"Glacial Melt at the Third Pole: Perceptions, Geopolitics and Timing"

Research Article for Chatham House, November 2009

1. The loss of the Third Pole – the worst case scenario

The purpose of a worst case scenario is to set the stage for actions that avoid the risk or prepare for the aftermath and recovery. John Shellnhuber of the Potsdam Climate Impact Research Institute has an impressive visual representation of where the planet has, and will warm in the period 1950 to 2050. This shows the Hindu Kush/Himalayas/Tibetan Plateau (HK/H/TP) region, the so-called Third Pole, warming to 12ºc above pre-industrial levels by 2050. This implies higher than normal water flow as glaciers melt and are not re-nourished, followed by the near total loss of summer glacial melt water in the great rivers of Asia by 2035. The flash floods caused by the melting of the glaciers and the loss of summer river water will damage agriculture, impede development and cause political instability which would make Asia, rather than Africa, the prime victim of climate change. The loss of Tibetan permafrost, the disruption of the monsoon, the rise in sea-level caused by the loss of terrestrial ice and the increased incidence of earthquakes and landslides once the weight of the glaciers are gone will be a deadly cocktail.

2. Perception, Geopolitics and Timing

Given the scale of this worst case scenario and its impact on many Asian countries, it is surprising that the issue of glacial melt has not received more attention from policy makers. This paper will look at possible explanations for this absence of urgency, review some of the likely security implications, and consider policy options available now that might slow down the loss of the glaciers and their summer melt water.

To date there has been an absence of an agreed 'map'. Should the focus be national, Himalayan or Asian? Or should it embrace all the countries who will be damaged by the loss of glaciers? Each country in the region has its own perspective. For India, Tibet and Kashmir bring into sharp relief the tensions with China. Pakistan and Afghanistan tend to see water in terms of domestic politics, but should be considering the impact of water shortage on the war in both countries and its implications for policies such as replacing opium poppies with wheat. The Central Asian republics look at the dangers of melting-induced landslides disturbing Soviet era toxic waste and at the implications for cotton production. China obsesses about the stability of its agricultural population and contemplates diverting water from the Brahmaputra into the Chinese river systems. It regards its control of the Tibetan 'water tower' as a major resource. Laos, Cambodia and Viet Nam worry about the loss of water flow in the Mekong. Burma and Bangladesh consider the impact of glacially-induced flooding. Nepal and Bhutan look at the impact on their hydro-power resources. Few of them have yet been prepared to internationalize the issue or set it in the context of current climate change negotiations. Thankfully this is about to change with the 'Kathmandu to Copenhagen' initiative led by Nepal. This aims to find common ground between the regional countries and to establish a consensus that climate protection begins immediately.

Despite 30 years of effort, Environmental Security is still not trusted by policy makers as an operating principle of national and international defence. There have been 'false dawns' for the credibility of Environmental Security, which has often been damaged by over-claiming. Because it involved a mixture of disciplines, there have been the inevitable academic jealousies and contests for research funds. There remains tension between those who prefer 'Environmental Security' intimately linked to development policy and those who want to talk about 'Environment and Security' and make links to foreign and defence policy. The latter are accused of 'securitizing' the debate. This absence of consensus is referred to in the UN Secretary General's Report on Climate Change & Security, and by implication, is used to underplay inconvenient conclusions flowing from academic work.

In the absence of agreement on 'environmental security', there is tension between different academic disciplines and a failure to produce an integrated response. In the case of the Himalayas for instance, those concerned about afforestation, biodiversity, water flow and the living conditions of mountain peoples may take very different views. Indeed the discussion of water itself if split in to various academic silos. Expertise on water tends to be viewed in the context of river basins, and often does not

extend to the mountains and glaciers which feed the rivers. There is tension between those who specialize in ice, those who specialize in fresh water and the salt water experts concerned by sea level rise. The world needs the growing body of knowledge about glaciers and how they break up. However in the worst case scenario the expertise needed is not on ice, but on the absence of ice. Without an integrated discipline, it becomes difficult to challenge long held views. For example the assumption that countries do not go to war over water may be vitiated by the order of magnitude involved in the loss of the Asian glaciers.

