved cooperation between the two countries.

A star on the horizon could be a tripartite Brahmaputra Treaty between Bangladesh, India and China, modelled upon a modernised Indus Treaty, brokered (again) by the World Bank and/or the Asian Development Bank, in which the three countries are prominently represented and which could also link river basin security to the development and poverty abatement needs in the region.

5.4. Regional action

Environmental cooperation should be the new rallying point between nations in South Asia as climate change would affect all, albeit in varying degrees of severity. The management of climate change-induced impacts has a clear regional dimension. South Asia countries need to work out improved or new cooperation plans and mechanisms for issues such as transboundary water sharing, disaster management and climate refugees.

Managing internal as well as cross-border migration is of special importance from a security perspective. Strengthening border management and cooperation to avoid flashpoints is critical with the case of the cooperative spirit between India and Bangladesh in the recent years setting a good example.

Much can be accomplished through increased regional cooperation focused on strengthening urbanisation tools and creating employment opportunities on a large scale. Economic co-development of the region is probably the only answer to avoiding a large scale human tragedy.

Climate change does not have any boundaries. Most countries in South Asia are highly vulnerable to the impacts of climate change thus making it a common challenge. A common challenge presents an opportunity for collaboration and cooperation. Initiatives can be taken by governments as well civil society and academia to exchange best practices and develop common solutions.

6. Recommendations for regional environmental cooperation to achieve security, stability and sustainability

To best structure cooperation solid mechanisms for environmental and climate **diagnosis** and **prognosis** on a regional basis have to be put in place.

In terms of **diagnosis** in the field of climate the periodic Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC), explicitly describes and diagnoses the situation of the various regions of the world, including South Asia, but with intervals of 4-6 years. Therefore the relevant climate parameters have to be monitored continuously as is the case for example with on-line data from NASA where CO₂ parts per million, global temperature rise since 1880, sea level rise, and the decrease of Arctic ice and land ice are displayed on a continuous basis. Monitoring of such data focused upon South Asia is essential for good diagnosis related to the region.

The South Asia Drought Monitoring System looks at precipitation patterns over time,⁶⁸ and on glaciers there is of course the World Glacier Monitoring Service with information on the glaciers including in Central Asia.⁶⁹

On sea level rise a new U.S./European oceanographic satellite, Jason-3, was launched in January 2016 which monitors sea level rise around the world, including of course South Asia.⁷⁰

With regard to **prognosis** of, for example, the impact of sea level rise on coastal zones one needs models like the one developed in 2012 by UNESCO - IHE, the Technical University of Delft, and the Dutch consultancy on water management Deltares.⁷¹

Specific Recommendations:

Recommendation 1: Establish a regional advisory council to regularly analyse climate change related security threats and make recommendations to governments, think tanks and civil society. Such a council could commission the preparation of a periodical – say, annual - consolidated report for South Asia bringing together all the sources of environmental security diagnosis and prognosis. The periodic reports should include a regularly updated inventory of South Asia national climate change strategies to help drive the exchange of information among governments on action plans as well as on key areas where bi-lateral and regional cooperation and coordination is essential.

Recommendation 2: The consolidated report should be a prominent input into the security and military scenarios as they are developed and updated by the various security think tanks and Ministries of Defence in the region, so as to see where and when conflicts may arise and to advise on preventative measures to be taken by governments, the private sector and civil society across a wide range effecting human and state security.

Recommendation 3: On the national level climate change should be mainstreamed in all national policies and actions. All major government institutions such as the ministries of finance, agriculture, energy, water and defence must work together to devise comprehensive and effective national strategies which tackle the severe climate change-related impacts that could lead to crises.

Recommendation 4: National strategies should also include information campaigns explaining how climate change would adversely impact the quality of life for all. National efforts should include those by academics and researchers, civil society and the private sector.

Recommendation 5: Military strategies in the region need to incorporate climate risks. Deployment needs to be adapted to respond to increases in climate-induced disasters and more frequent relief operations. Threats include rising sea levels and the resulting risk to military installations, including nuclear facilities.

