Climate Wars Redux?
On Climate Variability and Armed Conflict in Asia

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Abstract
Extant research on the climate-conflict nexus focuses almost exclusively on (Sub Saharan) Africa. Yet, Asia is historically equally prone to armed conflict and many Asian countries are considered highly vulnerable to short-term environmental variations as well as long-term climate change. In this paper, we assess dominant claims for a climate-conflict connection and provide an empirical test of the statistical relationship between climate variability and intrastate armed conflict in Asia. Through the aid of geographic information systems (GIS) and geo-referenced environmental and conflict data, we are able to explore local, national, and regional dynamics while controlling for important contextual factors at various levels. Based on the documented findings, we offer a discussion on the way forward, with particular emphasis on avenues for future research and implications for policy.

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Introduction

Climate Change is much talked about and dooming scenarios of coming climate wars seem to be a favorite topic in public media as well as along NGOs and Policy makers. Most common linkages draw a line between dwindling resources, scarce fresh water availability and the fuelling grievances leading to conflict. In a recent report on “A Climate of Conflict” International Alert draws a global map identifying 46 countries most likely to be involved in armed conflict as a consequence of climate change: most of them located in Africa and Central, South and South-East Asia (Smith & Vivekananda 2007). While Africa is usually projected as being hit first and hardest by climate change and the conflict in Darfur has often been referred to as the first climate war [SOURCE], recent publications have put focus on water security and conflict in Asia. The German Advisory Council on Climate Change (WBGU 2008) sees high potential for conflicts over scarce water in Central Asia and as a consequence of changing monsoon patterns in India, Pakistan and Bangladesh. The United Nations Environmental Program adds to the rumors in a report on water stress in South Asia by foreseeing that if “the population increases, and the per capita water availability declines, conflicts over water allocation are likely to increase” (UNEP 2008: XIII).

While the physical consequences of climate change as projected by natural science research have turned into widely accepted general knowledge the public discussion about social consequences of a changing climate has gone a different path than social science research on the topic. Recent research on the climate-conflict connection offers mostly dismissive empirical evidence. To conclude that climatic variability is irrelevant for armed conflict would be premature, however, as earlier studies often are limited to exploring (Sub-Saharan) Africa. Africa currently hosts one-third of the world’s armed conflicts (Themnér & Wallensteen 2011); its post-colonial history is defined by institutional instability, social inequalities, and violent power struggles; and it is widely regarded as the continent most vulnerable to future climate change. The traditional focus on Africa, then, is well founded, but that does not make climate security a strictly African challenge. Indeed, larger parts of Asia\(^1\) share many of the characteristics that identify conflict-prone and environmentally vulnerable societies: A history of violence, widespread poverty, corruption, low level of technological sophistication, weak oppressive regimes, and inequities in economic and political privileges between social groups (e.g., ethnic, caste). Moreover, while all continents have experienced an absolute decline in armed conflict

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\(^1\) Asia here refers to Gleditsch/Ward country codes 700–860, which includes the following: Afghanistan, Turkmenistan, Tajikistan, Kyrgyz Republic, Uzbekistan, Kazakhstan, China, Tibet, Mongolia, Taiwan, North Korea, South Korea, Japan, India, Bhutan, Pakistan, Bangladesh, Myanmar, Sri Lanka, Maldives, Nepal, Thailand, Cambodia, Laos, Vietnam, Malaysia, Singapore, Brunei, Philippines, Indonesia, East Timor.
during the last 20 years, the decline has been least prominent in Asia, where South and Central Asia and Asian Middle East host an increasing share of all conflicts (Figure 1).