The glaciers are in a region that is both inaccessible and militarily significant. Good photography from space exists, but sharing the data will involve sensitive discussions. The area contains a major war and a host of insurgencies. The wider area that would be damaged by the loss of water contains almost all of the security hotspots in mainland Asia.

With climate change, as with most policy challenges, timing is of the essence. Under an assumption of 'linear' climate change the military could comfort themselves that security-relevant damage was unlikely to take place before 2050. In recent years however we have been forced to recognize the reality of 'abrupt' climate change with damaging feedbacks. All the evidence is that, in the eloquent phrase of the scientists, the global climate system is 'squealing' (Nature, 3 September 2009). This is what happens to any system as it approaches an irreversible tipping point. We have probably past the tipping point on the Arctic sea ice. The Asian glaciers are the next in line, followed by the loss of much of the Amazon rainforest. Such 'squealing' is now so loud that it has forced its way on to urgent military agendas. The loss of the HK/H/TP glaciers would be not only the largest environmental security event in terms of its impact on humanity, but also the one most likely to trigger conflict. As we shall see, the scientists can tell us that glacial melt is happening. They cannot yet tell us with precision when we will start to lose the summer melt water. It could be 2035? It could be 2020? We should recall the original timing estimates for the loss of Arctic sea-ice which proved to be wildly optimistic. The relevant date for policy makers will inevitably be earlier than this. To date the political impact has been delayed by denial, however the military may want to apply the precautionary principle and advocate earlier intervention to protect strategically important water supplies in neighbouring countries. The general public in Asia is, as yet, unaware of the danger. Once they understand the threat, the political consequences will be immediate.

3. The Science

The Hindu Kush-Himalaya-Tibetan region has the largest concentration of glaciers outside the Poles. They feed many rivers, amongst them are seven of Asia's greatest rivers - Brahmaputra, Ganges, Huang Ho, Indus, Mekong, Salween and Yangtze. These rivers directly affect the lives of two and half billion people living in the river basins. Himalayan snow and glacial melt supply up to 50 per cent of the average flow of the major rivers in the region. For example, in the 'shoulder seasons', before and after precipitation from the summer monsoon, 70 per cent of the flow of the Ganges, Indus, Tarim, and Kabul rivers depend on Hindu Kush and Himalayan melt water. In Western China, glacial melt provides the principal water source in the dry season for 25 per cent of the population.[1]

Global climate change is hitting this region hard. The HK/H/TP glaciers are receding faster than the world average and are melting by 7 per cent annually. There are also local factors that exacerbate the warming caused by global climate change. Pollution from Black Carbon, the soot that results when people cook with wood, crop waste or dung, is a major contributing factor. It causes warming in two ways. First, Black Carbon in the atmosphere absorbs solar radiation, which heats the surrounding air; second, surface deposition of airborne Black Carbon can darken snow and ice and accelerate melting.[2] In the Himalayan region, Ramanathan and Carmichael estimate that solar heating from Black Carbon at high elevations may be as important as CO_2 for melting snow and ice. Their model simulations indicate that approximately 0.6℃ of the 1℃ warming in the Tibetan Himalayas since the 1950s may be due to

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[1] Xu Jianchu, Arun Shrestha, Rameshananda Vaidya, Mats Eriksson, Kenneth Hewitt, "*The Melting Himalayas. Regional Challenges and Local Impacts of Climate Change on Mountain Ecosystems and Livelihoods*", ICIMOD Technical Paper, Kathmandu, June 2007, p. 2

[2] Forster P, et al., "*Changes in atmospheric constituents and in radiative forcing*", in Climate Change 2007: The Physical Sciences Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, eds Solomon S, et al. (Cambridge Univ Press, Cambridge, UK), pp. 129–234, 2007.