Recommendation 6: Military activities which impact on the environment must be curtailed, e.g. India and Pakistan spend substantial sums each year to retain a military presence in high glaciers such as Siachin, resulting in ecological deterioration due to the accumulation of pollution from troops and equipment. In order to better preserve the glacier environment, de-militarization of glaciers should be considered as an urgent necessity by all actors concerned.

Recommendation 7: Continuous dialogue is key. Political disagreement must not prevent countries from holding dialogues on challenges as serious as climate change. **The countries in the region need to set up a cooperative mechanism or a specific forum on climate change.** Such a forum should seek to monitor the risk of and coordinate responses to disasters in the region. Data previously considered sensitive, such as on water flows and temperature shifts should be shared between countries in order to serve as an early warning system for mitigation of disasters on a large scale

Recommendation 8: Existing cooperative frameworks in the region such as the Indus Waters Treaty and the new cooperation on the Sundarbans, **should be strengthened and modernised** where necessary. They can serve as inspiration for similar arrangements elsewhere in the various countries.

Recommendation 9: South Asia countries should come together to prepare for the negotiations and decision-makings in the Climate Convention, the UNFCCC, which – while not the international body to specifically discuss the security aspects of climate change – is the most relevant international body to discuss the conditions for security from the climate perspective.

Recommendation 10: All concerned parties should recognize that, while South Asia has a long history of regional instability, **continuous dialogue and cooperation on a common challenge such as climate change can act as a catalyst for long term peace in the region.** If South Asia can achieve success in cooperation against this common and urgent challenge, it would be a model for other parts of the world.

7. Annexes

7.1. Annex I - Kishanganga Hydroelectric Project (KHEP)

by Shirleen Chin, IES

The Kishanganga Hydroelectric Project (KHEP) began in 2007 as part of run-of-the-river hydroelectric plan to divert water from the Kishanganga River, a tributary of the Jhelum River in northern Kashmir, to a power plant in the Jhelum River basin. With the completion date due some time in 2016, the dam is expected to be nearly 24 km long and will generate up to 330 MW of hydroelectric power. KHEP is developed by the Indian Government as part of its "Power for All" initiative and is one of the most important hydro projects in India today. However, Pakistan became worried about the adverse impacts of the flow of the Kishanganga River, which flows into its territory and meets the Jhelum River. Pakistan has a similar project downstream of the Kishanganga River called the Neelum-Jhelum Hydropower Plant.

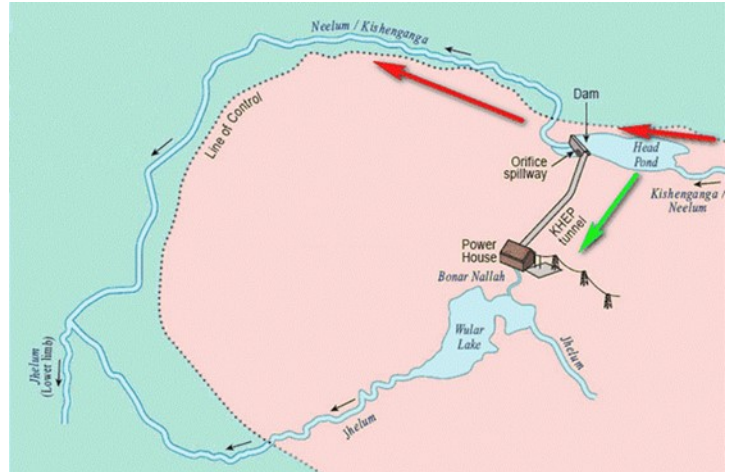


Figure 11: Kishanganga Hydroelectric Project (KHEP)

The Indus river basin originates from the Himalayan mountains in the north to the Sindh province in Pakistan in the south and into the Arabian Sea. On 19 September 1960, the Indus Water Treaty (IWT) was signed between India and Pakistan to distribute the share of the Indus rivers. The treaty came as a result of Pakistani fear that since the source rivers of the Indus river basin were in India, it could potentially bring about droughts and famines in Pakistan, particularly at times of war.

