Center for International and Security Studies at Maryland
School of Public Policy, University of Maryland

Climate change and its impact on the political dynamics of Pakistan

By Zafar Imran

CISSM Working Paper
July 2013

This paper was prepared with generous support from the Yamamoto-Scheffelin Endowment for Policy Research.

Center for International and Security Studies at Maryland
4113 Van Munching Hall, School of Public Policy
University of Maryland
College Park, MD 20742
(301) 405-7601

Introduction

The assessment report of the National Academy of Sciences/National Research Council on Climate and Social Stress[1] and the Intelligence Community Assessment on Global Water Security[2] both refer to a possible link between climate change and social instability in countries around the world. They argue that climatic variations in combination with preexisting social and political problems may contribute to social disruptions that could result in political instability, state failure, and sub-national violence, and thereby pose threats to international security.

Although there is a growing consensus about climate change's ability to disrupt societies, and ultimately threaten global security, little is understood about what these climate-induced social and political stresses will look like and how they may interact with each other, as well as with other factors endogenous to a society, to destabilize countries and regions. Most of the literature on the subject points to a mono-causal link between climate change and resource scarcity (predominantly food and water), and explains how food and water insecurity may stoke socio-political stresses.[3] Although, this "neo-Malthusian" theory has improved our understanding about the dangers that climate change poses to international security, it is far from being complete and is over simplistic.

Using Pakistan as a case study, this paper argues that the link between climate change, resource scarcity, and conflict is not as straightforward as many studies suggest it to be. Piecing together publicly available data about Pakistan, this paper suggest two points: First, climatic changes disturb the social and political equilibrium of a society by either creating new fault lines in the social, political, or ethnic landscape of that society, or by exacerbating existing ones. Disequilibrium brought about by climatic variability creates new winners and losers, and manifests itself in the form of social and political unrest by heightening tensions among them. Conflict may come later and will be difficult to reverse, as it will occur not only due to resource scarcity but also because of political grievances and tensions in a highly fragmented society.

Second, the preexisting social and political configuration of a society will determine how that society responds to climate change disturbing this equilibrium. For example, a reduction in water availability may not always translate into a lower agricultural yield. This dynamic is likely to depend on the influence agriculturists have over the distribution of water resources and related policy tools. The nature and level of stresses will differ from society to society and will depend on how new winners and losers adjust as climatic changes alter the availability of resources.

It is important to keep in mind the distinction between big natural disasters like flash floods, extended droughts, etc., and the slow and gradual variability in the climate. Whereas the former can unite a people in the face of environmental emergencies of a disproportionate nature, the latter has shown an unmatched ability to divide, at least in the case of Pakistan. Most ongoing effects of climate change, it seems, are too small and gradual (compared to the effects of natural disasters such as floods and droughts) to be noticed immediately by the people experiencing

them, and they tend to be interpreted in light of preexisting social, political, and ethnic fault lines.[i] Violence in this case could come as a result of heightened antagonism between groups who believe each other (and not the climate) to be responsible for their economic misfortunes. By carefully monitoring the underlying cause(s) of social unrest, including the potential effects of climatic variability, it might be possible to identify this phenomenon.

The case of Pakistan illustrates how climatic variability has altered the availability and distribution of resources and disturbed the country's social and political balance during the past several years. A rift has emerged between Pakistan's agriculturist ruling elite, who play a dominant role in the distribution of resources, and the country's manufacturing sector. The agricultural sector has received preferential treatment in the distribution of water for irrigation, substantially reducing the amount reserved for hydroelectric power generation. This has pitted big landowners against the owners of small- and medium-sized manufacturing units, as well as the country's sizable urban population who have to go without electricity for over 18 hours per day in most parts of Pakistan. Since both agriculturists and manufacturers are present in almost all ethnic and political groups in Pakistani society, this new fault line crisscrosses preexisting groupings and further complicates an already complex problem. New winners and losers have emerged both within and between various political and ethnic subgroups, causing enormous social and political unrest.

This paper is organized as follows: The first section summarizes the academic debates about this topic and identifies knowledge gaps. The second section provides an overview of the climatic changes taking place in the Indus River Basin and their impact on Pakistani society. The third section lists the factors at work in Pakistan's political economy. It argues that climatic variability is playing a role in current disputes and could play an even larger role in the months and years ahead as environmental degradation imposes more burdens on Pakistani society. The last section concludes that stresses brought about by climate change are tied to the existing social structure, political configuration, and history of a country. Climate change can create new winners and losers in any society by exacerbating pre-existing fault lines or creating new ones. In the case of Pakistan, climate change has exacerbated pre-existing fault lines in socio-economic and political structures, with agriculturalists being much less adversely affected than manufacturers. A holistic understanding of the impact of climate change on societies could contribute to the development of appropriate adaptation policies.

[i] Exception to this rather generalized statement may come from highly advanced and educated societies where awareness about climate change is abundant. However, since most of the countries vulnerable at the hands of climate change and conflict lack that level of awareness about the phenomenon of climate change and threats associated by it, I will stick to my assumption for the purposes of this paper.

Context

The debate surrounding the connections between climate change and security has generated qualitative and quantitative studies. These studies have traditionally focused on how the scarcity of natural resources contributes to civil conflict (armed rebellion within a country) or a full-blown war over water resources between upper and lower riparian countries sharing the same river basin(s). Although the data for the latter is almost non-existent (there is no precedent of countries waging war over water), researchers have tried to identify the connections between intrastate conflict and climate change, and have predicted its spillover to neighboring countries.

Based on a review of the existing body of literature, two notable schools of thought stand out: *neo-Malthusians* and *Cornucopians*. Neo-Malthusians argue that dwindling natural resources, which result from various factors, including climate change, contribute to socio-political conditions that are conducive to conflict.[4] Cornucopains, on the other hand, posit that countries can adapt to a scarcity of natural resources through technological innovation or market mechanisms, and thus are capable of avoiding conflict.[5]

Two researchers in the neo-Malthusian tradition, Hauge and Ellingsen (1998), have linked the adverse effects of climate change-induced land degradation, deforestation, and fresh water availability to the risk of civil conflict in Sub-Saharan African countries.[6] Other notable studies, including Homer-Dixon (1999)[7] and Bachler et al. (1996), have also advocated the neo-Malthusian hypothesis.[8]

Some studies have challenged the neo-Malthusian notion that scarcity of renewable resources is the dominant factor in the relationship between climate change and conflict. For instance, Theisen (2008) challenged the Hauge and Ellingsen (1998) study by using the same dataset to reach different results, suggesting that a careful interpretation of the scarce resources hypothesis was in order.[9] De Soysa's study (2002) found that an increase in renewable resources increased the chances of conflict, directly contradicting the neo-Malthusian hypothesis.[10] Koubi et al. (2012) argued that disagreements about the links between climate change and conflict could be partly due to the use of different measures of climatic variability, and different samples and time periods.[11]

Few quantitative studies link climate change and conflict.[12] While their results vary, they offer notable dimensions to the discussion. For instance, Hendrix and Glaser's study (2007) measured the impact of short-term climatic changes (inter-annual variability of rainfall) on civil conflict onset in Sub-Saharan Africa. The study showed that increases in rainfall significantly decrease the possibility of conflict in the coming year.[13] Similarly, Miguel et al. (2004) studied 41 African countries for a period of nineteen years (1981-1999) and reported that lower rainfall growth[ii]

[ii] Rainfall growth is a general metric used by the meteorologists and climate experts to measure change in rainfall from one year to the next.

reduced economic growth and indirectly increased the probability of intrastate conflict.[14] However, later studies challenged the results of Miguel et al. on the grounds that they included cases where countries participated in other states' civil wars (Jensen and Gleditsch, 2009),[15] and that using rain growth rates was an inappropriate measure of rainfall shock due to mean reversion in rainfall levels (Ciccone, 2011).[16]