atmospheric Black Carbon.[3] The burning of crop residues in the spring in Pakistan and western India is transported to the mountains by the monsoon. In the summer, dust from regional deserts to the north blows towards and up against the slopes of the Tibet Plateau forming high altitude layers of dust that absorb and reflect sunlight.[4]

The Gangotri Glacier in India, for example, which is the main water source for the 500 million people living in the Ganges River Basin, has been shrinking by 23 meters a year. This glacier has been receding for at least 100 years, but the process has doubled in speed in the last few years.[5] Unfortunately pictures of glaciers receding up valleys give no sense of the consequences of total loss. They can all too easily look like interesting tourists' snap shots.

The IPCC Fourth Assessment Report states that there is a high measure of confidence that in the coming decades many glaciers in the region will retreat, while smaller glaciers may disappear altogether. With a 2ºC increase in temperatures, by 2050 35% of the present glaciers will disappear and run-off will increase, peaking between 2030 and 2050.[6] The IPCC projects that the surface area of Tibetan Plateau glaciers will shrink to 100,000 km^2 by 2030 from 500,000 km^2 in 1995.[7] The Institute of Tibetan Plateau Research in China estimates that under current trends two thirds of the plateau glaciers could disappear by 2050 and recommends reducing BC as a priority.[8]

The melting glaciers have already started to leave behind dangerous glacial lakes, in which melted water ponds behind a dam of debris left by the retreating ice tongue. This collapse can cause disastrous and sudden "outburst" floods. Scientists have identified 34 such glacial lakes on the northern slopes of the Himalayas, and 20 outburst floods have been recorded in the past 50 years.[9]

The risk of floods, though, is but a short-term danger far exceeded by long-term issues. Experts warn that environmental deterioration and water shortages will threaten the livelihood of Asian people and have an irreversible impact on the global climate. In the long run, once glacial lakes have vanished, dry-season water supply will dramatically diminish and food production as well as economic growth will be negatively impacted. Infrastructure, such as hydropower plants, roads, bridges, and communication systems, will be either destroyed or rendered useless. Entire hydropower generation systems established on many rivers will be in jeopardy. What is worse, the situation may appear to be normal in the region for many years to come, even with increased amounts of water available to satisfy dry season demands, before a sudden cessation when the glaciers disappear.

The Hindu Kush-Himalaya-Tibetan Plateau is the 'regulating area' for the climate of China and much of Asia. Glaciers and snow cover play an important role in Earth's radiation budget. In summer, the vast highlands in Asia heat up more than the Indian Ocean, leading to a pressure gradient and a flow of air and moisture from the ocean intensifying the Indian monsoon. This pressure gradient is changing owing to loss of glacial and snow cover in the Greater Himalayas, affecting the pattern of the monsoons.[10] The dry season will become more arid, and the rainy season will see higher precipitation levels within shorter time intervals. The loss of HK/H/TP ice and snow will also have still-unknown, effects on global sea-level rise. The IPCC's conservative average sea-level rise estimate does not

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[3] Ramanathan V, Carmichael G, "*Global and regional climate changes due to black carbon*", NATURE GEOSCIENCE Volume 1, pp. 221–227, 2008.

[4] Jane Qiu, "*The Third Pole*", NATURE Volume 454, Issue 24, pp. 393-396, July 2008, p. 394

[5] Linden Ellis, "*Climate Change, Water, and the Himalayas*", Summary of the conference held in San Francisco by the Woodrow Wilson Institute on November 05, 2008

[6] Arun Bhakta Shrestha, Mats Eriksson, Xu Jianchu, "*The changing Himalayas: impact of climate change on water resources and livelihoods in the greater Himalayas*", ICIMOD, Kathmandu: January 2009, p. 9

[7] Cruz RV, et al., "*Asia*", in Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, eds Parry ML, et al. (Cambridge Univ Press, Cambridge, UK), pp. 469-506, 2007.

[8] Qiu, *supra* note 4.

