Climate Risks to India’s Internal Security

Sarang Shidore with Joshua W. Busby

KEY TAKEAWAYS

• India is among the countries most at risk due to climate change with a large part of the nation’s area as well as population in a high-risk zone even at the threshold 1.5°C global mean temperature rise.
• India also has several major internal security challenges that threaten state stability such as terrorism, insurgency, and violent protests, currently fueled mostly by factors other than climate change.
• By 2050, climate change will likely greatly heighten the vulnerability of India’s population through heatwaves, increased rainfall and cyclone intensity, and sea level rise. This will degrade crop yields, flood coastal and other cities, and cause greater episodes of drought.
• Rural distress, increased stresses on India’s delicately balanced federal structure, and urban violence are the arenas with the greatest security implications due to future climate change in India.
• Climate pathways leading to these security challenges include greater agricultural distress, inter-state migration, river water contestations between states, natural disasters, and heat wave-magnified violence.
BACKGROUND

With 1.3 billion people, India is the world’s second most populous country, projected to become the most populous within a decade. It has a large and varied geography with a long sea coast, a number of major river basins, forests, mountain ranges, and arid zones.

In spite of significant growth rates in recent decades, close to 40% of India’s population (i.e. about 500 million people) relies on rainfall from the Indian monsoon. But India is also an increasingly urbanizing country possessing several of the world’s largest cities such as Delhi, Mumbai, Kolkata and Bangalore.

India is one of the world’s most vulnerable countries when it comes to climate change. In 2018, it was the fifth worst country affected according to the Bonn-based think-tank Germanwatch, up nine notches from the previous year. The damage was estimated to be $37.8bn and 2038 lives (Germanwatch, 2019). India also has the largest number of climate-exposed people in the world (Busby, et al., 2018). Climate change is impacting temperatures, rainfall, sea level rise and helping strengthen extreme weather events such as cyclones. This presents ever-greater risks to farmers, fisherfolk, and urban and coastal dwellers, and raises questions on security impacts in the country.

This brief is an attempt to assess the risks of climate change for India’s internal security. Security is a broad term that has come to have multiple meanings, but this study will concentrate on state security, that is threats to state leadership and institutions.

In 2011, scholar T.V. Paul made the first major contribution to this topic at a time when the academic field of climate and security was less developed (Paul, 2011). He identified a variety of security-related challenges that India might face due to climate change. Paul warned that “climate change could exacerbate existing conflict patterns.” He noted that climate effects would make the existing development challenge harder, particularly via its effects on food production and access to water. Paul wrote that existing conflict patterns stemmed from “historically rooted socio-economic disparities, ethnic and linguistic issues, and caste-based allegiances.” Any climate-related challenges to India, Paul suggested, would not affect the whole state but be confined to “pockets or subregions,” with the Maoist tribal areas and poor areas in the North and Northeast of greatest concern.

Paul tempered his concerns with acknowledgment of some of India’s relative strengths, that compared to its South Asian peers, India had more institutional capacity given its strong federal and democratic structures, though its actions tended to be reactive rather than proactive. This echoes other findings on climate vulnerability in South and Southeast Asia (Busby 2019).

The climate security literature has produced mixed findings on the direct links between climate change and conflict, with some studies finding strong links and others disputing such claims. More recent research has explored the indirect causal pathways between climate change and conflict through economic growth, agricultural production, food prices, and migration (Busby, 2019). The field is beginning to develop a better understanding of the circumstances under which climate change is most likely to contribute to conflict, such as when negative rainfall shocks affect countries that have high dependence on agriculture and high levels of political exclusion (von Uexkull et al., 2016). Some single-country qualitative studies have highlighted the importance of climate factors in the onset of violence in countries like Syria, but these findings too have been contested (Femia & Werrell, 2012, Selby et al., 2017).

However, it is indisputable that climate change is likely to greatly increase human vulnerability in many parts of India. Increased vulnerability and distress will plausibly have major impacts on existing internal conflicts or could trigger new ones. India has currently three relatively well-
defined zones of political violence, but other forms of violence are present across the country and new ones could emerge, partly fueled by climate risk.

INDIA’S INTERNAL SECURITY CHALLENGES

Internal security challenges in a vast developing country such as India located in a tough neighborhood encompass multiple phenomena including terrorism, insurgencies, violent protests, and riots. The three main zones of internal violence in India are Kashmir, central/east-central parts of the country, and the northeast (figure 1).

Kashmir is mainly a phenomenon of terrorism by militants demanding the region’s merger with Pakistan. But Kashmir-linked militants have rarely targeted sites outside the region. The major exceptions were the 2006 and 2008 Mumbai attacks. The US and other governments have concluded that the latter were planned and executed by Pakistan-based militant group Lashkar-e-Taiba. There were also smaller scattered bomb attacks in some Indian cities in the 2000s that are seen to be the handiwork of local radical Islamist groups rather than Pakistan-based actors, with some (such as the bombing on an India-Pakistan train and a few mosques) tied to Hindu militant groups.

Parts of central and eastern India have pluralities of indigenous tribal communities. This is also where the bulk of India’s natural resources are located. These areas, centered primarily in and around the states of Chhattisgarh and Jharkhand, have had a Maoist (also called Naxalite in India) insurgency for decades that has ebbed and flowed. In recent years it has been pushed back and is now on a major low (Sahoo, 2019).