Hendrix and Salehyan (2012) measured the effect of deviations from normal rainfall patterns in Africa on more than 6,000 incidents of social conflict from the last twenty years. They reported that wetter and drier than normal conditions are both associated with social conflict.[17] Devitt and Tol (2012) employed a simulation model to analyze the relationship between climate change, economic growth, and civil war, and observed that higher temperatures, through their negative effects on economic growth, increase the probability of civil war.[18]

On the other hand, Thiesen et al. (2011-12) found that drought did not impact civil conflict in Africa during the period of 1964-2004.[19] Similarly, Bergholt and Lujala (2012) did not report increased probability of civil conflict as a result of climate-related natural disasters.[20]

This paper takes a different approach from the existing literature and argues that in order to establish (or disprove) the link between climatic variability and inter- or intrastate conflict, researchers first need to study if and how climate change destabilizes social and political processes. Unless it can be established that climate change - an exogenous variable - destabilizes the social and political equilibrium of a society over a period of time, contributes to the violent tendencies in a society, and consistently disrupts the functioning of daily life, it will be hard to definitively link it with the notion that scarce renewable resources can lead to civil conflict or inter-state war. This proposition assumes that violence caused by climate change occurs very slowly, with the effects of climatic variability gradually creeping into the preexisting social, political, and ethnic fault lines and exacerbating the fragmentation in a society. [iii] Early signs of this phenomenon can be identified by carefully monitoring the types of social unrest that may be caused by climatic variability if not entirely triggered by it.

This research also suggests that violence could come as part of the later stages of civil unrest and may result from complications of resource scarcity problems. Since climate change will affect a range of social processes that are linked through feedback loops, isolating the role of climate change in this complex mix will be challenging. Since it will also be difficult to pinpoint climatic variability (measured by changes in precipitation and temperature patterns from their respective long-term means) as the only independent variable, simple statistical approaches are unlikely to lead to a complete understanding. This study employs process-tracing to understand the

[iii] Exception to this definition of climate change are the climatic extremities e.g. flash floods, extended droughts, and rapid changes in the rainfall pattern. This paper, however, does not include such extreme events, and is focused on gradual climatic changes that take place rather silently, and often go unnoticed, particularly in the less educated societies who also happen to be the most vulnerable to the changing climate.

complicated process through which climatic variability could cause social unrest, and ultimately violence in a society.

Evidence of climatic stresses in Pakistan

The effects of climate change on Pakistani society have been among the most significant observed anywhere in the world. An increase in the mass balance of the Karakoram glaciers, a phenomenon unique in the Himalayan region, has substantially reduced water flows in the Indus River basin.[21] The pattern of rainfall throughout the country has varied widely,[22] and the duration and intensity of the summer season has increased.[23]

Pakistan, by virtue of being predominantly an agrarian society, is highly sensitive to climate change. Its land area is mostly arid and semi-arid. About 60 percent of the country receives less than 250mm of rainfall per year and 24 percent receives between 250mm and 500mm.[24] Agriculture and related activities constitute the country's single largest economic sector, contributing 23 percent to GDP and employing 44 percent of the workforce. As much as 65 percent of the country's foreign exchange is earned from the export of goods manufactured from raw material obtained from the agricultural sector.[25]

Originating at the Karakoram glaciers in the Western Himalayas, the Indus River forms the backbone of Pakistan's hydrological system. Runoff from the melting of Karakoram glaciers is estimated to make up about one-third of the flow of the Indus River, with snow and ice together providing perhaps two-thirds of the total amount of water in the Indus.[26] Immerzeel et al. found that glacier melt water is extremely important for the Indus basin: "Discharge generated by snow and glacial melt is 151% of the total discharge naturally generated in the downstream areas."[27]

With annual net gains in the Karakoram mass balance, shrinkage in the Indus Basin flows is inevitable; water is being frozen and captured as part of the glacier, thereby reducing the availability of water for hydropower generation, agriculture, and ecosystems.[28] Although the data necessary to link the mass buildup in Karakoram with reduced river flows downstream are not publicly available, consistent reduction of surface water availability (the long-term average annual flow of rivers) has been recorded, and that serves to document the relationship.

Per-capita surface water availability in Pakistan, which was 5,260 cubic meters in 1951, shrank to 1,038 cubic meters in 2010, and is expected to decrease to 800 cubic meters by 2025, according to the government's own estimates. [29] While it is hard to establish a causal link between climate change and decreases in per-capita water availability (which may be a result of an over five-fold increase in the country's population between 1951 and 2012[iv]), this trend points

[iv] Pakistan's population rose from approx. 34 million in 1951 to approx. 170 million in 2012.

toward a future where even slight climatic variability may have serious ramifications for Pakistani society.

This paper focuses on the effects of spatial and temporal climatic variability on a finer level as compared to the crude annual averages of climate indicators. As argued elsewhere in the paper, small-scale variability in climate patterns can have serious and outsized implications on a society.

Despite the variability in river flows, temperature, and rainfall patterns (both spatially and temporally) in Pakistan during the last two decades, long-term annual averages have not changed significantly. In such cases, tracking the long-term annual averages of climate indicators would not uncover climatic variability until its effects were unavoidable.

The Indus River System Authority (IRSA) – the Pakistani institution responsible for monitoring the flow of Indus Basin rivers as well as the apportionment of their waters among the provinces – reported in 2011 that river flows at the Tarbela dam stood at 176,000 cusecs (cubic feet per second) compared to the usual flow of 250,000 cusecs for the summer season, suggesting lower flows of about 75,000 cusecs per day.[30] The flow of the Jhelum River at the Mangla dam has decreased as well, with only 26,000 cusecs measured in July 2011 instead of the dam's normal 45,000 – 50, 000 cusecs.[31]

While direct rainfall contributes less than 15 percent of the water needed for the country's irrigation systems, the Indus and its tributaries have traditionally provided a majority of the water for Pakistan's irrigation needs. The Indus River and its tributaries on average deliver about 155 million acre-feet (MAF) of water annually. Of this, about 104.7 MAF is diverted for irrigation, while 39.4 MAF flows to the sea and about 9.9 MAF is consumed by system losses, including evaporation, seepage, and spills during floods. Approximately 48 MAF of water is pumped from the underground water table for irrigation.[32]

In addition to irrigation, the Indus Basin waters play an important role in addressing Pakistan's energy needs. Three large dams, Mangla, Tarbela, and Chashma are built on the Indus River and its tributaries, and make up approximately 31 percent of the country's power-generating capacity.[33] To address current shortfalls in the national power supply, officials are planning to increase hydro-power's share of the country's generating capacity up to 60 percent by building new dams.[34] The dwindling water flows of the Indus basin put these plans into question.

Reductions in the flows of water are not the only significant indicator of climatic changes in Pakistan. Rasul et al. have identified increases in maximum and minimum temperatures in summer and winter seasons, respectively, particularly in the first decade of this century.[35] The late onset and early ending of winter seem to have reduced the length of the growing season for

winter, or *Rabi,* crops,[v] with sharp rises in winter temperatures causing the forced maturity of grains and reducing economic yields.

Wheat, the most important staple crop in Pakistan, is grown in the Rabi (winter) season. If wheat is not irrigated properly it can result in shortages, which could have serious consequences for the country's food security. Perhaps this is the reason why the agriculture sector enjoys preferential treatment during times of water shortage, when there is just enough water available for either irrigation or power generation but not both.