[9] Ibid, p. 395

[10] J. Xu, R.E. Grumbine, A. Shrestha, M. Eriksson, X. Yang, Y. Wang, and A. Wilkes, "*The Melting Himalayas: Cascading Effects of Climate Change on Water, Biodiversity, and Livelihoods*" Conservation Biology, Volume 23, No. 3, p.527

account for such loss of terrestrial ice. Recent research projects a minimum average rise of 80 cm by 2100.[11]

Projected shifts in Tibetan Plateau ecosystems may also cause the near-complete disappearance of permafrost with the potential effect of releasing much of the region's soil carbon. Permafrost plays a vital role in protecting the ecological environment and hydrological cycles, but it has been breaking down during the past 50 years. Degradation of permafrost will endanger the plateau's alpine ecosystems, which rely on permafrost to trap water in the topmost layers of soil to allow plants to thrive at an altitude that would otherwise be too hostile for them. "A large-scale thaw of permafrost would result in the loss of its water content and trigger an ecological catastrophe," says Ouyang Hua, deputy director of the Institute of Geographical Sciences and Natural Resources Research in Beijing.[12] As permafrost stores one-third of the world's soil carbon, vegetation loss would lead to a huge amount of carbon entering the atmosphere, exacerbating global warming.

4. Glacial Melt and Security

This review makes no claim to specialist knowledge of the security issues in the countries discussed, rather it should be seen as an appeal to the experts to include the impact of glacial melt in their analyses.

a. India

India is central both geographically and politically to water issues in Asia. The work of Ramaswamy Iyer (Water in South Asia: A Tour d'Horizon) gives a magisterial summary of the history of water issues in Indian culture and politics. He points out that the issue is bedevilled by the ambiguity of the Indian Constitution and the overlapping competencies of federal and State authorities. The problems of loss of summer melt water will add considerably to the traditional problems of Indian water politics. He recounts the many difficulties that India has had with its neighbours on water issues.

Brahma Chellaney, Professor of Strategic Studies at the Center for Policy Research in New Delhi, regularly highlights the strategic significance of water in Sino-Indian affairs and underlines the significance of the role of the military in cutting through the political complexities of the issue.

The new Indian Environment Minister, Jairam Ramesh, announced in August 2009 his decision to talk to the Chinese about monitoring the Himalayan glaciers. It remains to be seen how this relationship will develop in the months ahead of Copenhagen.

b. Pakistan

90 per cent of Pakistan's agricultural irrigation depends on rivers that originate in Kashmir. The Indus Irrigation Scheme in Pakistan depends 50 per cent or more on run-off originating from snow melt and glacial melt from the eastern Hindu Kush, Karakoram, and western Himalayas. Until now, the glaciers in the Himalayas have naturally regulated Kashmir's waters. This water comes from three of the six tributaries that India and Pakistan split in their 1960 Indus Water Treaty. The Treaty has so far survived three major wars and nearly 50 years of hostile exchanges. Lack of water is already undermining Pakistan's stability. In recent years, recurring shortages have led to grain shortfalls. In 2008, flour was so scarce it became an election issue. The government deployed thousands of troops to guard its wheat stores. As the glaciers melt and the rivers dry, this issue will only become more critical. When Pakistan is no longer receiving enough water under the treaty provisions to sustain its own population, it is likely that Islamabad will challenge the agreement. The potential for serious conflict over the Indus waters is high.

A possible worst case climate change-induced conflict scenario might involve the three regional nuclear powers (China, India & Pakistan) and the full or partial failure of the Pakistani state. Such a conflict might bring in other countries on one side or the other. Even without certainty over the details of climate change impacts on Pakistan to 2030, it is clear that climatic stress will intensify Pakistan's pervasive instability. A failure of central military authority could result in Pakistan breaking up into its

[11] Ibid.