Maoist militants seek a radical overthrow of the Indian state and its replacement by some sort of peasant-oriented revolutionary government. They are very far from achieving their goals - the violence associated with these groups has declined dramatically over the past few years due to a strong counterinsurgency effort combined with developmental approaches of central and state governments (Sahoo, 2019). The latter included infrastructure construction and a welfare plan guaranteeing jobs in poorest districts. Serious levels of Maoist militancy are currently confined to southern Chhattisgarh and parts of Jharkhand.
The third violence-prone region is India's northeast where a different set of indigenous communities have long resisted being a part of the Indian union. Here the militancy is ethnic nationalist, with armed militants fighting for their own separate territorial states. Among these are Assamese, Naga, Bodo, Manipuri and other ethnic groups. This part of India is relatively remote, hemmed in by Myanmar, Bangladesh and Tibet and connected to the Indian mainland only through a narrow corridor of land.

Much of the militancy in India's northeast has been curbed over time by a combination of military action and the central government's political outreach. The coming to power of an India-friendly government in Bangladesh in 2008 led to the extradition of many militants who had made the country their base.

The states of Assam and Manipur have been key epicenters of violence until recently. After peaking in 1998 with 531 civilian fatalities, Assamese militancy has declined to minimal levels in 2019 with zero civilian deaths recorded (South Asia Terrorism Portal, 2019a). Militancy has also declined greatly in Manipur and Nagaland (South Asia Terrorism Portal, 2019b). The situation in Nagaland is however more fraught with peace talks between Naga militants and the government running into roadblocks (Mehta, 2019).

This relative peace however may be temporary. Recent moves by the Indian government to facilitate migration of non-Muslim minorities from Bangladesh under the newly passed
Citizenship Amendment Act (CAA) have sparked new unrest in the northeast, whose population is adamantly opposed to migrants from Bangladesh irrespective of their religion. Riots in India have been sporadic phenomena since the 1970s. Most of these are violent clashes between poorer Hindus and Muslims in densely packed urban zones. Major episodes include violence in Delhi in 1984, Mumbai in 1992-93, and Gujarat in 2002. Minorities have historically been disproportionate victims in such incidents, with allegations of state backing for the 1984 and 2002 events that took thousands of lives.

Since 2014, there have also been a spate of lynchings over alleged consumption or transport of beef, which is banned in many Indian states. Most recently, the passage of the CAA has been met with nationwide protests. The protests have largely been non-violent, but allegations of mob violence and police brutality have rocked some states such as Uttar Pradesh, Delhi, and Karnataka. There is a growing risk of future violence related to this fraught issue in 2020.

The agricultural sector has been seeing falling incomes and major spates of suicides of indebted farmers. Farmer protests, when they take place, tend to be localized. Farmer demands tend to be limited (such as increasing subsidies and waiving loans). Most such protests tend to be peaceful or minimally violent.

In the next sections we will examine what constitutes climate risk, and how India is likely to be impacted by climate change in the next two to three decades before returning and tying these to security dynamics within the country.

**CLIMATE HAZARD, EXPOSURE, AND VULNERABILITY**

The IPCC defines three specific components that make up climate risk – hazard, exposure, and vulnerability (figure 2). *Hazard* refers to the “climate-related physical events or trends or their impacts” (IPCC, 2014). This term therefore comprises the purely physical nature of a climate change-magnified event – e.g. an extreme rainfall episode or a powerful cyclone.

*Exposure* in this framework refers to “the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected” (IPCC, 2014). Thus, exposure is directly related to the extent and density of human inhabitation or assets in the geography exposed to a climate hazard.
The third concept in this framework is vulnerability, which the IPCC defines as “the propensity or predisposition to be adversely affected” (IPCC, 2014). Given the presence of a hazard and exposure in a geography, vulnerability is a measure of the adaptability to the human population and assets to cope with the net effects of the two. This adaptability is linked to the reduction of poverty or material deprivation.

Together, the three terms assess the overall risk due to climate change. The hazard term is external, and practically outside the control of an adaptation strategy. There is also a degree of inflexibility associated with the exposure term – while some assets or populations can be moved away from areas where climate hazards are likely, in most cases this is not feasible. It is therefore the vulnerability term that is the most under control of policymakers. This involves creating mechanisms and abilities for coping with climate stress (such as better governance, stronger social cohesion, and poverty reduction) and minimizing short- and long-term damage to human settlements.

The IPCC definitions have been complemented by alternative framings of climate risk. For instance, another approach sees vulnerability as the overarching concept, a combined function of physical exposure, population, household and community resilience, and governance (Busby 2019). A comprehensive literature review on climate vulnerability definitions in the Indian context indicated diverse approaches, depending on discipline and motivation (Singh et al., 2017).

The IPCC has also laid out scenarios which track global GHG trajectories until 2100, known as Representative Concentration Pathways (RCP) (Moss et al., 2010). Four such pathways have been defined in the most recent (fifth) assessment report from the IPCC (subsequently referred to as AR5) – RCP2.6, RCP4.5, RCP6.0, and RCP8.5, based on varying levels of “radiative forcing.” The first three envisage GHG emissions peaking before the end of the 21st century. Of these, the RCP2.6 is the most benign, keeping mean global temperature rise to within 1.5°C. RCP4.5 is roughly compatible with Paris Agreement goals of a 2°C temperature rise. RCP6.0 implies a mean temperature rise of between 3 and 4°C. RCP8.5 is the most pessimistic scenario of continuing increases in emissions beyond the end of the century. Current emissions pathways
have made achieving RCP2.6 extremely challenging, while RCP8.5 is also considered as unlikely given projected coal use.