The winter temperature increase in the Indus Basin could also explain the increase of the Karakorams' mass balance, despite the fact that the glaciers are receding at lower elevations.[vi] Satellite images of the Himalayas show that the Karakoram glaciers have a winter accumulation pattern, and the accretion is apparently occurring at higher elevations where measuring stations have not yet been placed. All of the Himalayan glaciers to the east of the Karakorams have a summer accumulation pattern, and their mass balance is declining.

As a result of the above-mentioned climatic changes in the region, three notable trends have emerged that provide a snapshot of the state of affairs in Pakistan and bring into sharper focus the catalytic role climate change is playing in destabilizing Pakistani society. These findings form the crux of my argument that the nature of social and political stresses brought about by climatic variability are context specific, and may not be understood without deeper knowledge about the underlying social, political, and ethnic conditions in a society.

First, the unprecedented, reduced water flows in the Indus Basin have left Pakistan's hydropower infrastructure unable to meet the country's ever-growing energy demand. Although protests about power outages are not new in Pakistan, civil unrest has increased significantly in the last five years. Policy decisions by the government, which is dominated by influential landowners in Punjab and Sindh provinces, favor the allocation of reduced water supplies to agricultural irrigation instead of power generation.[36] In 2012, with the onset of a sweltering summer, the shortfall in Pakistani power generation hit a record high of 8000MW—nearly 45 percent of national demand.[37] Outages of 18-20 hours per day were common, mostly in big cities in all four provinces, and led to bloody riots and mass-scale protests. The situation was even worse in rural areas, where outages lasted more than 20 hours per day. Violent protests were reported throughout the country, particularly in the urban centers. In the most violent episode, rioters burnt down trains, damaged banks and gas stations, looted from shops, blocked roads,

[v] Rabi is perhaps the most important growing season in terms of food security in Pakistan. Rabi crops, most important of which is wheat, are grown between the months mid November to April. These crops require irrigation. Due to recent lengthening of summers, more water is required to achieve the optimum level of water required for the grains to attain full size.

[vi] It is hypothesized that higher temperature at low altitudes of Karakoram during the winter season might be causing precipitation at the higher altitudes, thereby leading to higher than usual snow accumulation at higher levels while glaciers recede at the lower elevations.

and, in some instances, attacked the homes of members of the National Assembly and of the provincial assemblies.[38]

Second, the extreme variability of rainfall patterns and the increased frequency of successive droughts and floods have overwhelmed the Pakistani government, which lacks the capability to protect its citizens and maintain order in the face of a changing climate. In the 2010 floods, which displaced at least 3.27 million people in the country,[39] for example, the government of Pakistan was outperformed by non-state actors, including some violent extremist organizations, who rescued affected populations and provided food and shelter to the internally displaced.[40] The government response was not only slow, it was insufficient and exposed the government's inability to deal with big climatic shifts, the type of which are expected to become more frequent in the country in the coming years.[41]

In the absence of effective government action, a Hobbesian society is emerging. The ability of influential landowners and politicians to redirect the natural flows of rivers during floods in order to protect their lands[42] has exposed the broader society to threats such as the spread of communicable diseases,[43] increases in malnutrition,[44] and the deterioration of critical infrastructure.[vii]

Third, the lengthening of the summer season and increases in average temperatures have increased the demand for both irrigation and potable water. Competition over this increasingly scarce commodity has heightened tensions between and within urban and rural populations. An increase in electricity demand for air conditioning and refrigeration in the lengthened hot season has put an additional strain on the energy infrastructure, which already faces an acute water shortage for power generation.

Homer-Dixon divides environmental scarcity into three broad classifications: 1) Supply-induced scarcity, which is brought about by the degradation or depletion of environmental resources, 2) demand-induced scarcity, caused by uncontrollable population growth or an increase in per-capita consumption of resources, and 3) structural scarcity, which arises from the unequal social distribution of a resource.

The case of climate change-induced social and political instability in Pakistan, however, is more complex by comparison than any of these classifications. Resource scarcity *is* exacerbating tension and conflict in Pakistan, but so is the lack of social cohesion, rampant corruption, and the rigid and predominantly feudal political system. The fact that the country's leadership considers

[vii] In 2012, a torrent which was roughly 45 miles long, and 15 miles wide, inundated a vast area and displaced around 0.7 million people in the district of Dear Ghazi Khan. The torrent, which initially flowed adjacent to the nuclear installation, was diverted overnight by the concerned authorities towards the city. The torrents entered the facility and inundated a vast area of the installation. During the massive floods in 2010 and 2011, millions of people in Southern Punjab and Sind were internally displaced as influential landowners diverted flood waters towards densely populated cities in order to protect their agricultural lands.

expanding nuclear energy generation as a credible way to offset some of the hydro-electric shortfalls due to climate change adds another dimension to the challenge. The sharpening of ethnic and social cleavages in Pakistan suggests that, even as climate-induced resource scarcity contributes to civil violence, the imminent collapse of the Pakistan's legal order may be already steering society in that direction.

Pakistan's failing political economy and climate change

Although the link between a society's political structure and climate change is ill-defined**,** it is undoubtedly a fundamental one. Climatic changes induce social and economic stresses, which can be mitigated only if a political system is flexible enough to recast the national narrative around climate adaptation and the conservation of resources. Since climate change holds the potential to aggravate or induce socio-economic stresses and fundamentally alter entire societies (challenging their ability to survive in the face of shrinking natural resources), social cohesion and strong political leadership are likely to increase a society's chance of survival.

Pakistan is not such a society. Unable to unite discordant ethnic, religious, and political factions in the face of the threats posed by reduced river flows and variable rainfall and temperature patterns, Pakistan's failed political structure is actually fueling the tensions and exacerbating an already complex problem.

Pakistan's political system is fragmented along ethnic, religious, social, and political lines,[45] and climatic variations intersect all of these divisions. Since a large majority of Pakistani political leaders come from influential feudal families, rivalries among them are common. These rivalries originate in the competition over the timely and abundant availability of water for their crops. As such, inter and intra-communal violence is common during times of climatic extremes. Political leaders tend to use their political influence to protect their *own* lands from floods or droughts, usually to the disadvantage of rival politicians, un-influential landowners, and small farmers. [46]

This abuse of political and social influence has given rise to a subculture of corruption, which is particularly rampant in Pakistan's irrigation sector. Common people, particularly small farmers whose shares of water are usually usurped by big landowners, are forced to pay large bribes to irrigation officials to get their fair share of water.[47] As climatic variations become more frequent and intense, the chances of conflict rise too, as this inequitable and corrupt system protects only the interests of a handful.

Despite the fact that Pakistan has been dealing with the effects of climactic variability for several decades, the ruling elite have done little to develop a comprehensive and holistic approach to dealing with the problem. Meanwhile, current problems, such as food insecurity, water scarcity,

energy shortages, and the outbreak of communicable diseases, threaten to trigger deadly conflict that could easily spread throughout the entire region, and may even jeopardize global security.

The following micro-level analysis examines in greater detail some of the most important social, political, and economic stresses that threaten Pakistan's economy, stability, and security—and that could be further exacerbated by additional effects from climate change.

1) Interprovincial disputes over water apportionment

The roots of water conflict between Sindh and Punjab provinces can be traced back to the days of the British Raj, when Punjab's attempts to build irrigation infrastructure on the Indus were bitterly opposed by Sindh.

In 1945, a three-member committee, called the Rau Commission, imposed a solution on the two provinces that gave Sindh preferential rights over the Indus waters. The commission restricted Punjab to drawing water from the eastern rivers (Ravi, Sutlej, and Beas), and suggested that it could draw a maximum of 25 percent of the Indus's water, and that only after Sindh's water needs had been met.