[12] Jane Qiu, "*The Third Pole*", NATURE Volume 454, Issue 24, pp. 395

constituent ethnic and regional sub-units. The inability of the Pakistani government to cope with climate change-induced challenges would increase support for radical solutions such as Taliban-style fundamentalist movements or prompt a generalized insurgency.

c. Afghanistan

As long ago as June 2003, the UN Special Representative of the Secretary-General for Afghanistan, Lakhdar Brahimi, pointed out that the water issue was more than an environmental problem in Afghanistan. "Water is, perhaps, the most precious resource in Afghanistan, and so it can be a source of conflict." Brahimi, observing that much of the conflict in the country was the result of land disputes, said "Land rights do not mean much without water rights". He stressed that one of the most important tasks facing the country was to impose order and the rule of law over land and water rights. The water problem is aggravated by the increase in demand as a result of a fast growing population and the decrease in supply, caused by decline in precipitation, destruction of irrigation works and deforestation. Water scarcity favours the cultivation of opium poppies rather than wheat as they require much less water. A sound agricultural base is a key condition for a durable peace in Afghanistan. The country used to produce 8 per cent of the world harvest of dried fruits e.g. peaches, apricots and pistachio nuts of high quality. Many of the drying sheds and the traditional subterranean water channels, the *kareshes* were destroyed by the Soviets.

In addition to the internal destabilising influence of water stress, there is an international dimension. Pakistan receives water from the Kabul River and Iran does so from the Helmand river. Regional tensions will increase if Afghanistan draws more water from these rivers. Given that Western forces expect to be in Afghanistan, on one basis or another for the next forty years, they will presumably be studying the impact of glacial melt on conflict in both Afghanistan and Pakistan.

d. Central Asia

Central Asia is rich in water resources, however, more than 90 per cent of the water is concentrated in Kyrgyzstan and Tajikistan, where the region's two main rivers, the Syr Darya and the Amu Darya, originate. Uzbekistan and Kazakhstan are the region's main water consumers, with Uzbekistan alone consuming more than half of the region's water resources, largely for agriculture. Kyrgyzstan and Tajikistan control the water needed by the other Central Asian states and view water as a means of strategic influence. Since the dissolution of the Soviet Union brought an end to the decades-old centralized system of water management, competition for water has been increasing in Central Asia. Combined with interstate tensions over disputed borders, competition over the region's energy resources and internal instabilities emanating from rising poverty, authoritarian rule and religious extremism, water disputes already have the potential to tip the region into conflict.

Many climate experts believe that the Central Asian climate will significantly warm up, resulting in major environmental, economic and social disruptions. Glaciers are already shrinking. From the 1950s to the 1990s, the Pamir-Alai glaciers lost 19 per cent of their ice, with the process now gaining in intensity. For several decades, the area of glaciers in the different regions of Tien Shan, Gissaro-Alai, Pamirs, Dzhungarskiy and Zailiyskiy Alatau have been shrinking. According to some predictions, the availability of summer water in the Syr Darya will decrease by up to 30 per cent and in the Amu Darya by up to 40 per cent. Increasing occurrence of droughts and decreased grain productivity are also widely predicted. Field data indicate that significant changes in the seasonality of glacial flows have already occurred as a result of warming[13]. While rising temperatures may provide short-term benefits for the region's lucrative cotton industry, the lack of ample irrigation will ultimately doom the cash crop.

On average, glacial melt contributes 10-20 per cent of the total run-off in Central Asia. During dry and hot years, the input of glacier water into summer river flow can be as high as 70-80 per cent, compared

[13] Changes in the climatic and hydrological process in the mountains of Kyrgyzstan and Tajikistan are well documented and indicate a steady increase of precipitation during the past decades, but also a decrease of glacial volume and area. A study conducted by Uzhydromet (Hydro meteorological Service of Uzbekistan) suggests that by 2030–2050 the temperature in mountains of south eastern Uzbekistan will increase by 1.5–2.5°C, causing higher runoff of the Amu Darya, Zeravshan, and Syr Darya due to accelerated melting of the mountain glaciers and precipitation will increase by 100–250%.

to 20-40 per cent in normal years. This proportion is critical for agriculture, the economic sector that consumes about 90 per cent of water resources and is highly dependent on water availability. During the severe drought of 2000-2001 in the southern districts of Central Asia, glacier water played a crucial role in sustaining agricultural production. Irrigated crops, such as cotton, survived, while most rain-fed crops, especially cereals, failed.