**CLIMATE HAZARDS IN INDIA**

Observed historical data for weather events in India gives us clues to trends, but climate modeling is key to trying to understand the prognosis for temperatures, precipitation, cyclonic activity and sea level rise. Current models are more accurate on predicting temperature increases, but challenging for predicting precipitation, mainly because of the extreme complexity of the Indian monsoon.

**Temperature Rise**

Temperature rise in India is projected to affect practically the entire country even under optimistic climate mitigation scenarios. The greatest temperature increases will be seen in the northwest, west, northern plains and the eastern portion of peninsular India (figure 4). These include the states of Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, Gujarat, Telangana, Andhra Pradesh and Tamil Nadu.

**Precipitation**

The Indian summer monsoon typically begins in June and ends in September. It contributes to 78% of all rainfall in the country (Roxy and Chaithra, 2018) and is the most important contributor to the sustenance of life in the subcontinent.

Observational data of the monsoon over the past several decades show a number of clear trends. The mean rainfall is decreasing in large parts of the country (figure 4) including southern Kashmir, practically all of northern and north-central India, northeastern India, and large parts of the west coast. It has however been increasing in northern Kashmir, Gujarat, Odisha, Andhra

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**FIGURE 3: Temperature rise projections for India for 2050 and 2100 for higher (RCP 8.5) and lower (RCP 4.5) carbon mitigation pathways. Source - (University of Chicago, 2019).**
Pradesh and southern Karnataka (Roxy and Chaithra, 2018; Roxy and Ghosh, 2017). More of the monsoon rain is now seen in June and less in July and August than before (Singh, 2015).

![Figure 4: Mean precipitation in India is decreasing across much of the country, though increasing in some regions. Source - (Roxy and Chaithra, 2018).](image)

At the same time, the variability of rainfall within a monsoon season is increasing, i.e. more and more of the net precipitation is occurring as bursts of heavy rainfall, particularly in the warmer years (figure 5). There has been a three-fold increase in extreme rainfall events across a wide band across central and eastern India and parts of the west coast, a region with a large fraction of India’s population dominated by rainfed agriculture (Roxy and Chaithra, 2018). This includes the states of Gujarat, Maharashtra, Goa, Madhya Pradesh, Chhattisgarh, Telangana, Odisha, West Bengal, and Assam (figure 6).
Figure 5: Changes in mean precipitation in India plotted from the coldest to warmest years. As mean temperatures rise, this trend will likely intensify. Source (Roxy and Chaithra, 2018).

According to the EM-DAT International Disasters database, India experienced 285 reported flooding events in the period 1950 to 2017, impacting 850 million people and causing homelessness among 19 million. The death toll is estimated to be 71,000, and financial damage totaling $60 Billion (EM-DAT International Disasters Database). The Dartmouth Flood Observatory data indicates no clear pattern of increasing number of flooding events in India and a decreasing death toll from 23065 in the 1990s to 8514 in the current decade (Dartmouth Flood Observatory, 2019). However, climate change acts to increase intensities of adverse events rather than necessarily increase their frequency. Also, the natural disaster preparedness of the Indian state has vastly improved in this century. Nevertheless, developmental improvements do not necessarily imply better adaption capabilities when it comes to climate change (Singh et al., 2019)
Much of India is dominated by its many river basins (figure 7). Data show varying rainfall trends in these river basins since 1951 (Deshpande and Kothawale, 2016). The massive Ganga river basin in the northern plains and the Narmada-Tapti basins in western India have seen a significant reduction of rainfall. A smaller reduction has been observed in Godavari river basin in central India. Data show no changes in the Krishna and other river basins in southern India. Zero rainfall days are increasing in most regions (indicating greater intensity of rainfall) except parts of the peninsular region, northeast, Kashmir and northwest India. A study of a river basin in the state of Kerala indicated decreasing rain fall (Varughese, 2017). Research also indicates that precipitation is increasing in water-deficit river basins, while increasing in water-surplus ones (Ghosh et al., 2016).
A significant rise in the number of hot days in all river basins has been observed. A significant rise in the maximum and mean temperature are also seen for the west coast and southern river basins (Deshpande and Kothawale, 2016).

Historical data presented above foregrounds future projections obtained from climate modeling simulations. AR5 presents results of such simulations of the Indian monsoon. It projects increasing mean precipitation in the coming decades, however this projection comes with large uncertainty (IPCC, 2013b, Figure A1:63). The AR5’s CMIP5 comparative modeling exercise also shows substantial errors in reproducing historical trends (Sharmila and Joseph, 2015; Pathak et al., 2019). This implies that the confidence levels in these models is not high.

Adding to this uncertainty are historical data, which show decreasing mean precipitation in much of the country (figure 4), contradicting modeling projections of increasing mean precipitation. There are two explanations for this apparent discrepancy.

The first is the observed long cycles of 30 and 60 years for the monsoon (Bryan and Hughen, 2019). These cycles long precede global industrialization. India has been on a downward curve for mean rainfall since around the 1950s and the cyclical effect could be dominating the smaller precipitation increases due to climate change thus far. If this interpretation is correct, we will eventually see increasing mean rainfall levels as climate effects begin to strengthen with time.

Monsoon data inferred from geological evidence shows that monsoon precipitation has been broadly increasing over the past 250 years, corresponding to the industrial era (Bryan and
Hughen, 2019). This is consistent with the AR5’s projections of increasing monsoon strength. The study also shows decreasing inter-decadal variation, which indicates that the 60-year monsoon cycle may be attenuating with time.