The arrangement changed significantly when the Indus Basin Treaty gave exclusive control of the eastern rivers to India, leaving Pakistan to rely exclusively on the Indus and its tributaries for irrigating its lands.[viii] Although Sindh and Punjab provinces learned to share the Indus water in the wake of Indus Basin Treaty, the peace didn't last long, as flows in the Indus Basin continued to dwindle and population in both provinces continued to grow.

In 1990, as the flows of the Indus Basin rivers dropped to less than 25 percent of the flows at the time of Pakistan's creation, interprovincial antagonism grew to new heights. A parliamentary committee called the "Committee of Common Interests (CCI)," made up of chief ministers of all four provinces, proposed a formula for the equitable and fair allocation of the Indus waters among the provinces. The committee's recommendations, named the "Pakistan Water Apportionment Accord of 1991," allowed for a minimum flow of water into the Arabian Sea, and shared the remainder between all four provinces.[ix]

The Accord used the average river flow in the Indus and its tributaries between 1977 and 1982 as a guideline for developing its regulations. However, since the availability of water in the basin kept declining, the Accord did little to address the antagonism among the provinces; the Accord

[viii] Indus basin treaty was brokered by the World Bank in 1961 in order to resolve the water dispute between Pakistan and India over the ownership of the Indus Basin rivers.

[ix] Minimum flow of water to be discharged into the sea was set to be 10MAF (12.34 km^3), and was meant to ensure that the seawater doesn't gush back in and cause salinity. A total of 114.35 MAF (141.11 km^3) was distributed among the provinces as per the following scheme: a) Punjab 55.94 MAF (69.03 km^3), b) Sindh 48.76 MAF (60.17km^3), c) Khyber-Pakhtunkhwa[ix] 5.78 MAF (7.13 km^3) (+3 MAF from the un-gauged canals above the rim stations), and d) Balochistan 3.87 MAF (4.78 km^3).

did not provide a formula for ensuring that decreases in water flows had equal impact in the provinces. Smaller provinces claim that Punjab, an upper riparian province with control over most of the irrigation infrastructure, has been drawing its full share of water even during times of overall water shortage.[x] Sindh, in particular, contends that it has received less water than it is entitled to under the 1991 Accord. In order to meet its water needs, Sindh has let less water than required flow out to the Arabian sea, causing increased salinization of the agricultural lands in lower Sindh.[48] A lack of fresh water in Sindh has also caused mangrove forests to shrink. Once ranked the sixth largest in the world, Sindh's mangrove forests shrank by 38 percent between 1977 and 1990 alone.[49]

Controversy over damming the Indus

As water levels in the Indus Basin have reached new lows, Punjab and other provinces have clashed several times since 2010. Each time, the provinces cite the inequitable distribution of constrained river flows as the reason for the conflict. Bitterness against Punjab over water issues turned into a deep political crisis in 2012, when the Lahore High Court issued a verdict in favor of Punjab, and ordered the federal government to start the construction of a new reservoir on the Indus River at a site called Kalabagh near Mianwali District. The provinces of Sindh, Khyber Pakhtunkhwah (KPK), and Baluchistan vehemently opposed the verdict, and the governing assemblies in each of the provinces passed resolutions against the dam's construction, threatening "dire consequences."[50]

Punjab, the only proponent for constructing new water storages on the Indus River, argues that it is impossible to ensure food security for Pakistan and to minimize energy shortfalls without the construction of new reservoirs. In Punjab alone, approximately 3.85 million acres of land are uncultivable due to shortages of irrigation water. If cultivated, these lands could contribute toward food sufficiency for the country's growing population.[51] A new reservoir, Punjabi officials argue, would store an enormous amount of water that would otherwise be wasted during seasonal floods and that could be used to generate electricity and minimize energy shortfalls.[52]

Fearful of Punjab's geographical position and its history of drawing inequitable amounts of water from the basin, even during water shortages, Sindh has been hostile toward all proposals to add additional reservoirs on the Indus. While political disputes over water between these two provinces used to be relatively manageable, this current dispute is on the verge of leading to a secessionist movement. Some researchers have argued that the construction of Kalabagh reservoir may result in the complete drying up of the agricultural lands in Sindh province.[53] Many Sindhis fear that this could lead to the extinction of the ancient Sindhi culture, as native Sindhis (farmers) will be forced to migrate to other parts of the country in search of livelihoods.

[x] Over 75% of the irrigation infrastructure lies in Punjab, and is meant to divert Indus waters to irrigate the agricultural lands in Punjab.

Khyber-Pakhtukhwah's (KPK) resentment and mistrust of Punjab over the issue of new water reservoirs on the Indus is based on slightly different reasoning. Located at a higher altitude than the rest of the country, KPK is an ideal location for the construction of new hydro-electric dams on the Indus River. However, the people of KPK have bitter memories of how Punjab seized thousands of acres of fertile KPK land for the construction of the Tarbela dam without providing any compensation. Some researchers estimate that construction of the Kalabagh dam will displace 120,000 people and may raise the water table high enough to submerge the historic city of Nowshehra.[54] Also, KPK leadership and civil society doubt that the construction of the Kalabagh dam will contribute toward their province's economic development and believe that the project's benefits (both in stored water and electricity) will accrue mostly to Punjab. Pakistanis in KPK have threatened to physically prevent efforts to build new dams in their province by protesting at the construction site(s); some have even threatened to lead a secession movement if the KPK's wishes are not respected by the country's Punjab-dominated ruling elite.[55]

Balochistan, Pakistan's largest province in terms of area and smallest in terms of population density, plays a minimal role in the country's agricultural activity. Despite the fact that Balochistan's abundant natural gas deposits have fueled Pakistan's economy for decades, the province's water and energy needs have been largely ignored by the rest of the country. By backing growing secessionist movements against the predominantly Punjabi civil and military leadership, Baloch leaders see climate change-induced political turmoil as an opportunity to unsettle Punjab and destabilize its economy.

Lack of transparency in water distribution

Despite the significant mistrust among provinces over the fair apportionment of water, there is no monitoring mechanism in place to record and predict the fluctuations in the Indus Basin. The only data available on fluctuations in river flows is maintained by the Indus River System Authority (IRSA) and is classified for political reasons. Small details from IRSA's internal meetings, obtained by local press, give some indication of the country's dwindling water resources and of how government officials are unprepared to deal with the problem. The only reliable information on river flow fluctuations comes from independent climate change experts who rely on satellite images to report changes in mass buildup in the Himalayan glaciers.

In 2008, the government of Pakistan, with the help of World Bank, installed a telemetry system, which was intended to use satellites to gauge and report the real-time status of water levels at specific locations. The project was instituted by then-military dictator Pervez Musharraf in 2005 and was completed in 2008. If fully implemented, the project would have provided accurate information about the level of water in Indus Basin rivers, would have helped with the transparent apportionment among provinces, and would have helped to make cautionary measurements in case of extreme weather events. However, the project was shut down after its

installation, perhaps under pressure from the influential politicians and landowners whose political support Musharraf needed to stay in power, and who preferred not to share information about river levels in order to achieve their political goals.

2) Impact of climate change on Pakistan's energy needs and plans

Pakistan's unraveling energy infrastructure and the crippling effects on almost all sectors of Pakistani society is another example of an existing stress that could be made worse by climate change and inept governance. Without enough water to generate the hydropower needed by Pakistani businesses and households, thousands of industrial units and businesses have had to shut down, setting in motion a wave of unemployment and bringing angry mobs onto the streets.