On 17 May 2010 (pursuant to Article XI and Annexure G of the IWT), Pakistan submitted a request for arbitration to the Permanent Court of Arbitration (PCA) located in The Hague, the Netherlands. Pakistan complained that India is violating the treaty in constructing the Kishanganga Hydroelectric Plant by increasing the catchment of the Jhelum River through diversion thus depriving Pakistan of its water rights. Prior to resorting to the PCA, both India and Pakistan have attempted to resolve the dispute bilaterally to no avail.

After a site visit to both the Kishanganga and Neelum-Jhelum projects, the PCA gave a partial award on 18 February 2013 where it unanimously decided that KHEP is a run-of-the-river plant within the meaning of the IWT. This meant that India may divert water from Kishanganga River for power generation. However, the PCA also decided that India is under the obligation to construct and operate KHEP in such a way as to maintain a minimum flow of water in the Kishanganga River. In its final award on 20 December 2013, the PCA determined that India shall release a minimum flow of 9 cumecs at all times into the Kishanganga River to maintain the environment downstream.

While access to the waters of the Indus Basin has always been a consideration in the conflicts between India and Pakistan and local water disputes have taken place after Partition in 1947, the Indus Waters Treaty (IWT) managed to prevent the water issue from becoming a primary cause of these conflicts, by referring disputes over water to technical and/or legal settlement bodies.

7.2. Annex II - The water towers of Asia

The water towers of Asia ⁷²

The Himalayas–Hindu Kush, Kunlun Shan, Pamir and Tien Shan mountain ranges (see figure 12 below) function as water towers, providing water to people through much of Asia. The glacier-fed rivers originating from the mountain ranges surrounding the Tibetan Plateau comprise the largest river run-off from any single location in the world. While the mountains are homes to some 170 million people, the rivers that drain these mountains influence the lives of about 40 per cent of the world's population. The rivers provide household water, food, fisheries, power, jobs and are at the heart of cultural traditions. The rivers shape the landscape and ecosystems and are important in terms of biodiversity.