The glacier degradation is accompanied by increasing debris cover on many glacier termini and the formation of glacial lakes. Such lakes have the potential to threaten downstream areas with devastating mudflows and avalanches in the mountainous regions of Tajikistan, Uzbekistan, Kazakhstan, and Kyrgyzstan. There is a particular fear that such landslides, induced by glacial melting, will disturb toxic and nuclear dumps left over from the Soviet era.

e. China

China is among the driest nations on earth with more than one-fourth of its land classified as desert. Rivers there are unable to provide all of the country's 1.3 billion people with adequate supplies of freshwater. With the increased rate of melting of the glaciers due to climate change, finding a solution to water shortage has become for Beijing a serious and urgent matter. However, with its tendency to solve its water crisis with major engineering projects, China has been perceived by its neighbours as a potentially dangerous nation. A great 'south-north water transfer' project that diverts river waters descending from the Tibetan highlands has been in particular cause of concern among South Asian countries, especially India. Under the 'south-north water transfer' project, water will first be drawn from the Junta, Yalong and Dadu rivers, on the eastern rim of the Tibetan plateau, by building 300 kilometres of tunnels and channels. In the second phase, water will be directed northward from the Shuomatan Point, or the 'Great Bend', just before the Brahmaputra enters India. If China was determined to move forward with such a scheme, it could become a major element in pushing China and India towards an adversarial rather than simply a competitive relationship. Border clashes related to control of the rivers are not out of the question.[14] The lack of any effective formal water-sharing agreement between Delhi and Beijing due to their disputed borders has already led to tensions over water use. The most serious followed a breach in a Tibetan reservoir in 2000, which resulted in border troops on both sides being put on the alert. The breach occurred on 11 June 2000, releasing floodwaters into territory under the de facto control of India and raising the water level of the Siang River by more than 30 meters. Serious flood damage aroused the indignation of the Indian public, and anti-China feeling ran high, causing both governments to put their border troops on an alert.[15]

f. The Mekong River riparian countries

While trans-boundary water has not yet sparked major disputes among countries downstream of China, the potential for conflict is growing in the Mekong basin. The Mekong rises in Tibet and flows through southwest China, Myanmar, Thailand, Laos, Cambodia and Vietnam. Of major concern to downstream nations has been China's ongoing and planned development of hydropower dams. The Yunnan provincial government has begun to build a cascade of eight dams on the Mekong, with two already operational and three under construction. China also has undertaken some projects to widen the river to improve navigation, particularly to access oil from Thai refineries. This development is causing serious ecological, economic, and even health problems in the lower reaches of the river. Between 80 and 90 per cent of the downstream inhabitants are dependent on the Mekong for their livelihood and transportation.[16]

A report by the United Nations Environment Programme (UNEP) and the Asian Institute of Technology (AIT) warns that China's plans might pose 'a considerable threat' to the river and its natural resources. In particular, the UNEP-AIT report said that Cambodia's great central lake Tonle Sap, the nursery of the lower Mekong's fish stocks, and Vietnam's Mekong Delta, its rice bowl, were particularly at risk from changes to the river's unique cycle of flood and drought. Scientists are

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[14] CENTRA Technology, Inc. and Scitor Corporation, "*India: The Impact of Climate Change to 2030 Geopolitical Implications*", National Intelligence Council, May 2009, p. 25

[15] W. Weilou, *Water Resources in the Sino-Indian Strategic Partnership*, China Rights Forum, No1 2006, New York