Climate adaptation gone wrong

In 1972, total energy consumption in Pakistan was estimated at 17 million tons of oil equivalent. In 2009-2010, the total primary energy consumption had grown to 85 million tons of oil equivalent.[56] The increase in Pakistani power consumption can be attributed to rapid urbanization and an increase in population. Whatever the reason for this increase, it is clear that demand has outpaced supply by a large margin. In the recent years, the energy shortfall has been as high as 45 percent of the total supply. Confronting decreases in surface water availability, Pakistani policy makers have tried to stimulate diversity in energy production, encouraging growth in thermal generation rather than hydropower. The 1994 Energy Policy of Pakistan invited independent power providers (IPPs) to install new power generation units that used any means for generating electricity other than the Indus waters.[xi]

Since thermal plants can be installed relatively quickly, policy makers hoped that the privately owned IPPs would efficiently fill the supply-demand gap. Higher production costs for thermal plants, however, meant that electricity produced by these plants would be further out of the reach of ordinary Pakistanis than before. The government offered subsidies and delayed payments to the IPPs to make electricity affordable for the general public. Yet, the economic downturn kept the government from paying these subsidies. Government debt to the IPPs has subsequently crippled the country's entire energy infrastructure. In early 2012, as Pakistan's total debt payable to the IPPs increased to 400 billion Rupees (approx. US$ 4.4 billion), the government of Pakistan committed its first ever sovereign default.[57] IPPs have taken the matter to the Supreme Court of Pakistan and have threatened to cutoff power production unless their dues are paid in full.

Erosion of legal order:

Despite thousands of protests throughout the country during the last several years, the government has not put forward a policy proposal to bring an end to the extended power outages.

[xi] Pakistan's 1994 Energy Policy clearly specified that private power providers could use any source for power generation 'except Indus waters.'

Accordingly, protests have become more violent: protestors have burned down public property, destroyed power pylons, and attacked public officials and political leaders.

The power crisis has affected all sectors of society, ranging from middle-class urbanites to small farmers, from industrialists to students, and from healthcare providers to businesses. Public backlash has been most intense from those whose access to basic necessities of life heavily depends on the supply of electricity. Thousands of workers have been fired from industrial units that are no longer financially viable as a result of an average of 18 hours a day of power outage.[xii] According to one estimate, more than 400,000 industrial sector workers have lost their jobs for these reasons during the last 2-3 years alone.[xiii] Last year, thousands of traders who lost their businesses due to extended power outages launched civil disobedience movements in major Pakistani cities and renounced the state's legitimacy to collect taxes.[58]

The situation is particularly volatile in Pakistan's infamous northwest tribal areas, where power outages can exceed 23 hours a day. Since the area's entire population depends on electricity to draw potable water from wells, the unavailability of electricity poses serious water and food security risks. Disgruntled tribesmen from the region have been among the most violent protestors, destroying or taking over power grid stations and attacking officials.[59] In some cases, their discontent might even be turning them into the Taliban's fold.

Uncompetitiveness and increase in the cost of production

In terms of lost productivity, the industrial sector has been hit the hardest by the country's energy crisis. The increased cost of production due to inordinate power outages has made most of Pakistan's industrial sector uncompetitive. According to an estimate by a member of the Planning Commission of Pakistan, approximately 25,000 industrial units have become "sick" in a very short time.

Textiles and clothing is Pakistan's largest industrial sector in terms of investment, employment, and exports. It accounts for approximately 46 percent of Pakistan's total industrial output; it absorbs about 38 percent of the industrial labor force; and it contributes around 54 percent to the country's export earnings.[60] The ongoing energy crisis has brought the sector to the brink of collapse. The All Pakistan Textile Mills Association claims that "a week's suspension of electricity results in a loss of $300 million to the mills, and if the electricity supply remained suspended for a month the loss would swell to $1 billion." In fiscal year 2011-2012, approximately 15 percent of all textile units were either shutdown or moved to neighboring

[xii] On average, there is one hour power outage after every half an hour of electricity supply in the big cities like Lahore, Karachi, Rawalpindi, Islamabad, Faisalabad, etc. Situation gets better with the increase in the river flow as water level reaches to higher levels in the dams. Power outage is worse in the smaller cities and rural areas, and loadshedding, as power outage is called in local vernacular, is as high as twenty hours per day there.

[xiii] Remarks by Dr. Samar Mubarakmand, Member Science & Technology, Planning Commission of Pakistan, at the Rawalpindi Chamber of Commerce and Industry (RCCI), July 03, 2011

countries. In the current fiscal year (2012-2013), an additional 25 percent of all units could relocate to countries like India, Bangladesh, and Sri Lanka, where the cost of production is lower.[61]

Emergence of new fault-line: Manufacturers vs. the landowners

The disequilibrium brought about by the climatic shifts documented in this paper, as well as the adaptive measures taken by Pakistani policy makers, has created new winners and losers and heightened tensions between existing divisions.

While the availability of water in the Indus Basin has decreased, consistent increases in crop yields suggest that agriculturists have used their influence over policy to cheat their way out of the adverse effects of climate change.[xiv] By comparison, industrial and business sectors have suffered. The preferential treatment given to the agricultural sector has contributed to acute energy shortages throughout the country. Thousands of manufacturing units have been shutdown; hundreds of thousands of industrial workers have lost their jobs; and billions of dollars have been lost in export revenue. According to one estimate, the textile sector alone has lost Rs. 1 billion (approx. US$10 million) per day because of ongoing power disruptions.

In this new social structure, agriculturalists and manufacturers are the winners and losers, respectively. Successive military regimes and some political groups have tried to limit the influence of Pakistan's feudal landowners by introducing land reforms, but these efforts have failed. Taxing the agricultural sector has also been a non-starter due to the agriculturists' strong grip on the policymaking infrastructure. If there has been any change in the political setup, the family members of the landlord class have merely rearranged alliances.

While the land-owning minority's inequitable control over Pakistan's natural resources may have worked in the past, the rapid depletion of water resources and the highly variable climate have made it the weakest link in Pakistan's social and political structure. Leading manufacturers appear headed for a confrontation with the land-owning ruling elite. The severity of this confrontation was made plain by the vice-chairman of the Punjab Board of Investment and Trade—a government body set up to help facilitate private sector growth in Punjab—who advised manufacturers to change their line of business and start investing in agriculture. "This is the only option if you want to avoid the worst impact of energy shortage in the country," he said.[62]

[xiv] Pakistan's food production has steadily increased from 3,909,000 metric tons in 1960 to 23,300,000 metric tons in 2012. Some of this increase can be attributed to the technological advancement of the factors of agricultural production. It is not the sole factor, however. Media reports of the Indus River System Authority's meetings point towards the preferential treatment given to the agriculture sector by the country's policymakers. This policy choice has had serious implications, espcially during the times of water shortage when there was just enough water available for either irrigation or power generation. Due to losses incurred as a result of evaporation, seepage, etc., doing both (hydroelectric power generation and irrigation) is not possible during the times of bind.

Since most of Pakistan's industrial infrastructure is located in Punjab, the newly emerging manufacturer-agriculturist fault line is being superimposed over preexisting ethnic fault lines. In the previous administration, the Punjab-based industrialists considered themselves discriminated against by then Sindh-based members of the ruling Pakistan People's Party. Yet, Punjab's agriculturist elite was equally responsible for the use of Indus waters for irrigation rather than for power generation.[63] Now that the Punjab-based and self-proclaimed pro-business Pakistan Muslim League, headed by Prime Minister Nawaz Sharif, has taken over power from the predominantly Sindh-based Pakistan People's Party the dispute between industrialists and agriculturists is likely to intensify and may even lead to overt confrontation between the two sectors.

