# Changing Weather Patterns, Clmate Change and Civil War Dynamics:
### Institutions and Conflicts in the Sahel
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Changing weather patterns increasingly shape battlefield dynamics in civil wars. Civil wars have complex origins and once violence erupts, local, regional, and global drivers, including changing weather patterns, shape the processes of conflict.[1] As one study published in *Nature* indicated, the "stability of modern societies relates strongly to the global climate." Others have shown that climate change undermines 'human security' and that warming temperatures lead to an increase in crime. Some contend that climate change research has overdramatized the causes of certain wars while downplaying important pre-war cleavages. Finally, some studies show the difficulty of drawing a direct causal link between climate change, statistically significant changes in weather patterns due to anthropogenic activity, and civil war on-set.

Our field research provides further clarity and greater nuance on these debates and studies by investigating various processes and variables involved with local-level violence, environmental changes, and weather shifts. Additionally, there has been a change in the character of battlespaces, fragile food systems, and food (in)security, which highlights how changing weather patterns directly impact the formation of new battlespace dynamics and the processes of violence in the Sahel. Indeed, there is significant evidence that links temperature and rainfall shifts with decreases in political stability in the Sahel (see Figure 1). For the purposes of this article, we restrict our analysis to the central portion of the Sahel, specifically the Lake Chad Basin (LCB) area, which is bordered by Chad, Cameroon, Niger, and Nigeria. Already, there is substantial evidence linking temperature and rainfall shifts with decreases in local and regional political stability across the Sahel (see Figure 1). While some research finds "limited support for viewing climate change as an important influence on armed conflict," our field work and research into the LCB illustrates how weather is impacting it specifically regarding new dynamics of violence.

## Two Decades of Change in the Sahel

Although political stability has increased for most Sahel nations, only a handful of countries end up having a positive rating in this dimension; most have become less negative. Average annual temperature has gone up for nearly all countries. The change in annual average rainfall has been mixed. Nigeria has the biggest loss and Ethiopia the biggest gain.

Countries in the Sahel have tended towards political instability over the past 20 years, but there has been improvement in many countries. In nearly all Sahel countries, the average yearly temperature has increased, while Nigeria, Cameroon and Central African Republic have seen decreases in yearly average rainfall.
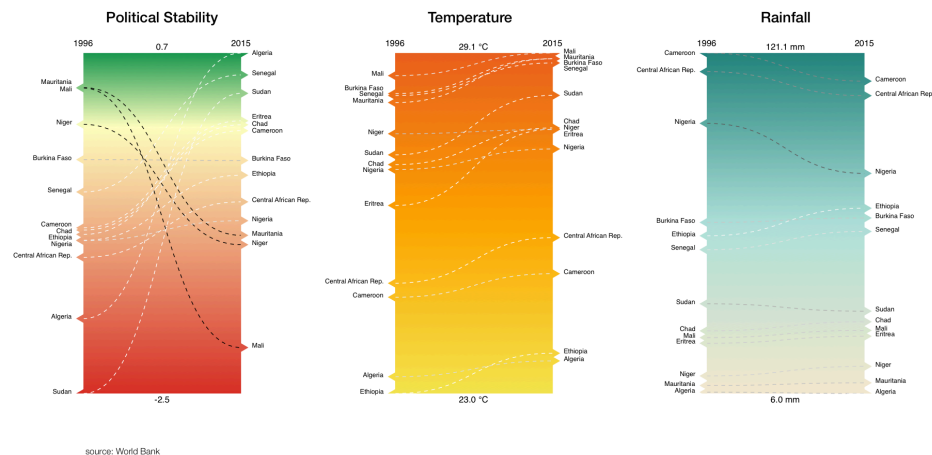


source: World Bank

**Figure 1.** Regional Sahel changes in political stability, temperature, and rainfall between 1996 and 2015. Source: Molly Jahn, Buddhika Jayamaha, William S. Mulhern, Douglass E. Ross, Matthew A. Rose, Gregory F. Treverton, "Global food system stability and risk: At the nexus of defense and development," *Thomson Reuters*, April 2018, https://www.thomsonreuters.com/content/dam/ewp-m/documents/thomsonreuters/en/pdf/reports/global-food-system-stability-and-risk-0718.pdf.

We conceptualize changing weather patterns as a global structural change where some countries and regions experience the suite of effects of climate change far more intensely than others. Then, we contend that geography, levels of economic development, and institutional capacity of the state, in combination with changing weather patterns, play a direct role in how battlespaces are defined and shaped. We briefly explain how changing weather patterns affect conflict dynamics as militias, rebel groups, and civilians adopt to the change – sometimes "weaponizing" it to their own advantage. Consequently, in some instances, changing weather patterns become part of (and influence) the endogenous violent processes inherent to civil wars. Finally, to explain the emergence of these new processes, we rely on our research and field work in the Lake Chad Basin (LCB) bordering Chad, Nigeria, Cameroon, and Niger to highlight how climate change is increasingly impacting civil wars.