As our projections for the future have to be based on our knowledge of the past, this study wants to assess possible linkages between changing climate patterns in the past and armed conflict in Asia within the last 50 years. It provides an empirical assessment of the association between drought, water shortages, rising temperatures and civil war onset in Asia. In addition to its focus on the Asian continent, two contributions make this paper stand out from most earlier research. First, we acknowledge that the ethno-political context may be a powerful determinant that affects whether a drought translates into mobilization and violent protest. Environmental hardships, such as prolonged drought, tend to accentuate societal divides, as marginalized groups often lack alternative means of livelihood and income and are less likely to be at the receiving end of government-sponsored redistribution programs and relief aid. Second, we acknowledge that grievances and human suffering will emerge first, and be most acute, in locations where drought coincides with political and economic marginalization. Instead of considering countries at large as homogenous entities, we employ a geographically disaggregated design that allows capturing the environmental and political context at the local level.

Figure 1. Frequency of armed conflict, 1946–2009

![Graph showing frequency of armed conflict, 1946–2009, with a note explaining the data sources and definitions.](image)

Note: The figure illustrates annual frequency of armed conflict in Asian Middle East and Central and South Asia (dark color) compared to the trend for the rest of the world based on the UCDP/PRIO Armed Conflict Dataset.

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2 A drought is normally defined as deficiency of precipitation over an extended period of time, usually a season or more. See ISDR (2008).
Water Security in Asia

A recent report on water challenges in the Hindu-Kush Himalaya (which extends from Afghanistan in the west through Pakistan, India, Nepal, Bangladesh, and Bhutan to Myanmar and China in the east; henceforth referred to as the HKH) reports that the region “is already in a state of crisis” and that “further conflict could result from the natural and human-made [water] pressures facing the HKH region over the next twenty years” (Third Pole 2010: 3). The report concludes that many water scarcity-induced crises may escalate into developmental “catastrophes” unless vital knowledge gaps are addressed and necessary preparatory steps are taken.

The IPCC Fourth Assessment report (2007) projects the surface air temperatures in all of Asia to rise, least rapid in South-East Asia and most extremely in northern latitudes, continental Central Asia and during winter periods. The total number and duration of heat waves is expected to increase, which goes along with higher frequency and intensity of droughts in many parts of Asia. In South Asia a higher variability in summer monsoon rainfall with more severe flooding, and decreasing rainfall during winter time with more severe droughts, is most probable. China is expected to experience higher annual precipitation in the central and western regions, whereas in the north and northeast annual amounts of rainfall will drop. Across the entire continent greater extremes of precipitation are expected, causing floods as well as droughts – this goes hand in hand with an increase in the interannual variability of daily precipitation in the summer monsoon (Cruz et al. 2007).

The Third Pole report’s alarmist voice and gloomy depiction of a future business-as-usual world are far from unique. Although its explicit focus on South Asia is particularly relevant to this paper, equally dire warnings have been issued from numerous more general policy and NGO publications in recent years (e.g. Christian Aid 2007; CNA 2007; Schwartz & Randall 2003; Smith & Vivekananda 2007).

Climate change has rapidly approached the top of the political agenda and is now widely interpreted as “an all encompassing threat” to peace and security (Kofi Annan 2006: 3). US President Barack Obama (2009), upon receiving the Nobel Peace Prize, added further weight to this view, declaring that “there is little scientific dispute that if we do nothing, we will face more drought, more famine, more mass displacement – all of which will fuel more conflict for decades.”

The increasing attention to possible societal consequences of climate change is most welcome. Yet, the public debate is fraught with assumptions and untenable speculations, and relevant policy reports seldom acknowledge the (scarce) peer-reviewed scientific literature (Nordås & Gleditsch 2007; Salehyan 2008). The biased treatment of climate security partly results from significant research gaps, but also partly because alarmist statements and predictions are more likely to achieve...
the level of attention required for inspiring political action. The fact is, research on environmental conditions and human security is still in its infancy, and many questions and conundrums remain unresolved (see Buhaug, Gleditsch & Theisen 2010 for a detailed assessment of the literature). The need for more research is especially acute at the local level; almost all risk assessments today are carried out at the country or regional level, relying on overly aggregate data with little sensitivity to local characteristics and contexts.