Shift towards nuclear energy

In order to compensate for decreasing river flows and increasing energy demand, in 2005, the Planning Commission of Pakistan proposed a 25-year plan to increase eight-fold Pakistan's installed power generation capacity—from ~20,000MW to 162,000 MW. The plan diversifies the country's energy portfolio, increasing by a factor of 100 the production capacity of coal-based thermal power plants. More importantly, the plan also proposes a twenty two-fold increase in the use of nuclear energy, from 340 MW to 8800 MW by 2030. This increase would entail building 10-20 new nuclear reactors. The Pakistan Atomic Energy Commission (PAEC) has also proposed building a large civilian uranium enrichment plant and a nuclear fuel production facility as part of this expansion.

Pakistan's electricity generation plan 2005-2030 (Megawatts)

Yr.	Hydroelectric	Oil	Gas	Nuclear	Renewable	Coal	Total
2005	6460	6400	5940	400	180	160	19540
2010	7720	6560	10800	400	880	1060	27420
2020	19990	7160	30910	2800	3150	8260	72270
2030	32660	7760	83760	8800	9700	19910	162590

Source: "National Energy Needs", presentation by Humayun Farshori, Secretary, Planning and Development Division, Government of Pakistan, to Pakistan Development Forum, 26 April 2005, Islamabad

As well rounded as the plan appears to be, it is riddled with political, climatic, and technical hurdles that make its successful implementation unlikely. The PAEC plan proposes a more than 100-fold increase in coal use by 2030. In light of the climatic turbulence in the Indus Basin, this large an increase in the use of a carbon-emitting energy source is unsustainable. Indeed, this plan suggests that the country's policy makers are unaware of climate change and its impacts on Pakistan. Similarly, the proposed five-fold increase in hydroelectric power generation is out of sync with the already decreased water resources of the Indus Basin. The speed with which Pakistan has pursued nuclear energy in recent years indicates its preference to expand this part of its energy infrastructure before seriously exploring other options.

Pakistan's current installed capacity for nuclear power production is 640MW. Since 2005, the country's leadership has been consistently following through on its plan of increasing the role of nuclear power in overall energy portfolio. In 2008, Pakistan announced that it had secured another deal with China for two additional reactors of 340MW each to be built at the Chasma nuclear complex. According to the news reports, the current government, which came to office less than two months ago, approved the budget for two additional nuclear reactors to be built in Karachi with the Chinese support.[64]

With limited technical capability, both in terms of infrastructure as well as trained human capital, and almost no international help available in case of accidents and natural disasters, expanding the nuclear capacity at such a rapid pace is a risky endeavor. Moreover, the fact that Pakistan is beleaguered with the menace of terrorism and rising radicalism and is a safe haven for national and international non-state actors makes the nuclear expansion even more dangerous.

3) Rising urbanization and a growing sense of deprivation among the masses

Pakistan is a rapidly urbanizing society, with 57.32 million people living in the urban centers of the country.[xv] Of those living in urban centers, 20 percent are below the age of 25, so it is a fairly young society as well.[65] As climatic variations affect the government's ability to provide basic necessities—water, food, fuel, and electricity—to citizens, the political blowback is most visible, and perhaps most violent, in the country's cities.[xvi]

As Pakistan's urban population continues to grow, the situation could become even more explosive. According to a UN estimate, by 2020, more than 50 percent of Pakistan's total population will live in cities.[66] In absolute numbers, this means that the urban population could surpass 90-100 million people.[67] In light of recent unrest from climate-induced social stress, cities are likely to become more intense hotbeds of violence as water becomes more scarce, food more expensive, and power outages more frequent.

[xv] Total population of Pakistan in 2009 was 162.32 million, of which 57.32 million were estimated to be living in urban centers of the country.

[xvi] It was reported that there were at least six protests per day in Karachi in 2011 alone, over the power outages, and most of them were violent in nature.

This trend is likely to have economic impacts. Urban centers contribute overwhelmingly to Pakistan's gross domestic production (accounting for more than 79 percent of all GDP) and to government revenues. The rise in per capita income in the country, at a rate of 13 percent annually, to US$1,046 by 2008 was largely due to increases in the productivity of the urban economy.[68] As this paper notes, however, Pakistan's political system is configured to favor the country's agriculturists through the unequal distribution of water and electricity, setting the respective populations on a collision course. This expanding urban-rural divide adds an additional layer to Pakistan's societal fragmentation.

Although the nature of social stresses brought about by climatic perturbations in the Indus Basin is similar throughout the country, two problems are exclusive to the cities and make them more vulnerable to social unrest and higher levels of violence. First, the government's diversion of water for irrigation, instead of for power generation, has resulted in the closing of thousands of factories, businesses, schools, hospitals, and offices. Many of these facilities have been in cities, leaving a big chunk of the urban population unemployed. As a consequence, public unrest is highest in cities, and the threat of civil violence is more potent there than anywhere else in the country.

This is especially true in the megacity of Karachi, home to approximately 21 million Pakistanis from disparate backgrounds, all living side by side. Since the population of Karachi is divided along ethnic, religious, linguistic, and tribal lines, violence has been a growing problem. [69] In 2012 alone, more than 3,000 people were murdered in targeted killings, and ethnic and religious conflicts.[70] Karachi's ethnic and religious violence could easily escalate beyond the confines of the city, possibly leading to a full-blown civil conflict throughout the country.

Scarcity of drinking water in large cities is another important problem that could spin out of control and trigger a broader conflict. Decreases in Indus Basin river flows, variable rainfall patterns, and excessive pumping of underground water to meet the needs of growing city populations are turning drinkable water into a conflict-resource. Illegal water-hydrants (pumping stations) have sprung up in Karachi and are operated by non-state actors and local influentials, usually in collusion with corrupt police officials. Pumping water illegally and selling it at inflated prices has become a lucrative business and an important source of revenue for these actors. The situation is the same in Islamabad, where citizens can wait in line for hours to get a week's supply of water. That such markets exist speaks volumes about the Pakistani government's inability to meet the most basic needs of its citizens. The corruption associated with these markets is also fueling anger among local populations.

4) Food insecurity

Though the United Nations lists Pakistan as a food surplus country, it is vulnerable to food insecurity. If not addressed prudently and holistically, the effects of climate change could introduce abnormalities into a country's economy, particularly its commodity markets, and lower

living standards. Because commodity markets are integrated globally, these abnormalities can easily be exported from one country to another and indirectly threaten stability. A close examination of climate change's effects on Pakistan's commodity markets, and their concomitant effects both within and outside of Pakistan, will help to explain this phenomenon.

Despite dramatic decreases in Indus Basin river water flows, as well as successive droughts and floods, Pakistan's agricultural sector has consistently increased its crop yield. According to the State Bank of Pakistan's 2011-2012 annual report on the state of Pakistan's economy, the agricultural sector grew by 3.1 percent in the fiscal year 2011-2012 and by 2.4 percent in 2010-2011, despite the heavy floods in 2011.[xvii] As this paper has discussed, this increase in agricultural production has come with a cost for the industrial sector. Since a large portion of Pakistan's industrial sector is involved in converting raw agricultural products into finished food items, the frequent power outages have increased the cost of production and the price of finished food items.[71] The annual average cost of a food basket (per capita/month) increased by 130 percent from Rs. 785 in 2005-2006 to Rs. 1805 in 2011-2012.[72] From 2004-2005 to 2011-2012, the average price of major food items increased substantially: 128 percent for wheat, 161 percent for sugar, 194 percent for pulses, 151 percent for vegetable ghee and edible oils, and 158 percent for meat.[73] The inflation of food prices has made food inaccessible to a large portion of Pakistan's population. According to Pakistan's 2011 National Nutritional Survey, approximately 58 percent of the country's population is food insecure, of which "29.6 percent faced hunger or severe hunger."[74]

For food manufacturers and traders, the increase in food prices has meant a shrinking domestic client base. As such, they have found new overseas markets for their products, especially food insecure countries in the Middle East. The UAE has been the largest importer of Pakistani food products. In 2012, it imported more than $500 million worth of Pakistani food products;[75] this accounts for more than 10 percent of the Emirates' $5 billion worth of annual food imports. Pakistan aims to double its exports to the UAE in terms of export revenues.[76]

War torn and landlocked, Afghanistan is another major destination for Pakistan's expensive food products. Afghanistan's dependence on Pakistani food items has significantly increased in recent years, with the total trade volume between the two countries growing to 30 percent of Afghanistan's total imports. For example, Afghanistan imports approximately 500,000-700,000 tons of wheat flour from Pakistan every year. As the international community's interest wanes from engagement in Afghanistan, and the global economic recession forces international donors to slash their foreign assistance to the Afghan government, the government could stop importing expensive food items from Pakistan.