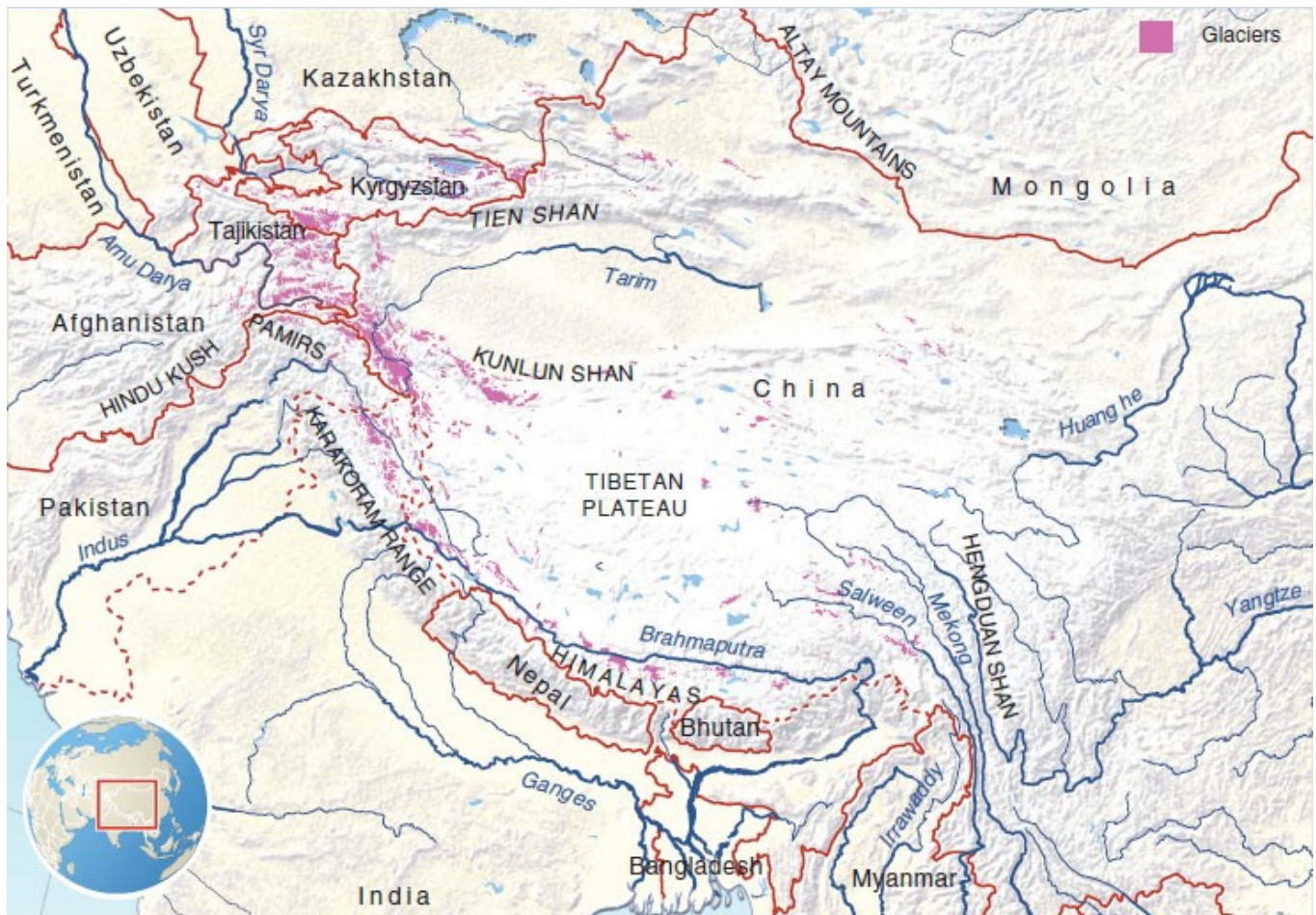


Figure 12: The Himalayas-Hindu Kush-Tien Shan-Tibet region.

While mountains traditionally have been considered the major water sources of the region, there is great diversity in the hydrological significance of mountains and glaciers for downstream water supply, particularly between the dry north-western region and the monsoon-influenced south-eastern regions. In spite of the vast water supply, seasonal water scarcity is a major issue.

Projections of glacier retreat in the region (based on IPCC scenarios) suggest that increases in the mean annual temperature for High Asia in the range of 1.0°C to 6.0°C (low to high estimate) by 2100 are likely to result in a decline in the current coverage of glaciers by 43 to 81 per cent⁷⁸. The Tien Shan and Qinling Shan are likely to become entirely devoid of glaciers, and glacial coverage would be greatly diminished in the Himalayas–Hindu Kush. The extent and amount of snow will also decrease as temperatures increase and the snow line moves to higher elevations. Given that some of the rivers, such as the Amu Darya and the Indus, receive nearly 90 per cent of their total water discharge from upper mountain catchments including glaciers and snow, the water flow in the rivers could decline perhaps by as much as 70 per cent if the glaciers disappear. In some cases, like in the Tien Shan, the rivers could become seasonal. Reduced water flow

in the dry seasons will lead to more and longer periods with critical shortages of water for transportation, drinking water and irrigation, with consequences for trade, small and large-scale agriculture and with increased potential for disputes over sectoral and regional allocations of this diminishing resource.