The second explanation has to do with what scientists call “aerosol forcing,” i.e. the cooling effect generated by the high levels of air pollutants, particularly over northern India. Aerosol forcing may be more than making up for climate change effects, thus leading to a net cooling and consequent decrease in rainfall.

Until modeling efforts reach greater accuracy therefore, it is reasonable to accept the broad scientific conclusion of the AR5 that, as temperatures rise, monsoon winds ought to carry greater moisture content. This ought to eventually result in greater mean precipitation.

However, this takeaway comes with several complexities. The first is scale – models are generally more accurate at larger scales and miss major variations at smaller scales. Localized monsoon variations are expected to be substantial (Sharmila and Joseph, 2015; Varadan, 2015). For example, a local climate modeling study in the Godavari river basin has projected decreasing rainfall trends (Hengade and Eldho, 2019), whereas modeling for the massive Brahmaputra river that dominates India’s northeast projects increasing precipitation and floods through the century (Apurv, 2015).

Local projections can depart significantly from broader national level trends for multiple reasons. These include land use change, urbanization, and suspended particulate matter (aerosols) which generates a localized cooling effect. High air pollution in the northern plains of India is currently acting to temper what would otherwise be a greater local temperature rise of 0.5 C or more. The Indian monsoon is also affected by distant phenomena such as the El Nino-Southern Oscillation (ENSO) in the eastern Pacific.

Model projections are more certain on rainfall variability in India. There is strong agreement that rainfall of the future will likely be in the form of increasingly intense bursts. The AR5 projects increased interannual variability, extreme rainfall incidents as well as a longer monsoon duration (IPCC, 2013a, 1229-1232, 1272-1273). Thus, the observed trend shown in figures 5 and 6 will continue to strengthen. This implies a larger number of dry days in the future punctuated with spells of increasingly intense rain (Sharmila and Joseph, 2015; Sahany and Mishra, 2019).

A likely increase in the intensity of precipitation combined with possible increases in mean levels highlights the need for greater water storage. However, water storage capacities are currently far less than needed. All of this implies much greater flooding events during the monsoon season (Whitehead et al., 2015). Flooding magnified by climate change is among the greatest disaster risks India faces in the years ahead.

Flooding risk in the wet season will likely be compounded by higher risks of drought in the dry season. River flows in the dry season are unlikely to increase much and could also decrease as shown in a study on the massive Ganga basin (Whitehead et al, 2015). This is more likely for non-perennial rivers that don’t rely on glaciers such as the Narmada, Krishna, Cauvery, Godavari, and Mahanadi.

Sea Level Rise and Cyclones

Projections on cyclones (known as hurricanes in the Americas) also come with large uncertainties. However, global warming should induce greater cyclone intensity with greater rainfall (Mann et al., 2017). For India specifically, cyclone intensity is projected to especially increase on its western coastline, which faces the Arabian Sea. The northern part of the Arabian Sea is projected to experience particularly high increases in sea temperatures, driving greater cyclone intensity (Yadav, 2019).
Climate change will also cause global sea level rise due to melting ice in the Arctic, Antarctic and the “third pole” in the Himalaya-Hindukush-Karakoram-Tibet region of Asia. Even under optimistic mitigation scenarios, sea level rise could be up to 0.5 m by the end of the 21st century. Deltas (particularly the Sunderbans in the state of West Bengal and the Mahanadi river delta in the state of Odisha) and low-lying coastal cities (such as Mumbai) are most at risk.

**Climate Hazards: The Takeaways**

To summarize, the takeaway on climate hazards in India is complex and comes with uncertainties. Significant temperature increases will be seen in much of the country, with sharp temperature spikes very likely in the states of Punjab, Haryana, Delhi, western Uttar Pradesh, western Madhya Pradesh, Rajasthan, Gujarat, interior Maharashtra, Telangana, and some other parts of peninsular India. Net precipitation will plausibly increase. Rainfall intensity and variability will very likely increase. More intense flooding events are likely in most of the country. Greater droughts are plausible in large parts of already water-stressed central and peninsular India. Cyclonic intensity on both coasts will likely increase, with the west coast seeing a greater impact. Sea level rise threatens low-lying cities and major river deltas. All climate effects will have substantial spatial variability. Additional factors such as air pollution and land use changes underway (as the country transforms economically) add major perturbations to climate impacts. If air pollution challenges are addressed, this will perversely lead to greater temperature increases, especially in northern India.

**EXPOSURE AND VULNERABILITY**

Recall that exposure and vulnerability are the other two components of the IPCC climate risk framework (figure 2). Exposure scales with population and human assets located in zones of high hazard, while vulnerability is the lack of capacity of exposed populations to absorb the ill-effects of climate change. As a densely populated country almost everywhere, India’s exposure levels are high.