Rapid increases in agricultural intensity, (unsustainable) irrigation, and the use of biochemicals over the last century made food security for the burgeoning population in large parts of Asia possible. Today, ecological collapse seems imminent; agricultural yield is stagnating and urban drinking water supply is at best intermittent. Thus far, the magnitude, causes, and societal consequences of water resource depletion across Asia are not well understood.

Figure 2. Annual precipitation across Central and South Asia

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3 One example of how policy sometimes purposely runs ahead of science can be found in the justification for the 2004 Nobel Peace Prize awarded to Wangari Maathai. The Chairman of the Norwegian Nobel Committee, Ole Mjøs, upon declaring connections between peace and the environment, predicted that more comprehensive analyses of conflict in coming decades would verify this relationship (Mjøs 2004).
Climate Variability and Societal Insecurity

Three developments associated with climate change stand out as potentially harmful to security and peace: loss of per capita supply of subsistence resources, increase in frequency and intensity of natural disasters, and rising sea levels. The Asian continent is particularly relevant in this regard, for several reasons. The region has a long history of political violence – hosting some of the world’s most durable insurgencies (notably in peripheral Myanmar, northeast India, Pakistan, southern Thailand) as well as numerous fundamentalist terrorist groups, and containing the international dispute with perhaps the highest potential for nuclear war in the foreseeable future (Kashmir). It contains the largest source of permanent (frozen) freshwater outside the Polar Regions (hence the HKH is sometimes referred to as ‘the third pole’), although the glaciers are now retracting rapidly – notwithstanding the recent controversy around the exact rate of melting. The booming economies of India and China and the sustained population growth in large parts of the region will put increasing demands on the diminishing water resource. According to a recent World Bank-initiated report, India will not be able to meet half of its water needs by 2030 unless drastic measures are taken (WRG 2009). The IPCC Fourth Assessment Report (2007) projects similar trends for other parts of the continent: Freshwater availability in Central, East and Southeast Asia particularly in the large river basins is likely to decrease dramatically due to the melting glaciers in the Himalaya, higher variability of the monsoon and changing precipitation patterns in general. Along with population growth and rising standard of living, a large share of the region will be under water stress by 2050. A significant drop of per capita freshwater availability (indeed, even lack of per capita growth) might have severe consequences for agricultural production, food security, health, and power production, and might accentuate prevalent intra-regional wealth inequalities. Yet, poor understanding of the ways in which water variability might interact with societal and contextual factors to generate human insecurity and, potentially, collective violent behavior, hinder the development of effective mitigation and risk reduction policies.

The large case-based environmental security literature offers several narratives of political violence and armed conflict within the context of resource scarcity (e.g. Homer-Dixon 1999). These tend to be quite local events, where abrupt shortages of e.g. freshwater and food cause widespread grievances that could instigate inter-communal (inter-ethnic) violence as well as urban riots. A proposed separate mechanism is large human displacement, often to regional urban centers, in response to (among other factors) scarcity-induced loss of livelihoods. The ongoing insurgency in Assam is but one example of an armed conflict in an environmentally vulnerable region that is shaped in part by host-newcomer tensions.
A key characteristic of the world’s poorest and most vulnerable societies is their dependence on rain-fed agriculture for income and food supply. Global warming is likely to affect precipitation patterns as well as surface temperatures and increase the unpredictability of extreme weather events, thereby probably having a negative impact on health and food security in many parts of the world (Christensen et al. 2007). Some argue that these developments might have implications for peace and security also in a stricter sense. The Environmental Security (ES) literature offers several case-based accounts of armed conflict within the context of competition over scarce resources (Baechler 1999; Homer-Dixon 1991, 1999; Kahl 2006). Yet, it remains unclear whether these cases are exceptions or whether they epitomize a more systematic pattern of resource scarcity and conflict in general and drought and violent conflict in particular (Buhaug 2010; Burke et al. 2009).