The impacts are not evenly distributed geographically or socially. High proportions of impoverished populations in the region are mountain and foothill dwellers. Impoverished populations have also largely settled in areas with high flood risk, such as low-lying urban areas and deltas – because there is often no alternative. The impacts are aggravated by the methods of meeting energy demands – traditional fuel sources such as fuel wood and animal dung account for 94 per cent of energy supply in some mountain areas in Nepal and Tibet. Because of this dependence on fuel wood and livestock, most watersheds have experienced deforestation and overgrazing, making the hillsides much more vulnerable to landslides, either during peak snowmelt or in relation to tectonic activity. Only 3 per cent of watersheds in the region are protected. High in the mountains, a rise in elevation of the snowline will lead to drying out of village grazing areas, eroding the basis of villagers’ livelihoods by reducing the carrying capacity of their surrounding lands. Even slight increases in severity and frequency of landslides and flash floods may significantly reduce the ability of herders to move and transport their livestock between grazing areas and to towns for sale.

The hydrological role of mountains, glaciers and snow is particularly significant for the Tarim, Syr Darya, Amu Darya, Indus, Ganges, Brahmaputra, Yangtze and Huang He (Yellow) rivers. With increases in seasonal floods and significantly reduced overall water flow, especially during critical times of low rainfall, about 1.3 billion people could be exposed to risk of increased water shortages:

- in China up to 516 million people;
- in India and Bangladesh approximately 526 million people;
- in central Asia, including the Xinjiang province of China, about 49 million people;
- in Northern India and Pakistan as many as 178 million people.

This only includes the populations living in the watersheds, not those affected by reduced crop production from failure to secure water for irrigation, or those affected more generally from

impacts on regional and national economies. The result of glacier loss is therefore not only direct threats to lives, but also great risks of increased poverty, reduced trade and economic decline. This poses major political, environmental and social challenge in the coming decades.

River	Basin km ²	Total population	% cropland	% forest	% basin protected	Hydrological significance of glaciers and snow for rivers
Tarim	1 152 000	8 067 000	2	<1	21	Very high
Syr Darya	763 000	20 591 000	22	2.4	1.0	Very high
Amu Darya	535 000	20 855 000	22	0.1	0.7	Very high
Indus	1 082 000	178 483 000	30	0.4	4.4	Very high
Ganges	1 016 000	407 466 000	72	4.2	5.6	High
Brahmaputra	651 000	118 543 000	29	19	3.7	High
Yangtze	1 722 000	368 549 000	48	6.3	1.7	High
Huang He (Yellow river)	945 000	147 415 000	30	1.5	1.3	High
Salween	272 000	5 982 000	6	43	2.2	Moderate
Mekong	806 000	57 198 000	38	42	5.4	Moderate

Figure 13: Overview of the major rivers in the Himalayas-Hindu Kush-Tien Shan-Tibet region.

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Air Marshal A.K. Singh (Ret.), President of GMACCC is former Commander in Chief of the Indian Air Force. New-Delhi based Air Marshal AK Singh is United Nations Environment Programme's special resource person on environment, Director of Environment and the Armed Forces Project of the Centre for Air Power Studies, New-Delhi, and consultant member of the Environmental Protection Agency, USA.

He received the prestigious National Honour, "The Mahatma Gandhi Service Award" for humanitarian services of exceptional order in 2005-06.

Air Marshal Singh was accorded international recognition in environment protection and awarded the 2010 US EPA Montreal Protocol Award.

In the course of his praiseworthy career he has conducted several emergency humanitarian operations such as those during the Tsunami in 2005, unprecedented earthquake 2005 and has been a key participant in high profile environmental summits organized by EPA, UNEP, GLOBE, Brookings, Wilton Park, London, NAC, Washington, President Global Military Advisory Council on Climate Change (GMACCC) of IES and invited to deliver the keynote address at Denmark Parlia-

ment, Copenhagen for Global Legislators Forum and European Parliament on Security implications of Climate Change. In addition, Air Marshal Singh has a number of published essays, a paper on "Green Army" and a book on Disaster Management, A book on 'Ozone Protection and National Security' A Military Perspective and contributed chapters for 'Technology Transfer For The Ozone Layer' Lessons for Climate Change.

During his service Air Marshal Singh was honoured with four Presidential Awards: VM – Gallantry (1989), Vishist Seva Medal (1999), Ati Vishist Seva Medal (2000), and Param Vishist Seva Med (2005).