Water is a particularly potent driver of vulnerability in India. The country has multiple zones of high water stress (figure 8), even before most effects of climate change have set in, largely due to poor water management and consumption practices. These include northwestern, western and large parts of southern India. These include the major cities of Delhi, Bangalore and Chennai. A narrow strip along the west coast (which includes the city of Mumbai) receives high rainfall, and has low water stress. Most of eastern India also scores well, except for a few districts. The country’s northeast is the best positioned region (World Resources Institute, 2020; NITI Aayog, 2018).
The degradation and desertification of land is another major signifier of vulnerability. This is taking place due to land use changes, poor irrigation practices and emerging climate hazards. Of the larger Indian states, data show that this phenomenon is most prevalent in Jharkhand, Rajasthan, Gujarat, Maharashtra, Karnataka, Odisha, and Telangana (figures 9a and 9b). However, if the rate of change is also included in assessing the threat, Jharkhand, Gujarat, and Maharashtra stand out as the three states most vulnerable (figure 9a). Additionally, Assam and Uttarkhand are at relatively low net extent of land degradation, but exhibit high rates of worsening.

FIGURE 9B: India’s major states shaded according to fraction of land degraded and desertified. Darker shades indicate higher degradation. Compiled using data from (ISRO, 2016).

A study cited by the IPCC examined the composite vulnerability increases of global populations to 1.5, 2.0, and 3.0 C mean temperature rise due to climate (Byers et al., 2018). The study mapped multi-sectoral risks globally by normalizing and summing indicators for land, water, and energy risk and combining these with SSPs. The indicators included, among others, water stress index,
water supply seasonality, clean cooking access, heat stress events, habitat degradation, and crop yield changes.

The researchers found that South Asia was among the few parts of the world to reach high risk levels at the threshold 1.5 C warming itself. Many more regions entered the high-risk space at 2 C and. At 3 C warming about half of the world’s population was at high risk (Byers et al., 2018; Science Daily, 2018).

At 1.5 C mean global temperature rise, much of India is in the high-risk zone, but the eastern, northeastern, and parts of central India are at lower risk (figure 10a). At 2.0 C, risk zones enlarge in northwestern, western and parts of southern India and emerge in the northeast (figure 10b). At 3.0 C, practically the entire country is at high risk levels (figure 10c).

Sea level rise is a major threat to coastal India. Recent findings have tripled the globally vulnerable population exposed to sea level rise (Kulp & Strauss, 2019). Previous assessments of vulnerable populations overestimated the mean land elevation in densely populated or vegetated regions. The corrected elevation in the study greatly increases the estimates of the land area and therefore vulnerable population in India from 5 million to 36 million in 2050 under the RCP4.5 scenario of moderate emissions growth (Climate Central, 2019). Major coastal cities such as Mumbai (India’s financial capital) and Kolkata (the largest city in the country’s east) show major fractions of their land areas subject to sea level rise and annual flooding (figure 11).
Climate change could impact India’s internal security through its effects on vulnerable populations. High vulnerability will leave populations unable to cope with a climate-magnified natural disaster, plausibly breeding dissatisfaction. More “slow moving” vulnerabilities such as deteriorating farm incomes or increasing migration can also be pathways toward negative security outcomes (Busby, 2017).

An initial conclusion can be drawn by comparing current zones of high violence in India (figure 1) with zones of high water and land stress (figures 8 and 9b). The comparison interestingly indicates little geographic overlap, except for Kashmir and parts of Jharkhand.

However, much of the political violence in the country so far has been primarily caused by factors other than climate change or the environment. With much more adverse climate impacts in the coming decades, pathways to vulnerability and social stress will be far more salient in the next two decades, when mean temperature rise will likely reach and exceed 1.5 °C.

In the next sections, three key pathways of security risk due to India’s growing climate vulnerability will be highlighted, namely rural unrest, tensions over federalism, and urban violence.

Rural Unrest

Rural unrest in India is deeply tied to the long-standing state of crisis in the agricultural sector. Most of India’s growth over the past two decades has come in the service and secondarily the manufacturing sectors. Agriculture’s share in GDP has steadily shrunk from about 50% in 1950 to about 14% today (Mazumdar, 2009; Ministry of Finance, 2019), due to growth rates in agriculture being slower than in other sectors. However, agriculture still remains by far the country’s largest employer with about 60% of the population, i.e. more than 500 million people. Thus, farm incomes have been falling behind those from other sectors for decades. This has led to major urban-rural inequality in India.
Farmers rely on credit for their growing season, as fertilizers, genetically-modified seeds, and pesticides cost money, and an overwhelming majority of Indian farmers are small landholders with barely subsistence-level incomes. Such farmers also have few capital reserves and rely on rains for irrigation. Their woes are compounded by dropping crop yields as the fertilizer and water intensive model of agriculture India adopted during the “green revolution” of the 1970s is increasingly failing (Sharma, 2015). When crops fail, as has been happening frequently in parts of India, farmers go deeply into a cycle of debt (Ingle and Dandekar, 2005).

Inability to pay debts has caused more than 250,000 farmer suicides over the past two decades, mostly in the drought prone regions of peninsular India – interior Maharashtra, Telangana, Karnataka, Andhra Pradesh but also in Madhya Pradesh and Chhattisgarh in central India and Punjab in the country’s northwest. Farmer suicides are not a threat to state security. But they are a form of violence directed towards the individual self rather than the state or at other ethnicities. Thus, they are a major human security issue.

Climate change is only a smaller factor behind the agricultural crisis in India but it will become much more salient in the future. As volatility of rainfall increases, groundwater depletes, and drought cycles become more frequent, crop failure rates will likely increase and with it the vulnerability of the rural population. Agricultural yields in the 2012-2039 period are projected to decrease in the range of 4.5 to 9% due to climate change depending on the extent of warming, according to a study by Indian government scientists (Central Research Institute for Dryland Agriculture, 2013).