[16] Linden Ellis and Jennifer L. Turner, *Environmental Security and Regional Politics in the Mekong Basin*, Woodrow Wilson Center, Washington D.C.: February 2007

concerned that reductions in the Mekong's natural floodwater flow will cause falls in the lake's water level and fish stocks, already under pressure from over-harvesting and pollution. Vietnam worries that dwindling water volumes will aggravate the problem of sea water intrusion and salination in the low-lying Mekong Delta, where climate change and sea level rise threaten to inundate large areas of productive farm land and displace millions of people by the end of this century. China is not alone in developing the river without regard to downstream interests, for other riparian countries also are building dams without consulting neighbours. Before the global credit crisis and economic slow-down hit Asia's export-oriented economies this year, Cambodia, Laos and Thailand had announced plans to follow China's lead on the upper Mekong by building a series of dams on the mainstream of the river in the lower basin.[17] All these problems [18] will seem small by comparison with the eventual loss of summer melt water in the Mekong. The riparian countries are likely to be amongst the first to raise the issue internationally.[19]

g. Burma

Burma is expected to be one of the countries to suffer the most from changing climate patterns. These changes in global climate patterns are likely to produce more extreme weather events such as Cyclone Nargis. Melting glaciers will make water levels in the Irrawaddy and Salween rivers unstable. Such changes will exacerbate pre-existing ethnic tensions posing an increased risk of political instability. Such ethnic tensions have already been roused by the proposed construction of a series of dams on the Salween River, a basin rich in terms of biodiversity, inhabited by a remarkably diverse set of minority ethnic population groups. Both in Burma and in China there is concern among human rights advocates that further dam building will lead to the displacement of populations. Two of the projected dam sites are in Burma's Shan State, a region which has already experienced large-scale forced population relocation as part of the Burmese government's concern to exercise control over dissident, and potentially dissident, minority populations. A variety of NGO reports estimate that up to 300,000 people have been forcibly relocated in Shan State over the past decade.[20]Human rights issues, as these relate to ethnic minority dissidents, have also been raised in the case of the planned Hutgyi dam. The area in which the dam is to be built is home to members of the Karen minority, who have long opposed Burmese control. One indication of the problems in the general Hutgyi area has been the increased flow of refugees across the border into Thailand.

h. Bangladesh

Bangladesh is acutely vulnerable to flooding and sea level rise. Its population is projected to nearly double to 250 million by 2035. The country is a classic example of the dangers of the combination of climate change and extreme population growth. Bangladesh is a land scarce country. Rapid population growth, declining cultivable land and unequal distribution of land resources has induced large-scale migration to India. Initially movements of people from Bangladesh were confined to the neighbouring Indian states of Assam, Tripura and West Bengal. Insurgencies in both Tripura and Assam are directly related to the uncontrolled illegal immigration combined with marginalization of the indigenous communities[21]. The influx of refugees has had negative socioeconomic ramifications and has led to an increase in revolutionary activity against both the government and local administrations. Tensions between Bangladesh and India emanating from the disputed status of their border, illegal migration and Bangladesh's alleged support for militant groups operating in India's Northeast, coupled with rising Islamic fundamentalist sentiment in Bangladesh are likely to be exacerbated.

It is possible that climate change will put stress on Bangladesh to such an extent that the wider stability

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[17] Michael Richardson, "*Dams in China Turn the Mekong Into a River of Discord*", Yale Global Online, 16 July 2009

[18] Ng Boon Yian, "*The ISEAS Forum on Water Issues in Southeast Asia*", Trends in Southeast Asia Series: 11(2005), Singapore: November 2005, pp. 4-5

[19] Asia Society, "*Asia's Next Challenge: Securing the Region's Water Future*", Leadership Group on Water Security in Asia, April 2009, p.17

[20] M. Osborne, "*The Water Politics of China and South East Asia II. River, Dams, Cargo Boats and the Environment*", The Lowy Institute for International Policy, Sidney: May 2007, p.17

[21] In Tripura, the indigenous population has fallen from a high of 70 per cent in 1947 to a mere 27 per cent of population today.

of South Asia is threatened. In a worst-case scenario, in which the country is struck by sudden, cataclysmic flooding, the international community will have to cope with a humanitarian emergency in which tens of millions of water logged refugees suddenly flee toward India, Burma and China. IPCS page 20.