## Changing Weather Patterns, State Institutions, and Civil Wars

Geography, alongside the nature of formal and informal state institutions, shapes the complex processes of how climate change influences civil war dynamics. The impacts of harsh geography compounded by climatic change unfold in distinct ways in countries where government institutions are very weak. These are countries where political leaders typically exercise authority through personal networks that they construct behind the façade of formal statehood. The real basis of their power is rooted in the politician's capacity to control markets, including illicit sectors of the economy, and to manipulate other people's access to these resources in ways that enhance the politician's own power. State offices give these politicians access to foreign aid and other resources channeled through state institutions that can then be converted to patronage to distribute to supporters. In our analysis, it is especially important to focus on how climate change influences conflict within this key realm of political authority. Formal institutions are best characterized as the bureaucratic agencies and the procedures and constitutional rules that define governance on paper, whereas informal institutions describe how patron-client networks operate in asserting power and authority.[2] Thus, we contend that the institutional configurations and state capacity bear directly on any attempt to explain the variations of climate change and any attendant effects on conflict and its severity.

There is an indubitable consensus in the scientific community that global weather patterns are changing as a result of anthropogenic activity (i.e., humans). In addition, geography coupled with the resiliency of ecosystems also play a role in how and why climate change impacts some places in the world more significantly relative to other places. Though the effects of climate change are broad, the specific nature of these impacts varies across different societies and political systems. Each of these factors shape how individuals and communities adapt to this change. This adaptability is very much contingent on both the nature of the institutional structure and capacity of the state that governs social, political, economic and military affairs.

Climatic change impacts the Arctic islands of Northern Canada just as it does the many Philippine archipelago islands. However, Canada's government and society are better situated to handle such changes because they have institutional structures in place that assist societal actors to adapt with low costs and risks. Similarly, variations in institutional capacity within countries and the territorial reach of institutional capacity also matter significantly. For example, Manila is better situated to manage the adverse impacts of climate change and adapt at a relatively-low cost compared to those on the southern end of the Mindanao Island. Individuals in Manila

experience better state capacity and an institutional structure that absorbs some costs, thereby providing a public good while creating an incentive structure that shapes individual decisions. Mindanao's local political environment is dominated by personalist networks of politicians and neighborhood strongmen who leverage their relationships to the formal institutions of the state to build extensive patron-client networks rooted in the formal and illicit economies. Consequently, as weak and inefficient as institutions may be, citizens in Manila can handle changes better than many of the smaller islands. Likewise, the disruptions of climate change have different social and political effects in these two places due to the different weaknesses and flexibilities of these two kinds of authority structures.

Civil wars add an extra inimical layer to an already complex relationship between climate change, state institutions, and society. The effectiveness of the state and its institutional reach across territory play a direct role in shaping civil war dynamics to include how insurgencies recruit and fight. Historically, rough terrain always provided perfect rear bases to conduct protracted insurgencies because the rebels could take advantage of the terrain due to the inability of the state to maintain order, monopolize violence, and regulate social behavior. However, insurgency in urban environments are becoming increasingly common due to changes in state strategies and policies in the employment of military force. In the current milieu, our ongoing research on insurgencies, food insecurity, and climate change indicates that the Sahel region is in the 'eye of the storm.'

The Sahel sits at the nexus of rapidly changing weather patterns due to its geography and ecosystem between the Sahara Desert and tropical Africa. The region is also host to countries in which formal state institutions are very weak. This incapacity is a chronic stressor that impedes development and leads to endemic corruption, political instability, and poor physical infrastructure, et cetera. Multiple conflicts are emerging in the Sahel that span national boundaries along ethnic, ideological, economic, and religious cleavages (see Figure 3). Understanding the role of formal and informal institutions is crucial in understanding how one state can collapse due to dramatic weather changes, whereas other states can improvise and adapt their institutions (i.e., the informal personalist patron-client networks as well as government bureaucracies) to ensure that various elites and local powerbrokers are satiated.