Will this clear and present danger to India’s vast agricultural population change from a human security to a state security challenge? The argument “where drought advances, so do Maoists” was persuasive during the first decade of this century (Parenti, 2015). Three pathways of the food crisis translating to violence have been proposed (Wischnath & Buhaug, 2014), namely lowered opportunity costs of rebelling, increased opportunities for recruitment, and accentuated and more widespread social grievances.

However, the Maoist insurgency’s steep decline after its peak in 2009-11 (Sahoo, 2019) even as farmer suicides and droughts continued to take place indicates that factors beyond climate change have been also key in determining trajectories of rural violence in India (Khanna and Zimmerman, 2017).

This is not surprising, as climate effects have been relatively at modest levels during the past decade. However, over the next two to three decades (when global temperature rise is likely to reach or exceed 1.5 C or 2.7 F), climate change will increasingly be the dominant stressor on agricultural livelihoods. The intersection of looming climate threats and other forms of environmental degradation with political, social, and governance factors will ultimately determine which situations could lead to violence.

Given that climate projections at local scales come with major uncertainties, it is challenging to predict the precise locations where agricultural distress due to climate change will be the greatest. However, water, land degradation and overall vulnerability mapping discussed above indicate that water-stressed peninsular India (interior Maharashtra, Telangana, northern and central Karnataka, western Andhra Pradesh and parts of Tamil Nadu), Jharkhand, Assam, Bihar, Uttar Pradesh, parts of Odisha and Chhattisgarh, Gujarat, Rajasthan, and Punjab are at greatest risk in terms of increased crop failure, drought, and flooding.

A subset of these regions, namely Uttar Pradesh, Jharkhand, Bihar, Assam, Rajasthan, and Chhattisgarh also have high fractions of young men in their populations, which has been shown to correlate with greater civil conflict (Collier, 2009). These are the zones, therefore, where climate risk has the highest chances of translating to violence. Additionally, this risk will also likely lead
to greater migration to other states and an increase in river water contestations, which can spark inter-state tensions (below).

**Tensions over Federalism**

At independence, India adopted a federal constitution with significant devolution of powers to its states. In any federal structure, differences and contestations are normal. Questions of security arise, however, when these threaten to become irreconcilable and open up possibilities of separatism or violence.

The axes of contestation in this category can be either between states or between states and the central government. Three climate-magnified stressors could potentially aid such a dynamic in India’s federal structure – migration, disputes over sharing river waters, and extreme weather events.

**Inter-State Disputes**

Two pathways through which inter-state disputes could arise or worsen in a climate-afflicted India are inter-state migration and the sharing of river waters.

**Inter-state Migration**

According to the Indian government’s Economic Survey (Ministry of Finance, 2017), India saw an inter-state migration of 9 million between 2011 and 2016. Most inter-state migrants come from the states of Uttar Pradesh and Bihar followed by Madhya Pradesh, Punjab, Rajasthan, Uttarakhand, Kashmir, Odisha, and West Bengal. They tend to migrate to the more prosperous states such as Delhi, Maharashtra, Gujarat, Goa, Karnataka, Tamil Nadu, and Kerala.

Migration in India tends to be rural to urban in nature in a country that is urbanizing rapidly. India’s agricultural crisis forces farmers to move to cities to seek part-time or full-time work to supplement falling farm incomes. As we saw above, climate change is currently only one factor in this crisis, but its salience will greatly increase in the future. Migration has been touted either as an adaptation strategy or a sign of failure to adapt, but such binaries do not capture the complex nature of these vulnerabilities (Singh & Basu, 2019).

Natural disasters are another major cause of migration. According to the Geneva-based Internal Displacement Monitoring Center, India witnessed 2,171,000 new displacements due to natural disasters in the first half of 2019 (IDMC, 2019). Specifically, this consists of the sinking of river deltas, extreme rainfall episodes, and more intense cyclones that will threaten habitation, livelihoods and infrastructure in cities and villages. A majority of such migration happens due to highly localized, micro-disasters that do not make the news.

Adverse weather events in India have been linked to inter-state migration in a recent study, and responsible for 8% of all rural-urban moves between 2005 and 2012 (Sedova & Kalkuhl, 2020). Since climate change acts to magnify adverse weather events, this fraction is likely to increase in the future.

The sinking of river deltas is already being witnessed in the Sunderbans region in West Bengal (Raha et al., 2012) and the Mahanadi river delta in Odisha (Hazra, et al., 2019). The causes for this are mainly human activities such as building dams (which trap silt upstream), but climate change is playing an increasing role.

Threats to coastal cities will likely greatly increase in the future with sea level rise causing major flooding events on an annual basis in densely populated cities such as Mumbai, Kolkata and Surat (see above). The resultant displacement from coasts to inland areas is yet another driver of future migration.
Globally, rural-to-urban migration has not been linked to significant violence (Buhaug & Urdal, 2013). However, this conclusion may not hold in a climate change-dominated future, especially in the Indian context. Indian states are mostly organized on a linguistic basis, with each state being culturally a nation-like entity with one predominant language. This enables inter-state migration to manifest itself as an issue of ethnic conflict.

Anti-migrant politics has a long history in Maharashtra, but more recently, this sentiment has also been seen in Karnataka, Kerala, and Tamil Nadu (Radhakrishnan and Vasan, 2019; Indresh, 2019). Anti-migrant politics is by far the greatest in India’s northeast, where indigenous communities have long opposed an influx from Bangladesh. This is one key factor behind the region’s separatist movements.