Climate-induced environmental stress as projected above is expected at most to exert an indirect influence on peace and security – it is not a single cause of violence as it is projected to add to other adverse economic, political, and social factors to produce violence (Homer-Dixon 1999). Buhaug et al. (2008) identify five social effects of climate change impacts to be influential intermediating catalysts of violence (see Figure 1):

- **Economic instability** – Scarcity of renewable resources in societies dependent on subsistence-economy could lead to unemployment and loss of economic activity (Ohlsson 2003) therefore decreasing state income (Homer-Dixon 1999).

- **Social fragmentation** – Kahl (2006) argues that competition over resources in heterogeneous societies can attract opportunistic elites who deepen social and ethnic cleavages and make the population more prone to radicalization.

- **Political instability** – Economic instability, higher unemployment and reduced state income resulting from resource scarcity can possibly reduce political legitimacy and therefore give rise to political challengers (Homer-Dixon 1999).

- **Inappropriate response** – Efforts and measures of climate change mitigation or adaptation are likely to have adverse side effects which could lead to tension and conflict between different actors and the aggrieved party (Goldstone 2001).

- **Migration** – Environmental stress can urge people to migrate to better off places. Movements in large groups can worsen environmental conditions in the receiving areas and lead to social fragmentation (Reuveny 2007).
Asian dependency on rain-fed agriculture is, compared to Sub-Saharan Africa, not that distinct. Only 4% of Africa’s arable land is irrigated, making many of the agricultural dependent economies vulnerable towards changing rainfall patterns. All Asian economies rely, not to same extend, on agricultural output – e.g. in Nepal, Cambodia and Pakistan the GDP depends to more than 30% on agricultural output, in Central Asia the value added to the GDP by the primary sector lies at about 20% (Worldbank 2011). Irrigation techniques are far more prevalent in Asia than in Africa. Nevertheless, two thirds of the arable land is not covered by irrigation systems making agricultural productivity, especially in rural areas, highly reliant on consistent precipitation.

Therefore rainfall becomes a solid measure of rural income as extremely dry as well as particularly wet time periods lower agricultural output (Hendrix & Salehyan 2011).

Based on causal chains put forward by the ES literature armed conflict should be more likely in years where dry spells decrease water availability and therefore lead to lower rural incomes as well as in times where extreme rainfall causes damage to yields. If the amount of precipitation deviates significantly from the usual and has a negative impact on agricultural output, it reduces the states income and could, in several ways, lead to a higher risk of conflict (Miguel, Satyanath & Sergenti 2004): Economic shocks undermine states ability to govern and indirectly increase rebel groups’ opportunities to take action. Additionally, if changing weather patterns put agriculturally dependent livelihoods at risk this leads to a reduction of personal opportunity costs to join a rebellion (Collier 2000).

Quantitative studies by Miguel et al. (2004) or Hendrix & Glaser (2007) undermine this line of argumentation. The authors find a connection between negative precipitation deviation and conflict onset in Sub-Saharan Africa. As reduced rainfall lowers national economic growth, the risk for civil war onset rises.

Not only decreasing amounts of rainfall can be seen as having negative impacts on security but also rising temperatures have been argued to lead to a higher risk of conflict. Burke et al. (2009) find that the risk of civil war onset in Sub-Saharan Africa increases significantly in warmer years. These results have recently been challenged by Buhaug (2010) and Buhaug et al. (2010). The theoretical linkages of rising temperatures and civil war are not explained in detail by Burke et al. but if higher temperatures decrease rural income through lower agricultural output, this lowers the opportunity costs for joining a rebellion (Buhaug et al. 2010). Therefore it can be argued that increased variability of climate parameters such as negative precipitation deviation and higher temperature can have negative effects on economic and political stability in developing countries and thus having the potential to increase the risk of armed conflict.
However, economic shocks, whether caused by changing climate variability or not, are an important cause when it comes to civil war onset but it should not be seen as a reason on its own. Civil wars can usually not be traced back to a single rationale, especially political and social circumstances do play a crucial role when it comes to armed conflict. Therefore the question of other influencing factors which add to the risk of civil war onset remains. Recent research on political exclusion as a contributing factor to civil war onset in Africa shows that ethno-political exclusion is a strongly related to an increased risk of civil war (Theisen, Holtermann & Buhaug 2010).