**Perfect Storm in the Sahel: Weak Institutions, Climate Change, and Insurgency**

The Sahel hosts numerous fragile states with weak institutional and infrastructural capacity that rank at, or very close to, the bottom in most indices of state capacity and citizens' well-being, and near the top of measures of official corruption. These geographically large states also contain what scholars refer to as "ungoverned spaces," where the primary economic activity outside of agriculture remains concentrated in smuggling routes and other illicit activities. These areas should not be understood as devoid of political authority, however, as the informal personal networks of key politicians often play an important role in organizing these activities. This "ungoverned" aspect of these spaces creates opportunities for some of these politicians and their partners to exploit their official positions to gain competitive advantages in these illicit and often violent markets. This can occur when an official is able to selectively gain exemption from the enforcement of laws or is provided with official documents to facilitate illicit opportunities. Likewise, this manipulation of state authority can be used to shield criminals from official scrutiny.[3] The primary means of supporting oneself (and their family) is through various criminal networks: working either as a smuggler; assisting smugglers with logistics; or if one holds territory, taxing smugglers in return for safe passage. With the addition of ideology and grievances, organized violence against the state (even when smugglers collude with and receive protection from specific state officials) becomes an obvious strategy in maintaining these smuggling networks, with most states in the Sahel unable to adequately respond – militarily and bureaucratically – to these threats (see Figure 2).
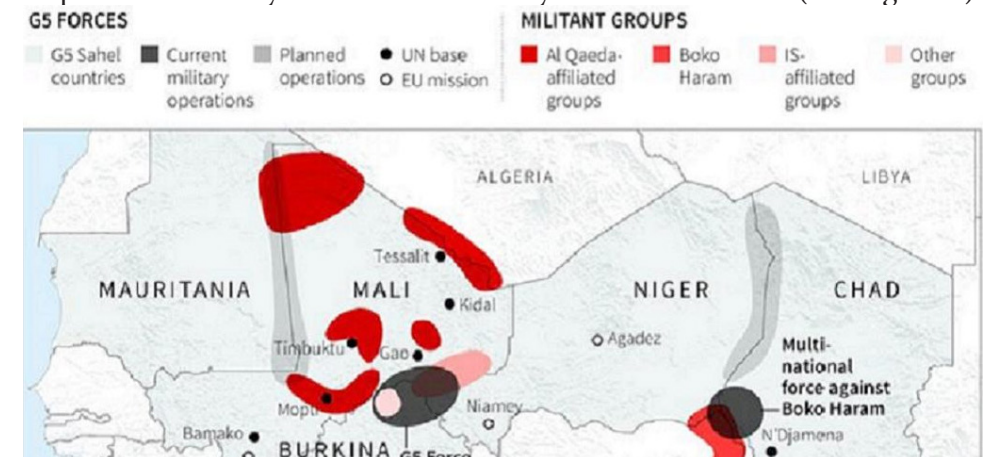


**Figure 2.** Current violence in the Sahel and military responses. Source: "Headquarters of West African G5 Sahel force in Mali attacked: sources," *Africa News*, June 29, 2018, http://www.africanews.com/2018/06/29/headquarters-of-west-african-g5-sahel-force-in-mali-attacked-sources/

In most parts of the Sahel, even a veneer of formal state authority is binding only in the major cities – and even that is a mixture of informal networks tied in with formal institutions. As one moves out from urban areas, this formal aspect of state authority and capacity dissipates quickly, forcing communities that are most affected by climate change to rely increasingly on informal authorities at best.  At worst, these dynamics force the world's poorest and most impoverished people to be self-sufficient in one of the world's most underdeveloped areas with only the most limited infrastructure and extremely inhospitable terrain. Lastly, the peripheral regions of the Sahel that have not experienced state penetration in its modern form have been the sites of numerous violent conflicts over the years. This has ranged from inter-state wars (e.g., Chadian-Libyan Conflict, 1978-1987), ethnic and secessionist conflicts (e.g., five Tuareg Rebellions since 1916), and sustained banditry, where smugglers fight it out to maintain their illicit economic networks that are a default employment opportunity for most youth in the region. Figure 3 shows how closely aligned smuggling and trafficking networks are to conflict zones throughout the Sahel region (and their linkages beyond).



**Figure 3.** Smuggling and trafficking routes situated around conflict zones in the Sahel region. Source: Norwegian Center for Global Analysis, 2015.

Ecosystems in the Sahel are acutely sensitive to changes in weather patterns that affect basic sustenance issues of communities in the region, which subsequently alter political, economic, and security relations between communities. Meanwhile, changing weather patterns may have no or only very limited bearing on the lifestyle of a white-collar professional in a city such as Bamako or Lagos, while it can have life-and-death consequences for communities in a transitory desert-jungle region. Such areas are inhabited by pastoralists, nomads that migrate between seasons, communities that engage in subsistence farming, and fishers that are dependent on some consistency in weather patterns. Climate change makes weather cycles, temperature, humidity, rainfall, and biomes more highly variable. Consequently, this leads to issues with soil nutrient regeneration, desertification, pests, and other agricultural and water cycle trends that are difficult to reverse. Such unpredictability increases the fragility of agriculture systems, making food supply systems extremely volatile. Small holder subsistence farming communities in the Sahel consist of a mixture of cash crops, subsistence crops, and a diverse livestock that are degraded by changing weather patterns. The average agriculture system in the Sahel makes it extremely difficult for farmers and pastoralists to absorb costs that result from erratic meteorological conditions. Unlike most Western states, governments in the Sahel do not provide insurance or subsidize changes in agricultural supply and demand issues.

Climate change distorts agriculture and food systems from production and distribution and all the way to consumption. This immediately puts a heavy premium on the issues of basic sustenance. Moreover, years of bad governance, endemic corruption, large numbers of chronically malnourished and impoverished people, illicit arms, human and drug trafficking networks, and protracted low-intensity conflict across national borders complicate and impede state and international responses to crises spurred by extreme weather changes (e.g. severe droughts, flooding, etc.).[4] Extremist violent non-state actors (VNSA) have leveraged these enumerable factors to gain a foothold and rely on informal networks, including ones that are associated with the political networks of some state officials, to enhance their power and reach. The injection of these new actors, alongside the tendency for deteriorating conditions to push politicians to search for new resources to maintain their patronage networks, destabilizes political systems in the Sahel region. This destabilization is particularly acute in countries like Mali and northern Nigeria where these networks are central to the real exercise of authority. In 2017, this combustible combination nearly pushed many Sahel states to the edge of possible famine at the same time that it destabilized existing political order.