The serious climate risk, high fertility rates, and overall poor governance of the states of northern India (especially Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh, and Rajasthan) make them particularly prone to even greater migration outflows in the coming decades. This sets up a potential clash with the south and the west of the country, which is more prosperous but itself subject to considerable climate risk (figures 11, 12, 13). The language divides of the 1950s could plausibly reappear in a different form as a political and security challenge in a climate-afflicted India.

Bangladesh’s serious climate challenges (such as loss of land and encroachment of salinity) generate potential for increased migration to India. With the passage of the CAA by New Delhi, Bangladesh’s significant Hindu minority may now be able to legally migrate into India’s eastern and northeastern states. This will not only enhance already-existing tensions in India’s northeast wrought by migration, but also fuel deeper alienation of minorities all across India, as signified already by the growing protest movement against the CAA in many parts of the country.

River Water Disputes

Though international water disputes often get the most attention, the more intense water conflicts in the world tend to take place at local and subnational levels (Conca, 2012). Variability rather than scarcity is a better indicator of conflicts over water, as existing practices and institutions have a harder time coping with higher levels of unpredictability (Risi, 2019).

Indian states have multiple disputes over sharing of waters of several rivers including the Cauvery, Mahanadi, Krishna, Periyar, Mahadayi, Beas, and Sutlej. Specially constituted tribunals have adjudicated some of these disputes, but others remain in litigation. Violence has occasionally been triggered by these disputes. Protests and scattered riots have in the past been triggered by the Cauvery dispute between the states of Karnataka and Tamil Nadu. Although the Cauvery tribunal delivered its final verdict in 2007, the frictions continue between the two states on the verdict’s implementation and other rivers (Shyam Prasad, 2019). Contestations over the Sutlej and Beas river waters was one driver behind the separatist Sikh insurgency which wracked Punjab in the 1980s.

Center-State Tensions

India’s states were mainly constituted along linguistic lines after language-rights agitations spread across the country soon after independence. The formation of such states defused the protests, some of which were threatening to spiral into secessionist uprisings.

However, a handful of regions such as Kashmir and parts of India’s northeast, continued to be embroiled in tensions with the central government. The Kashmir conflict in particular can be seen as the most extreme case of center-state tensions in India. The conflict is intimately linked to India’s rivalry with Pakistan (Schofield, 2010; Ganguly, 2016; Noorani, 2013).
The Kashmir dispute is currently minimally impacted by climate change. But increased volatility of river flows, extreme rainfall events, and glacier melt due to climate change (Yirka, 2019; Savoskul & Smarthin, 2013, Prasad et al., 2019) will likely cause a greater number of natural disasters such as floods and avalanches. If these disasters are not handled well, already deep alienation of the region’s population toward the Indian state is likely to grow. This was witnessed during the major floods there in 2014, when local residents alleged neglect by the Indian military sent for relief (Gowen, 2014).

Natural disasters tend to exacerbate existing insurgencies given appropriate external and internal political conditions, but can mitigate them in their absence (Klitzsch, 2014; Beardsley and McQuinn, 2009). If Pakistan maintains its support for the Kashmir militancy and India does not initiate a political process of reconciliation, climate vulnerabilities will likely further fuel the violence in Indian-held Kashmir.

Three states in the northeast are other candidates for increased tensions with the center in which climate change can act as a magnifier. Assam, the site of the massive Brahmaputra river basin, is likely to experience greater flooding. Assam has had a separatist movement that has ebbed over time, but the recent amendment to India’s citizenship laws by the central government has triggered alienation and major protests in the state. This could lead to renewed support for the separatist cause, which frequent climate-induced flooding disasters of the future could accentuate. Nagaland and Manipur are two small northeastern states with existing separatist movements which also bear watching.

More speculatively, there may be other states in which climate change could act as a multiplier of existing alienation from the central government. The recent turn toward majoritarian nationalism by the Modi administration, if sustained, has raised the possibility for the first time in decades that frictions could greatly increase between the central government and two states dominated by oppositional politics in the deep south of India – Kerala and Tamil Nadu.

Of these, Tamil Nadu has a history of secessionist movements in the middle of the 20th century. Tamil Nadu also has a serious drought and water scarcity challenge that could get compounded with additional risk of flooding due to climate change (Varadan et al., 2017). Kerala is experiencing decreasing rainfall, likely future drought and flooding risks (Varughese, 2017), and is already a major destination for migrants from northern India. Though Kerala does not have a history of separatist politics, the Modi government’s majoritarian policies have been widely opposed in the state.

Slow economic growth and inequality are well-correlated with greater probability of violent conflict (Collier, 2009). After many years of relatively good growth, India has entered what appears to be a structural rather cyclical economic slowdown, with its root causes in the country’s stricken financial system (Subramanian and Felman, 2019). The manufacturing take-off expected through the government’s “Make in India” initiative has not materialized, dampening hopes of reducing unemployment. Though climate change is not responsible for these problems, a structural slowdown with high joblessness, if it lasts several years, will increasingly intersect with growing climate effects and compound risks of unrest that could strain Indian federalism.

Urban Violence

Larger-scale urban violence in India has mainly taken the form of ethnic riots, chiefly between Hindu and Muslim communities. Violent protests have also occurred in urban and peri-urban areas due to various causes, such as displacement due to infrastructure projects. It is conceivable that a major shock to an urban area such as a natural disaster event could cause urban discontent in the form of violent protests against the state or riots between ethnic groups.
There is however little history in India of an urban natural disaster leading to violence. Major shocks such as the Asian tsunami in 2004 in Tamil Nadu, massive Mumbai flood of 2005, or the more recent flooding in Chennai in 2015 have generated more cooperative than conflictual behavior, though citizen discontent with urban governance increased in the wake of some of these disasters.