[xvii] Pakistan's food production has steadily increased from 3,909,000 metric tons in 1960 to 23,300,000 metric tons in 2012.

In general, the increase in food exports from one food insecure country to another does not bode well for either. If food insecurity and extreme hunger in Pakistan contribute to violence in Pakistani society, the unrest could be far reaching and could destabilize those countries that have grown dependent on Pakistan for food. In turn, the sudden cessation of food exports could move these countries into social and political chaos.

Conclusion

It is vital to understand the complex relationship between climate change and social stresses. According to models maintained by the Intergovernmental Panel on Climate Change, the world will increasingly suffer from the effects of climate change and have to confront their impacts on communities, economies, and other globally integrated systems. For instance, droughts, desertification, floods, and rising sea level could lead to mass migrations within a country or across borders, burdening resources and possibly contributing to interstate or intrastate conflicts.

This paper finds that an exogenous variable such as climate change holds the potential to disturb the social and political equilibrium of a society, creating new fault lines in social, political, or ethnic landscapes or exacerbating existing ones. This disequilibrium could lead to the creation of new winners and losers, heighten tensions among them, and ultimately steer society toward conflict.

Preexisting social and political configurations will likely determine how a society responds if climate change disturbs this equilibrium. In the case of Pakistan, the most visible new fault line—between agriculturists and the manufacturing sector—could potentially compound preexisting fault lines. Although these two groups are not engaged in an active confrontation, tensions have increased, and open conflict could be sparked quickly if precautionary measures are not taken.

The case study of Pakistan highlights the point that social stresses induced by climatic variability are more complex than they originally might appear to be. Since these stresses are highly context-specific and join with each other through social feedback loops, societies can successfully neutralize threats posed by climate change only by adopting a prudent and holistic climate adaptation approach. Pakistan's weak political structure, its lack of resources, and its misjudged past attempts at adaptation have contributed to the energy crisis that is the most direct and immediate impact of climatic variability in the country. The country has seen thousands of protests on this issue in the last two to three years, billions of dollars in revenue have been lost, the industrial sector has nearly collapsed, unemployment is rising, and the number of people living below the poverty line is rising as well. All of these trends call into question Pakistan's viability as a state capable of providing for its citizens.

Pakistan's attempt to address its energy crisis by investing more in nuclear power is a cause for concern, especially when viewed against the backdrop of an eroding legal order in the country. While the effects of climate change can destabilize societies, so can the policy responses meant to address the initial concerns, as well as the confluence of new pressures and preexisting conditions.

This paper argues that the social and political stresses brought about by climate change are deeply tied to the existing social structure, political configuration, and historical context of a country. Most scientific studies about climate change's ability to destabilize societies justifiably identify civil conflict as a probable end. Knowing this, however, does little to enhance our understanding of the path societies could follow as they slip into conflict. This paper argues that understanding the multiple phases that a state passes through on its way to climate change-induced conflict could help researchers and policy makers to forecast such conflict and to develop better, more comprehensive adaptation strategies.

Climate change will not directly induce new, easy-to-observe, and independently measurable stresses in a society until those stresses are unavoidable. Yet, as the case of Pakistan suggests, the effects of climatic variation are gradual and ongoing, even if they are sometimes too subtle to be noticed—even by the people experiencing them. By understanding how current Pakistani challenges rooted in climate change—such as food insecurity, water scarcity, energy shortage, and the outbreak of contagious diseases—could lead to deadly conflict we can hope to develop monitoring systems and analytical capacities that might help to prevent low-level conflict from engulfing an entire region and jeopardizing global security.

About the author

Zafar Imran is a doctoral student at the University of Maryland's School of Public Policy, specializing in International Security and Economic Policy, and a graduate fellow at CISSM, focusing on civil conflict issues. Prior to coming to Maryland, Imran worked as a Research Fellow at the Middle East Institute's Center for Pakistan Studies, Washington D.C. Imran holds a Masters Degree in Public Policy from Carnegie Mellon University.

References:

[1] *Climate and social stress: Implications for security analysis*, National Academies of Science/National Research Council, 2012.

[2] *Global water security: Intelligence community assessment*, February 2012.

[3] Hauge, Wenche, and Ellingsen, Tanja, *Beyond Environmental Scarcity: Causal Pathways to Conflict*, Journal of Peace Research, Vol. 35, No. 3, Special Issue on Environmental Conflict, pp. 299-317, 1998; Homer-Dixon, Thomas F., *Environment, Scarcity, and Violence*, Princeton University Press, Princeton NJ, 1999; Ba¨chler , Gu¨nther ; Volker Bo¨ge , Stefan Klo¨tzli , Stephan Libiszewski & Kurt R Spillmann, *Environmental Degradation as*

a Cause of War: Ecological Conflicts in the Third World and Peaceful Ways of Resolving Them, Zu¨rich: Ru¨egger, 1996.

[4] Miguel, Edward; Shanker Satyanath & Ernest Sergenti, *Economic shocks and civil conflict: An instrumental variables approach*, Journal of Political Economy 112(4): 725–753, 2004; and Miguel, Edward & Shanker Satyanath, *Understanding transitory rainfall shocks, economic growth and civil conflict,* NBER working paper (16461) (http://www.nber. org/papers/w16461), 2010.

[5] Simon, Julian, L, Lebensraum, *Paradoxically, population growth may eventually end wars*, Journal of Conflict Resolution 33(1): 164–180, 1998.

[6] Hauge, Wenche, and Ellingsen, Tanja, *Beyond Environmental Scarcity: Causal Pathways to Conflict,* Journal of Peace Research, Vol. 35, No. 3, Special Issue on Environmental Conflict, pp. 299-317, 1998.

[7] Homer-Dixon, 1999.

[8] Ba¨chler, et al, 1996.

[9] Theisen, Ole M., *Other pathways to conflict? Environmental scarcities and domestic conflict,* Journal of Peace Research 45(6), 2008.

[10] De Soysa, Indra, *Paradise is a bazaar? Greed, creed, and governance in civil war, 1989–99,* Journal of Peace Research 39(4): 395–416, 2002.

[11] Koubi, Vally, Bernauer, Thomas, Kalbhenn, Anna, Spilker, Gabriele, *Climate variability, economic growth, and civil conflict*, Journal of peace research, 49(1) 113-127, 2012.

[12] Hissler, Sebastien, *Econometric study on the impact of rainfall variability on security in the Sahel region*, Organization of Economic Cooperation and Development & Sahel and West Africa Club Secretariat, 2010.

[13] Hendrix, Cullen S & Sarah M Glaser, *Trends and triggers: Climate, climate change and civil conflict in sub-Saharan Africa*, Political Geography 26(6): 695–715, 2007.

[14] Miguel et al., 2004.

[15] Jensen, Peter Sandholt, Kristian Skrede Gleditsch, *Rain, growth, and civil war: The importance of location*, Defense and Peace Economics 20(5): 359–372, 2009.