As it currently stands, there are 30 million people in the Sahel that lack adequate nutrition, with over 12 million people requiring emergency food aid. Such information about these issues comes from the Integrated Phase

Classification (IPC), a multi-partner initiative, which is dedicated to providing "decision-makers with a rigorous, evidence- and consensus-based analysis of food insecurity and acute malnutrition situations, to inform emergency responses as well as medium- and long-term policy and programming." The IPC is a global standard that classifies five levels of food insecurity: Phase 1 (Generally Food Secure), Phase 2 (Borderline Food Insecure), Phase 3 (Acute Food and Livelihood Crisis), Phase 4 (Humanitarian Emergency) and Phase 5 (Famine/Humanitarian Catastrophe). Four countries across the Sahel and the Horn of Africa – Nigeria, Somalia, South Sudan and Yemen – are rated as an IPC Phase 4 due to food insecurity. Neighboring areas around LCB in Chad, Niger, Cameroon, and the peripheral regions of Mali are assessed as IPC Phase 3, while northeastern Nigeria is suffering with an IPC Phase 5. Spillover security effects are felt in neighboring regions, with refugees and insurgencies causing economic and political shocks (refer back to Figure 2). The LCB area that borders Chad, Niger, Nigeria, and Cameroon provides a field site to explicate the complex relationship between climate change, weak institutions, and civil war dynamics.

## Civil War Dynamics in the Lake Chad Basin (LCB)

The LCB is one of the largest sedimentary groundwater basins in Africa. Its geographic location and character of its ecosystem make the LCB highly vulnerable to changing weather patterns. Approximately 17 million people rely solely on the LCB, and over 30 million people in the surrounding countries indirectly depend on the LCB as it constitutes a core part of the agriculture system that includes farming, livestock, fisheries, and grazing for pastoralists. Consequently, the regional economic system also depends on, and is built around, the LCB. However, as a result of rainfall variability, temperature changes, population growth, and unplanned irrigation, the water surface has shrunk by 90 percent (see Figure 4). As a result of climate change, it is rapidly shrinking, degrading the economic and social well-being of millions of people, thereby providing new battlespace opportunities for insurgents and local "big men" to exploit.
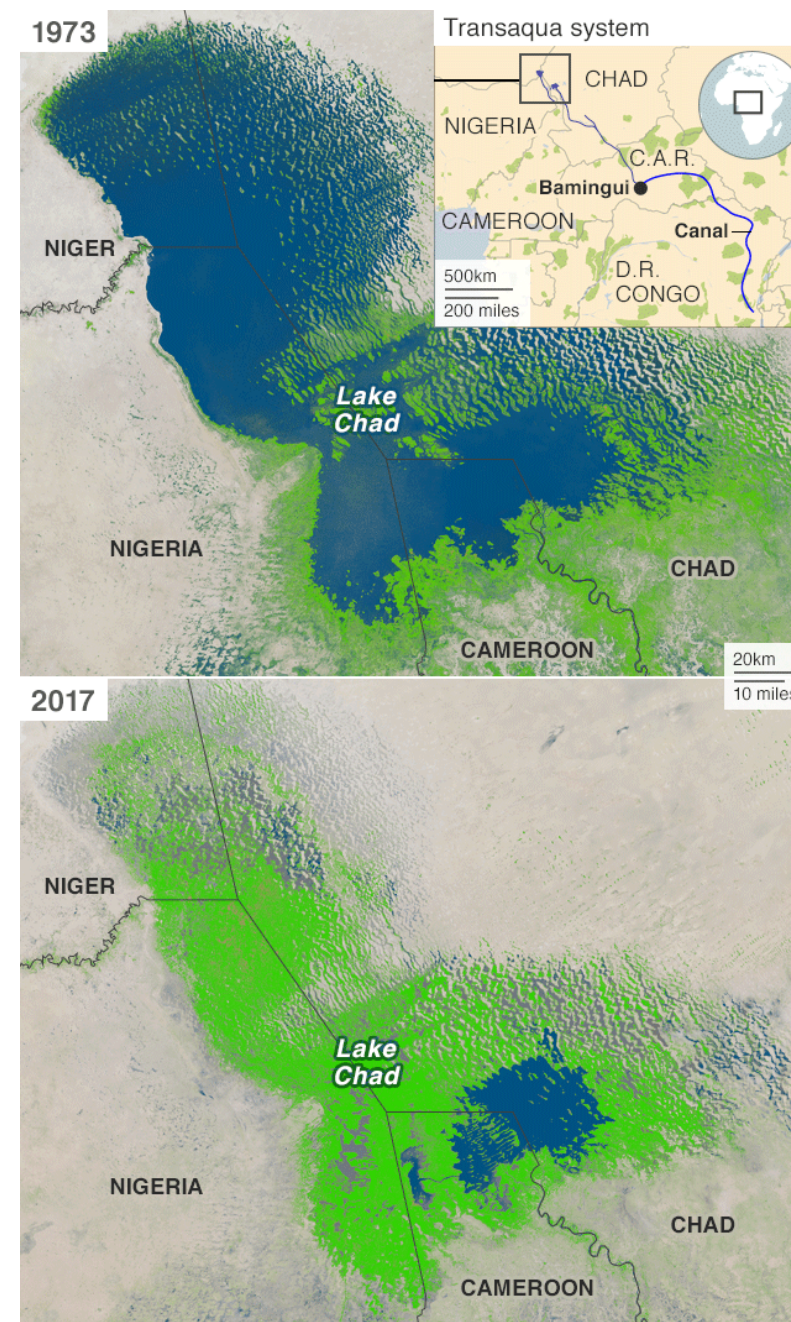