Urban dwellers are also reliant on markets for food, and climate change could undermine Indian food production, making the state more reliant on exports or subjecting the country to periodic food price hikes, a factor that has been attributed to protest activity in other contexts, such as the “Arab Spring” (Smith, 2014).

As we saw above, temperature rise and heat spikes are very likely in practically all parts of India even under moderate climate change scenarios (figure 4). According to the heat-aggression hypothesis, warm weather induces greater violent behavior (Baron & Bell, 1976; Anderson, 1989, Sellers et al., 2019). Increased temperatures have been shown to induce violence in urban neighborhoods which are already socially disadvantaged (Mares, 2013).

Indian cities with their deep class and spatial inequalities and skewed gender ratios, accentuated by suboptimal policies (Burte and Kamath, 2017) and proximate living conditions could be susceptible to greater violence due to the magnifying effects of climate change. This includes violence between religious and ethnic communities. Cities with major history of inter-community violence include Delhi, Mumbai, Ahmedabad, Meerut, and Hyderabad. Other cities in climate vulnerable zones, for example in India’s populous northern plains, could join them in the higher risk category for urban violence.

**CONCLUSION: SAFE IS BETTER THAN SORRY**

Climate change is only one of the challenges India faces currently, and many of the hard security crises the country faces today are driven more by other factors. However, projections for climate risk become serious for a large portion of the country close to the 1.5 C mean temperature rise threshold. If global temperatures rise by 2 C, as current trajectories indicate they will, the impacts on India are likely to be severe, and intersections with security risks are impossible to ignore.

Notwithstanding the uncertainties of climate science at regional and local scales, this brief has attempted to highlight the security challenges that may be most affected by climate dynamics in the time frame up to around 2050, with the focus being on state security. The causes of organized violence within nations are many and complex, but greatly enhanced displacements, loss of livelihoods, and natural disasters are likely to breed dissatisfaction in a country such as India, already beset with economic, social, and governance challenges.

This study points to rural distress, inter-state and central-state contestations, and urban violence as the areas with the greatest security implications due to future climate change in India. The intent is not to be alarmist, but to signal areas of greater risk so that policymakers can prioritize preventive actions.

It is plausible that some of the risks highlighted above will not be borne out. This could happen either due to high social resilience (traditionally associated with India at local and neighborhood scales) that leads to cooperative rather than conflictual dynamics on experiencing climate hazards. After all, India is no stranger to major natural disasters for many decades, and yet there is little empirical evidence of major organized violence in wake of these incidents. Or perhaps we will see a breakthrough in global climate mitigation efforts that keeps mean temperature rise within 1.5 C and averts most of the damage of climate change. However, current local and global trends make these futures unlikely. As always, it pays to be safe rather than sorry.
Sarang Shidore is a Senior Fellow at the Council on Strategic Risks and Senior Research Analyst at the Lyndon B. Johnson School of Public Affairs at the University of Texas at Austin, with expertise and multiple publications in geopolitical risk and the energy-climate nexus. Joshua Busby is an Associate Professor at the LBJ School of Public Affairs at the University of Texas at Austin, a Senior Research Fellow at the Center for Climate and Security and has published widely on climate and security for both academic and policy audiences.

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1 Called the Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS).
2 The act would also facilitate non-Muslim migration from Pakistan and Afghanistan.
3 Scientific term for the net energy balance the earth experiences due to GHG emissions, land use changes, and other factors.
4 A newer scenario approach, known as Shared Socioeconomic Pathways (SSP), is being adopted by the IPCC for its next assessment report. See (Riahi et al., 2017).
5 Since the IPCC AR5 was published in 2014, modeling accuracy for the Indian monsoon at local scales has not advanced significantly. However, the first results from more accurate, low-resolution models will be published later in 2020 and are likely to provide a better understanding of state-wise trends.
6 Storage in the form of large, modern dams has serious drawbacks including displacement of large numbers of people and destruction of ecosystems. Reviving age-old small-scale tanks to capture water is an option but these would still be insufficient given the large increases in population and consumption over the past century.
7 The Clausius-Clapeyron equation in climate science yields a roughly 7% increase in water vapor per 1 C of warming.
8 Note that climate change is one of several factors leading to this degradation, but these trends are early warning signs. For example, water erosion is already the biggest source of land degradation and intense rainfall activity due to climate change will increase this erosion in the future.
9 However, it must also be recognized that vulnerable populations subjected to natural disasters can also seek conflict de-escalation and cooperation. An example of this is the end of the Aceh rebellion in Indonesia in the wake of the 2004 Asian tsunami.
10 India has recently centralized the adjudication process for river disputes. See Choudhary (2019)
11 Kashmir is currently effectively partitioned between India, Pakistan and China. Indian-held Kashmir was demoted from its status as a state and split into two centrally controlled territories of Jammu and Kashmir and Ladakh in August, 2019.
12 A detailed analysis of the impact of climate change on the India-Pakistan rivalry is available as a separate brief in this series (Shidore, 2020).
13 A recent study (Housing and Land Rights Network, 2018) counted 260,000 coerced evictions in India in 2017, a majority of these being in urban areas.
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