Taking earlier research on causes of armed conflict into account and including measures of several economic, political and social factors this study puts focus on deviation of the climate parameters temperature and precipitation and possible impacts on the local risk of civil war.

Therefore the following hypotheses are to be tested:

H1 – precipitation deviation increases the local risk of civil war.

H2 – civil wars onset is more likely in warmer years.

**Materials and Methods**

Most earlier large-N studies dealing with the climate conflict nexus are designed at the country level and therefore are not able to catch variations within smaller geographical areas. Climate variations do not affect a country as a whole but are most likely to vary within borders. To catch regional diversity in climate patterns as well as of economic and social factors we use a spatially disaggregated dataset for Asia in the time period of 1960–2004. The gridded structure has a resolution of 0.5 x 0.5 decimal degrees and contains more than 11,000 cells per year. Each cell is observed once per year since 1960 or the year of independence of the country to which the cell belongs.

The dependent variable in all model specifications is onset of armed intrastate conflict, as defined by the UCDP/PRIO Armed Conflict Dataset (Gleditsch et al. 2002). To facilitate the highly disaggregated analysis, all conflicts were pinpointed to the exact onset location (i.e. the locality of fighting of the first day of the conflict) and assigned geographical coordinates. The onset cells are coded “1” in the initial year of a new armed conflict, as well as in the first year of conflict recurrence after a peaceful intermittency of at least two calendar years.

The explanatory factor of interest in this study is twofold: precipitation deviation as well as temperature anomaly. Geo-referenced precipitation data were derived from the Global Precipitation
Climatology Centre (GPCC). The GPCC data contain annual gauge-based estimates of total precipitation (mm) for the global land surface at 0.5 degree resolution for all years, 1951–2004 (Rudolf & Schneider 2005). The gridded temperature data used is provided by the Climate Research Unit (CRU) of the British Atmospheric Data Centre (BADC). It is based on an archive of monthly mean temperatures provided by over 4000 weather stations distributed around the globe. We test several alternative operationalizations of precipitation and temperature deviation, which all are calculated specifically for each cell-year. Operationalizations of deviations include temperature and rainfall differences between consecutive years, difference from the observed time periods mean value and a measure in standard deviations.

Data on local political marginalization is derived from the Geo-Referencing of Ethnic Groups (GREG) dataset (Weidmann, Rød, and Cederman 2010). The GREG data contain spatial representations of all significant ethnic groups and stored in a geographical information systems (GIS) format. Data on political status for each group were derived from Buhaug, Cederman, and Rød (2008). When adapted to the grid structure, each cell is coded in accordance with the status of the majority group within the corresponding geographical area. The variable for marginalized ethnic groups (MEG) takes on the value “1” in cell-years where the majority group in the cell is excluded from central governmental positions.

As control variables, we include

- cell- and year-specific estimates of (log) population size, based on the Gridded Population of the World (v. 3 data)
- a dummy for cells that contain the capital city
- distance measures to the nearest international border (log km)
- country-level controls for democracy, represented by the Polity 2 index from the Polity IV project (Marshall & Jaggers 2002)
- country-level controls for Infant Mortality Rate (Abouharb & Kimball 2007)
- country-level GDP data (Gleditsch 2002)

All results will be based on regressions on a reduced sample to limit computation time. The reduced sample contains all onset cell-years and a five percent random sample of the non-conflict observations between 1960 and 2004.
Results

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Discussion

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