**Figure 4.** The dramatic decrease in water availability in the Lake Chad Basin from 1973 to 2017. Source: Will Ross, "Lake Chad: Can the vanishing lake be saved?" *BBC*, March 31, 2018, https://www.bbc.com/news/world-africa-43500314
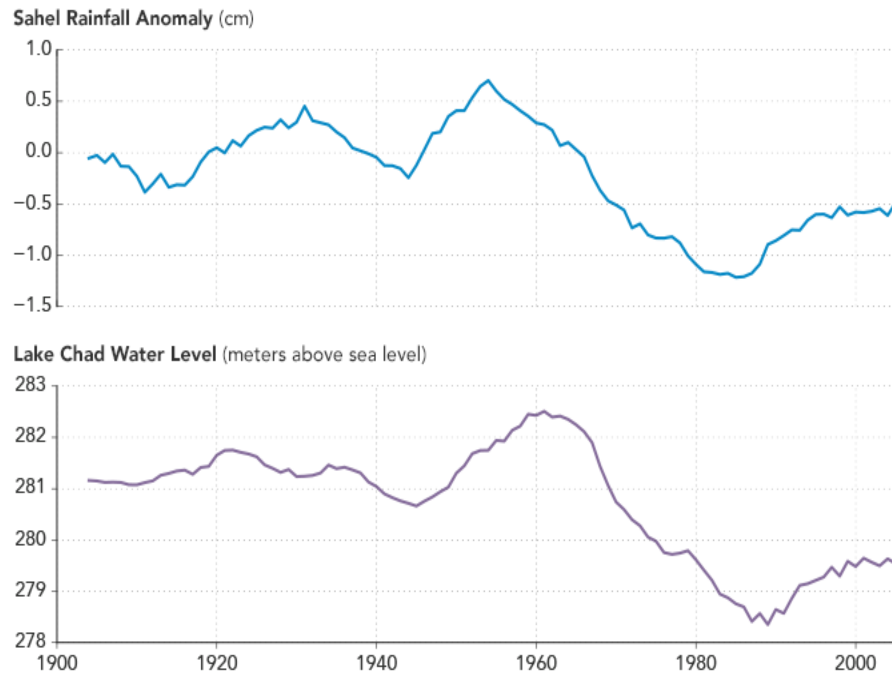
**Figure 5.** Rainfall and Lake Chad water levels from 1900 to 2010. Source: Kathryn Hansen and Paul Przyborski, "The rise and fall of Africa's Great Lake," *NASA: Earth Observatory*, November 9, 2017, https://earthobservatory.nasa.gov/Features/LakeChad.

The area around Lake Chad has historically been a neglected peripheral region of surrounding countries where state institutions have the least capacity. The region was long marked by banditry, transnational smuggling networks, and acute food insecurity. Thus, it has been perpetually in need of emergency food aid. The rise of an ideologically driven insurgent group – Boko Haram – made an already dire situation worse as the LCB became a secure rear-base for Boko Haram leadership. Now, insurgent activity, government counter-measures, and international military interventions reinforce the vicious cycles of violence as climate change has become endogenous to the regional conflict. Finally, Figure 5 illustrates how dependent the LCB is on rainfall in the Sahel. Current trends make it unlikely to return to pre-1960 water levels.

## Climate Change and 'Weaponizing' the Agriculture System

Boko Haram began as a localized, ideologically inclined rebel movement that sought to challenge existing secular and religious power relations in the Borno state of Nigeria. Boko Haram clerics, charismatic preachers influenced by Wahhabi and Salafist variants of Islam of the Gulf region (and some with financial assistance from sympathizers in the Persian Gulf), highlighted the long-neglected areas of northeastern Nigeria as a failure of the traditional secular power structure. Simultaneously, the clerics attacked the local religious hierarchy that adheres to the more inclusive Sufi version of Islam as both apostates and complicit in the oppression of the people – since they had clientelist relations with the secular power centers of Nigeria into which the religious establishment in Nigeria had largely integrated through formal and informal linkages. Boko Haram re-contextualized their local crisis in terms of the global jihad, to be increasingly seductive to the minds of the disenfranchised and disenchanted youth, under the auspices that Western education/enlightenment was a sin. This phenomenon unifies global and local circumstances for easy consumption with the Salafist-Jihadist narrative as the unifying theme.