[16] Ciccone, Antonio, *Economic shocks and civil conflict: A comment*, American Economic Review: Applied Economics 3(4): 215–227, 2011.

[17] Hendrix, Cullen S., Salehyan, Idean, *Climate change, rainfall, and social conflict in Africa*, Journal of peace research 49(1): 35-50, 2012.

[18] Devitt, Conor & Richard S J Tol, *Civil war, climate change, and development: A scenario study for sub-Saharan Africa*, Journal of Peace Research49(1): 129–145, 2012.

[19] Theisen, Ole Magnus, Holtermann, Helge, & Buhaug, Halvard, *Climate wars? Assessing the claim that drought breeds conflict*, International Security 36(3): 79–106, (2011–12).

[20] Bergholt, Drago, Lujala, Pa¨ivi, *Climate-related natural disasters, economic growth, and armed civil conflict*, Journal of Peace Research 49(1): 147–162, 2012.

[21] Immerzeel, W.W., Van Beek, Ludovicus P.H., Bierkens, M.F.P., *Will climate change affect the Asian water towers?*, Science 328, 1382, 2010.

[22] Rasul, G. et al., *Vulnerability of Indus delta to climate change in Pakistan, Pakistan journal of meteorology*, Vol. 8, Issue 16, Jan 2012.

[23] Zahid, Maida, Rasul, Ghulam, *Changing trends of thermal extremes in Pakistan, Climate change*, January 2012.

[24] Rasul, 2012.

[25] *Pakistan Economic Survey*, 2007-2008.

[26] Armstrong, Richard, *Melting glaciers: current status and future concerns, USAID glacier melt project*, May 21, 2010.

[27] Immerzeel, 2010.

[28] Bolch, T., Kulkarni, A., Kaab, A., Huggel, C., Paul, F., Cogley, J. G., Frey, H., Kargel, J. S., Fujita, K., Scheel, M., Bajarcharya, S., Stoffel, M., *The state and fate of Himalayan glaciers*, Science, vol. 336, April 20, 2012.

[29] Pakistan Water and Power Development Authority (WAPDA), Hydro-potential in Pakistan, November 2011.

[30] Dawn, *IRSA urges provinces to conserve water*, July 18, 2011.

[31] Ibid.

[32] Pakistan Water and Power Development Authority (WAPDA), Hydro-potential in Pakistan, November 2011.

[33] Ibid.

[34] Water and Power Development Authority (WAPDA), *State of water resources in Pakistan*, 2011.

[35] Rasul, G., A., Mahmood, A., Sadiq, S. I., Khan, *Vulnerability of the Indus delta to climate change in Pakistan*, Pakistan journal of meteorology, Vol. 8, Issue 16, Jan 2012.

[36] Business Recorder, *IRSA prefers irrigation to power generation*, March 27, 2012; Business Recorder, *Punjab asks to prefer irrigation over hydro-power generation*, November 12, 2012.

[37] Business Recorder, *Power shortfall crosses 8000MW*, June 17, 2012.

[38] The Express Tribune, *Loadshedding: Protesters attack PML-Q MNA's house in Kamalia*, June 19, 2012.

[39] United Nations High Commission for Refugees, *Six months on, flood-displaced Pakistanis return home to reconstruct*, January 26, 2011.

[40] McClatchy, *U.N.-listed 'terror front' group leads flood relief in Pakistan*, August 10, 2010.

[41] Al-Jazeera, *Anger over Pakistan flood response*, August 02, 2010.

[42] BBC South Asia, *Pakistan landlords diverted flood water*, September 02, 2010; The Christian Science Monitor, *Pakistan floodwaters subside as a tide of allegation rises*, September 10, 2010; Express Tribune, *Critical decisions ahead as barrages continue to resist*, August 10, 2010.

[43] IRIN Asia, *Measles kill over 200 in Sindh province*, January 03, 2013; Warraich, Haider, *Dengue fever: Pakistan's recurring nightmare*, AfPak Channel, September 19, 2011; The Nation, *372 Dengue deaths in Lahore*, December 03, 2011; Dawn, *Earthly matters: Dengue caused by climate change?* October 16, 2011.

[44] IRIN, *Floods uncover evidence of feudalism's impact on poor*, February 17, 2011; Christian Science Monitor, *Biggest hurdle to Pakistan's flood recovery: Wealthy landowners*, September 29, 2010.

[45] Cohen, Stephen P., *The idea of Pakistan*, Brookings Institution Press, August 01, 2006.

[46] Mustafa, Daanish, *To each according to his power? Participation, access, and vulnerability in irrigation and flood management in Pakistan*, Environment and planning D: Society and space, Volume 20, 737-752, 2002.

[47] Ibid.

[48] Erik Eckholm, *A River Diverted, the Sea Rushes In*, New York Times, April 22, 2003.

[49] Express Tribune, *Trouble downstream: 'Indus Delta's ecology is being harmed by reduced flows,'* December 25, 2012.

[50] The News, *Three provinces have rejected Kalabagh Dam*, December 26, 2012.

[51] Dawn, *Punjab's culturable waste*, September 10, 2012.

[52] The News, *Saraiki party supports Kalabagh dam*, December 26, 2010; The News, *Nine farmer organizations join hands for Kalabagh dam*, December 26, 2012.

[53] Ercelawn, Aly, and Nauman, Mohammad, *Damming Kalabagh: State vs. Community, Centre vs. Territory, Nation vs. Federation*, The News, June 21, 1998.

[54] Ibid.

[55] The News, *ANP to never allow construction of Kalabagh dam*, December 26, 2012.

[56] World Bank country data – Pakistan.

[57] The Express Tribune, *Government defaults on sovereign guarantees*, May 9, 2012; The Express Tribune, *Circular debt crosses Rs. 400 billion mark*, January 24, 2012.

[58] The News, *Faisalabad traders launch civil disobedience movement*, April 25, 2012.

[59] The News, *Tribesmen block roads to protest Loadshedding in Mohmand*, December 17, 2012; Express Tribune, *Wapda installations attacked as loadshedding crosses 24 hours*, July 29, 2012; The Nation, *Power loadshedding cripples life in Khyber Agency*, December 27, 2012; Express Tribune, *Protests in Khyber Pakhtunkhwa, FATA against outages*, January 20, 2012.

[60] Ministry of Finance, Pakistan, *Pakistan Economic Survey*, 1999-2000.

[61] Business Recorder, *Pakistan may lose major share of textile export this year*, September 30, 2012.

[62] The Express Tribune, *Constructive advice: Punjab asks industrialists to become farmers*, March 15, 2012.

[63] Business Recorder, *Hydel power generation: Provinces refuse to release water from the dams*, December 05, 2012.

[64] Dawn, *Pakistan set to inject 3500MW into national grid*, July 04, 2013.

[65] Planning Commission of Pakistan, *Task force report on urban development*, January 2011.

[66] United Nations, *UN World Urbanization Prospects*, 2009.

[67] Planning Commission of Pakistan, *Task force report on urban development*, January 2011.

[68] Ibid.

[69] Yusuf, Huma, *Conflict dynamics in Karachi*, Peace works no. 22, United States Institute of Peace, 2012.

[70] Human rights commission of Pakistan report, 2012

[71] The Washington Post, *Food and energy shortages stoke inflation, anxiety in Pakistan*, March 11, 2008.

[72] Planning Commission of Pakistan, *Change in cost of food basket*, 2011-2012.

[73] Ibid.

[74] Dawn, 58 percent of Pakistanis facing food insecurity, October 17, 2012; IRIN News, Pakistan: Inflation hits food security, November 22, 2012.

[75] Khaleej Times, *Pakistan to double food exports to UAE*, December 01, 2012.

[76] Ibid.