Wouter J. Veening, trained as a political scientist and economist at the University of Amsterdam, Netherlands, spent all his working life in the field of environmental policy. Beginning as general policy advisor and speechwriter at the Dutch ministry of the Environment, he later became policy director of the Netherlands Committee for the IUCN (International Union for the Conservation of Nature), where he actively participated in the international dialogue concerning the environmental policies of the World Bank, the IMF, the Regional Development Banks, and the WTO, and helped to shape the environmental dimension of the EU development aid programmes.



The focus in these policy interactions was the protection and sustainable management of the tropical rainforests, especially the Amazon and its Northern segment, the Guiana Shield ecoregion -the most intact forest region in the world and as such of immense significance for the global climate, the global fresh water reserves and the biodiversity of the world.

In 2002 he co-founded the Institute for Environmental Security (IES), headquartered in The Hague, opposite the Peace Palace, to highlight the stability and security impacts of environmental change, to stress the role of international (environmental) law and international institutions to address environmental issues in a fair and effective way, and to reach out to the security sector to involve their capabilities in preventing environmental and climate change processes from developing into (violent) conflict situations, to minimise the military ecological "boot print", and to prepare for further humanitarian relief operations in response to the increasing incidence of extreme weather events resulting from climate change.

He frequently lectures at Clingendael, the Netherlands Institute for International Relations, for diplomats from South and South East Asia on environmental security topics in their region and in relation to global policy-making. He is also on the Advisory Board of the Planetary Security Initiative of the Dutch Ministry of Foreign Affairs.



GLOBAL MILITARY ADVISORY COUNCIL ON CLIMATE CHANGE

The **Global Military Advisory Council on Climate Change** (GMACCC) is a global network of serving and retired military officers, and associated institutions, committed to highlighting the potential security implications of a changing climate and advocating action, including by the military, to minimise the risks.

The GMACCC Papers

The members of GMACCC believe strongly that global policy makers need to take seriously the issue of Climate Change and Security. The case for action is woven together from responses to a variety of real world situations that they experienced in their active careers. Generalisations are insufficient to persuade governments to invest time and money in policy development in the relevant urgent time-scale. The GMACCC Papers are designed to deploy academic excellence, in the form of briefs that are succinct enough to be read by busy policy makers, to highlight which issues need either further research or immediate action.

This paper was preceded by the publication of the GMACCC briefing on the **Climate Change: Implications for Defence - Key Findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report** by Brigadier General (Ret.) Wendell Christopher King, PhD - Dean, US Army Command and General Staff College (June 2014) and by the briefing on **Climate Change & Security in Africa: Clear Risks, Nuanced Impacts** by Ashley McIlvain Moran, Yacob Mulugetta, and Clionadh Raleigh (Dec 2014).

These and other materials are available on-line at www.gmaccc.org



The **Institute for Environmental Security** (IES) is an international NGO established in 2002 in The Hague, in order to increase political attention to environmental security as a means to help safeguard essential conditions for peace and sustainable development. The IES set up GMACCC in 2009 as part of its programme on Climate Change and International Security.

For further information

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South Asia is on the front line in confronting the implications of climate change and addressing the consequences for security.

Climate change could undermine peace and security in South Asia - a region which is already politically unstable and particularly vulnerable to further impacts. Rising temperatures, floods and irregular rain patterns will hit particularly hard in Bangladesh, India and Pakistan, and are expected to exacerbate livelihood insecurity in the region

This report outlines the drivers and perceptions of environmental security change within the region, illustrates the signs and impacts of climate change for South Asia and discusses the consequences of these impacts which can lead to important security challenges.

The briefing – addressed especially to the security sector - also reports on what is already being done to address these challenges and concludes with specific recommendations for further action on the national, bi-lateral and regional levels where new climate strategies will need to be evolved.

Continuous dialogue and cooperation on a common challenge such as climate change can act as a catalyst for long term peace in the region.

If South Asia can achieve success in cooperation against this common and urgent challenge, it would be a model for other parts of the world.