Transnational VNSAs such as Al-Qaeda (AQ), Al-Qaeda in the Islamic Maghreb (AQIM), and the Islamic State (IS) exploited local crisis contexts to the benefit of expanding the jihadist franchise. As it stands, food shortages, underdevelopment, disenfranchisement, and any number of local grievances become ammunition for the extremist ideology as the VNSAs have effectively subsumed localized grievances into their global ideology. Boko Haram initially gained an ideological foothold in the Borno state of Nigeria through its slow Islamic proselytization. Given the socio-economic interconnectedness in the region between Niger, Chad, Cameroon, and Nigeria – where people travel freely due to a lack of border controls and indeed the regional economy is built on trans-border networks – Boko Haram's message of altering existing authority relations spread readily across national borders but without the same success as seen in the Borno state.

Boko Haram transformed into a classical guerilla group with a firm ideological basis, an established organizational structure, a core group of believers, and a territory-centric military strategy. Due to a lack of state capacity in the region, Boko Haram killed, coerced, and/or co-opted regional informal governance structures to embed their movement within the fabric of society. This helped expand their influence and territorial control. Though harsh and militant, Boko Haram became a parallel governance structure alongside ineffective states. Within this context, Boko Haram realized both the revenue generation capacity of the extremely strained regional agriculture system due to changing weather patterns and the advantages of "weaponizing" it for recruitment and a broader military strategy.

Rainfall variability impacted subsistence farming, temperature changes decreased grazing lands, and shrinking water levels reduced fisheries; each shift made food into a precious commodity. Boko Haram imposed taxes on both production and accessibility aspects of the agriculture system, where controlling access became a core mechanism of asserting control. The strains of the agriculture system from climate change, shrinking water sources from unplanned irrigation, depleted agricultural land, and shrinking grazing land suddenly become endogenous to the conflict dynamics in the LCB. The counter-response by regional governments reinforced the vicious cycle.

The Nigerian government's coordinated response alongside the armed forces from Cameroon, Chad, and Niger had a direct and positive military impact, drastically decreasing Boko Haram's territorial control. It compelled Boko Haram to fall back on their rear-base of support in the LCB. As a direct consequence of military action, population displacements, and inadvertent collateral damage due to the counterinsurgency campaign, this led to a precipitous drop in agricultural production. Consequently, these factors undermine the regional economic system. In northeastern Nigeria, Boko Haram is not only extorting rural populations but is killing prominent farmers and dispersing landmines in the fields thereby reducing the ability of the remaining population to harvest out of fear for their safety. Finally, crops are destroyed and food stores pillaged, exacerbating the food security crisis, as wheat production in northeastern zones has declined by 80 percent, worsening Nigeria's trade deficit in staple foods.

Displacement not only disrupts agricultural production in areas where farmers move away or are killed but also hampers the productivity of in-migration regions where internally displaced persons (IDPs) relocate. This situation has resulted in staple food price spikes of between 50-100 percent, making it difficult for many communities to survive. In the Borno state, cereal production collapsed between the years 2010-2015, with decreases in sorghum (87%), rice (67%), and millet (55%). Worse, the Borno state, which historically produced about a quarter of wheat in Nigeria, no longer grows it. This was the economic center of the agriculture-based regional economy. Drops in production have also had a direct impact on decreasing the purchasing power of affected populations, while the destruction of economic infrastructure also has made food accessibility difficult, compounding production-induced scarcity. A "weaponized" food system that was already under extreme strain and combatant strategies and counter-strategies have created a vicious cycle rendering third party intervention and food aid the only remaining option

to alleviate the suffering. This, of course, only creates further dependencies and moral hazards, making the prospect of a long-term solution much more difficult for the international community to achieve.

The aid community faces severe challenges, including deliberate barriers due to endemic corruption. Formal government bureaucrats attempt to turn food aid into economic windfalls. The Nigerian military has failed to maintain control in the areas they have liberated, even failing to control territories in Nigeria liberated by neighboring military forces. The traditional informal governance structures that have provided law and order have been completely destroyed by insurgents and criminal networks. In these lawless environments where food aid is most needed, aid workers are subject to harassment; aid convoys are interdicted by bandits and local vigilantes. In many cases, more resources (and foreign peacekeeping troops) are dedicated to protecting aid convoys than trying to resolve local level conflicts, and the violent politics that sustain them.

In this precarious "environment," strained agriculture and food systems are "weaponized" to the advantage of groups such as Boko Haram, which leverage food insecurity in the LCB as a tool for recruitment. There is a distinction, however, as changing weather patterns, strained ecosystems, and agricultural production as a primary source of employment, has a complex link to insurgent recruitment. The combination of such factors makes the LCB an acute grievance environment, where leveraging one's capacity for violence, whether on behalf of smugglers, ideologically driven insurgents, or local vigilante groups, is an optimal source of income. Boko Haram, along with other localized violent groups, are exploiting the acute grievance environment, recruiting a mixture of believers and accidental guerillas into their midst. In sum, changing weather patterns have now become an elemental part of the civil war dynamic that is directly contributing to processes of violence in the Lake Chad Basin battlespace.