Environmental stress undermines confidence in public institutions and officials, particularly if they are incompetent, corrupt or perceived as such.[22] Climate change-induced disasters provide militant Islamist parties the political opening they need to gain legitimacy and entrench themselves. .

i. Nepal and Bhutan

Nepal and Bhutan are very vulnerable. Their ecosystems are fragile and their dramatic topography makes the countries prone to flooding. In Nepal institutions are weakened after years of civil turmoil. Adaptation to climate change is costly, and financial resources are desperately needed to rebuild the country, reintegrate ex-combatants and to pay salaries to civil servants. While Nepal's per capita green house gas emissions are negligible, the country is at risk from the negative consequences of glacial melt, such as flash floods and glacier lake outbursts. Its income from hydro-electric energy is threatened. Glaciers are an important storage of freshwater in Nepal as they accumulate mass in monsoon and winter seasons at higher altitudes and provide melt-water at lower elevations.

4. To Act or Not to Act? – "Threat Mimimizers"

The debate about global warming is concentrated on greenhouse gas emissions and primarily on CO2. As we have noted, there are other climate drivers that deserve attention. The work of Ramanathan, Molina, and Zaelke demonstrates clearly that Black Carbon is as important as CO2 in driving the warming of the Third Pole.[23] The elimination of wood burning stoves, clean diesel engines and the use of scrubbers on coal power plants would have a rapid and immediate impact, most notably by limiting the damage to the Albedo effect. Replacing traditional cooking with efficient Black Carbon-free stoves may reduce Black Carbon warming by 70-80% over South Asia and by 20-40% over East Asia.[24] According to a recent synthesis and assessment by the U.S. Climate Change Science Program, it appears that Black Carbon reductions from Asian domestic fuel use offers the greatest potential to substantially and simultaneously improve local air quality and reduce global warming.[25] In addition to its potential climate benefits, reducing Black Carbon is justified for public health reasons. With approximately 50% of the world still using fossil fuels for cooking, indoor air pollution from Black Carbon is associated with respiratory illness, the fourth leading cause of excess mortality in developing countries.[26]

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[22] In 1970, when a cyclone hit East Pakistan — now Bangladesh — and killed between 300,000 and 500,000 individuals, the Pakistan Government's (at the time Pakistan ruled what is now Bangladesh) tepid humanitarian response stimulated widespread indignation and is considered a key factor that stimulated the Bangladesh independence struggle a year later.

[23] Mario Molina, Durwood Zaelke, K. Madhava Sarma, Stephen O. Andersen, Veerabhadran Ramanathan, and Donald Kaniaru, "*Reducing abrupt climate change risk using the Montreal Protocol and other regulatory actions to complement cuts in CO2 emissions"*, Proc Natl Acad Sci USA, forthcoming 2009.

[24] Ramanathan & Carmichael, *supra* note 3.

[25] US Climate Change Science Program, *Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols*, eds Levy II H, et al., 2008.

[26] Wallack V, Ramanathan V, "*The other climate changers: Why black carbon and ozone also matter",* Foreign Affairs Volume 88, pp 105-113, 2009.

Black Carbon is an aerosol, not one of the greenhouse gases in the Kyoto Protocol and is therefore not currently involved in the negotiations ahead of COP15. The UN Secretary General's Report introduces the interesting concept of 'threat minimizers' as an overall for actions which can be taken now to reduce the likelihood of future conflict. Island countries are advancing Black Carbon mitigation strategies through a proposal for a fast-action work programme under the UNFCCC.[27]

For the first time in years, there are signs of political progress on the issue of glacial melt in Asia. Much more work remains to be done.

[27] The Federated States of Micronesia, *Decision on a Programme of Work on Opportunities for Rapid Climate Mitigation to Complement Long-Term Climate Mitigation and Stabilization* (UNFCCC, Bonn, Ger), FCCC/AWGLCA/2009/MISC.4 (Pt II), 2009.