## Conclusion

Changing weather patterns directly shape civil war dynamics. We use our case study of the Lake Chad Basin to highlight with added urgency how the impact of climate change has fused into the micro-level dynamics of violence. Moreover, these violent patterns shape the overall battlespace making a dire situation worse, enhancing acute difficulties for the international community working to address both humanitarian and security concerns in these regions. Indeed,

our ongoing research in central Mali indicates that the Inner Niger Delta (*Macina*) in central Mali faces a similar threat based on climate change and local level violent actors as formal state institutions and the informal patronage-based aspects of that government's political authority break down. Across the Sahel, climate change is altering livelihoods, straining agriculture systems, and VNSAs are 'weaponizing' the negative ramifications of climate change to their advantage.

We do not make causal claims about climate change and the on-set of conflict, but climate without a doubt, impacts the nature of civil war dynamics once violence erupts. Proper investigation into the impact of climate change in civil wars requires us to unpack the complex micro-level and institutional level dynamics that are nested within the broader human-terrain of the Sahel. That is, we need a better understanding of how individuals and communities relate to their geographic position, environment, and the broader ecosystem. It is a novel way to contextualize civil wars since existing literature assume away human relations to the broader physical geography and little discussion is ever found on the complex relationships that exist between individuals, the place they inhabit, and the broader ecosystem.

Our analysis on the Lake Chad Basin (and our ongoing field research in Mali) clearly indicates that it is the negative ramifications of ecosystem changes that create a new 'social space' that VNSAs can exploit. While many people in the Sahel have been provided or have access to various modern tools and technologies, major impediments often preclude their maximum benefit including anachronistic technical, social, cultural or economic practices that are far removed from modernity. This is an ironic paradox as members of Boko Haram preach anti-Western ideals through technology (mobile phones) and social media (YouTube) that was invented by the West. If there is to be any long-term stability in the Sahel – and with the expectation that weather trends will continue decreasing livability in that environment – the international community and governments in the region need to develop strategies and ways of circumventing insurgents, terrorists, and local "big men" that exploit such precarious climate shocks. This will require state capacity to be exercised in a way that curtails the development of new battlespace dynamics that are fueled by the uncertainty created by dramatic ecosystem disruptions caused by volatile weather patterns. Achieving such an 'ideal' however, seems difficult to achieve given how various armies in the Sahel have engaged in coups, or are coup-proofed (preventing them from being effective in addressing internal and regional threats). Stable governments

and reliable militaries are hard to come by in the Sahel, and it appears the international community will need to be there (as a mediator) for the foreseeable future until the formal and informal institutions in each country can find a suitable equilibrium that reduces the payoffs and local incentives for engaging in organized violence and criminal behavior.

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## Notes

1        Stathis N. Kalyvas, *The logic of violence in civil war* (New York: Cambridge University Press, 2006).

2        Solomon M. Hsiang, Kyle C. Meng, and Mark A. Cane, "Civil conflicts are associated with the global climate," *Nature* 476 (2011): 438-441.

3        Jon Barnett and W. Neil Adger, "Climate change, human security and violent conflict," *Political geography* 26, no. 6 (2007): 639-655; Marshall Burke, John Dykema, David B. Lobell, Edward Miguel, and Shanker Satyanath, "Incorporating climate uncertainty into estimates of climate change impacts," *Review of Economics and Statistics* 97, no. 2 (2015): 461-471.

4        For example, recent research pushes back against claims that the draught in Syria acted as a 'threat multiplier' in the current Syrian Civil War (2011-Present). Jan Selby, Omar S. Dahi, Christiane Fröhlich, and Mike Hulme, "Climate change and the Syrian civil war revisited," *Political Geography* 60 (2017): 232-244.

5          Halvard Buhaug, "Climate not to blame for African civil wars," *Proceedings of the National Academy of Sciences*, *107*, no. 38 (2010): 16477-16482.

6          For the purposes of this essay, we define Sahel countries as: Burkina Faso, Chad, Cameroon, Mali, Mauritania, Niger, Nigeria, Senegal, and The Gambia.

7          Nils Petter Gleditsch, "Whither the weather? Climate change and conflict," *Journal of Peace Research* 49, no. 1 (2012): 3-9.

8          Some of these factors make up the various traps identified in some of the poorest countries in the world. Paul Collier, *The bottom billion: Why the poorest countries are failing and what can be done about it* (New York: Oxford University Press, 2008).

9          Robert H. Bates, *When things fell apart: State failure in late-century Africa* (Cambridge, UK: Cambridge University Press, 2008).

10          The best elaboration of this system of governance is in: Jean-François Bayart, *L'État en Afrique* (Paris: Fayard, 1989).

11          Michael Bratton, "Formal versus informal institutions in Africa," *Journal of Democracy* 18, no. 3 (2007): 96-110.

12          Michael E. Mann, Stefan Rahmstorf, Kai Kornhuber, Byron A. Steinman, Sonya K. Miller, and Dim Coumou, "Influence of anthropogenic climate change on planetary wave resonance and extreme weather events," *Scientific Reports* 7, no. 45242 (2017), https://www.nature.com/articles/srep45242.

13          Colin H. Kahl, *States, scarcity, and civil strife in the developing world* (Princeton: Princeton University Press, 2006); William Reno and Jahara Matisek, "A New Era of Insurgent Recruitment: Have 'New' Civil Wars changed the Dynamic?" *Civil Wars* (2018): 1-21.

14          Paul Staniland, "Cities on fire: Social mobilization, state policy, and urban insurgency," *Comparative Political Studies* 43, no. 12 (2010): 1623-1649.

15          Molly Jahn, Buddhika Jayamaha, William S. Mulhern, Douglass E. Ross, Matthew A. Rose, Gregory F. Treverton, "Global food system stability and risk: At the nexus of defense and development," *Thomson Reuters*, April 2018, https://www.thomsonreuters.com/content/dam/ewp-m/documents/thomsonreuters/en/pdf/reports/global-food-system-stability-and-risk-0718.pdf.

16          J.J. Messner, "Fragile States Index 2018: Issues of fragility touch the world's richest and most developed countries in 2018," *The Fund for Peace*, April 19, 2018, http://fundforpeace.org/fsi/2018/04/19/fragile-states-index-2018-issues-of-fragility-touch-the-worlds-richest-and-most-developed-countries-in-2018/.

17          Refer to: *The Fund For Peace Index of Fragile States*, http://fundforpeace.org/fsi. Ungoverned Spaces are areas within a national boundary where state administrative authority, de-jure sovereignty of the state, does not reach. In every single Sahel country, state authority dissipates the further you move from the administrative capital. For a longer discussion, see: Anne Clunan and Trinkunas A. Harold, eds. *Ungoverned spaces: Alternatives to state authority in an era of softened sovereignty* (Palo Alto, CA: Stanford University Press, 2010).

18          Jean-François Bayart, Stephen Ellis, and Béatrice Hibou, *The Criminalization of the State in Africa* (Bloomington, IN: Indiana University Press, 1999); James McDougall and Judith Scheele, eds., *Saharan frontiers: space and mobility in Northwest Africa* (Bloomington: Indiana University Press, 2012); Fieldwork, Mali, August 2018.

19          Tor A. Benjaminsen, Koffi Alinon, Halvard Buhaug, and Jill Tove Buseth, "Does climate change drive land-use conflicts in the Sahel?" *Journal of Peace Research* 49, no. 1 (2012): 97-111.

20          Stephen A. Harmon, *Terror and insurgency in the Sahara-Sahel region: corrup-

*tion, contraband, jihad and the Mali war of 2012-2013* (New York: Routledge, 2016).

21          Tor A. Benjaminsen, "Does supply-induced scarcity drive violent conflicts in the African Sahel? The case of the Tuareg rebellion in northern Mali," *Journal of Peace Research* 45, no. 6 (2008): 819-836; Gary Busch, «The logistics of the war in the Sahel,» *Stability: International Journal of Security and Development* 2, no. 2 (2013); Field work, Mali, August 2018.

22          Patrick Gonzalez, Ronald P. Neilson, James M. Lenihan, and Raymond J. Drapek, "Global patterns in the vulnerability of ecosystems to vegetation shifts due to climate change," *Global Ecology and Biogeography* 19, no. 6 (2010): 755-768; Brett R. Scheffers, Luc De Meester, Tom CL Bridge, Ary A. Hoffmann, John M. Pandolfi, Richard T. Corlett, Stuart HM Butchart, et. al., "The broad footprint of climate change from genes to biomes to people," *Science* 354, no. 6313 (2016), http://science.sciencemag.org/content/354/6313/aaf7671?casa_token=u6xAVMxvx_gAAAAA:rIaMyX5NSg94._rQyWHOCn7JHC90qev0OTUhY_y4BJhBR0dCTRM_CbhY8kEXyprC4Bjq-fzzZZBa-Dw

23          Alex Vines, "Combating light weapons proliferation in West Africa," *International Affairs* 81, no. 2 (2005): 341-360; Francesco Strazzari and Simone Tholens, "'Tesco for Terrorists' Reconsidered: Arms and Conflict Dynamics in Libya and in the Sahara-Sahel Region," *European journal on criminal policy and research* 20, no. 3 (2014): 343-360; Asim Zia and Courtney Hammond Wagner, "Mainstreaming early warning systems in development and planning processes: Multilevel implementation of Sendai framework in Indus and Sahel," *International Journal of Diasaster Risk Science* 6, no. 2 (2015): 198-199.

24          "Instruments of Pain: Conflict and Famine," *International Crisis Group*, April 13, 2017, https://www.crisisgroup.org/global/instruments-pain-conflict-and-famine; "IPC Overview and Classification System," *IPC*, 2018, http://www.ipcinfo.org/ipcinfo-website/ipc-overview-and-classification-system/en/.

25          For more elaboration on the IPC phases and its framework, refer to: "Overview of the Integrated Phase Classification (IPC)," *Famine Early Warning Systems Network*, May 2017, http://fews.net/sites/default/files/IPC%20Overview_May_2017_final.pdf.

26          "Instruments of Pain: Conflict and Famine," *International Crisis Group*, April 13, 2017, https://www.crisisgroup.org/global/instruments-pain-conflict-and-famine.

27          Uche T. Okpara, Lindsay C. Stringer, Andrew J. Dougill, and Mohammed D. Bila, "Conflicts about water in Lake Chad: Are environmental, vulnerability and security issues linked?" *Progress in Development Studies* 15, no. 4 (2015): 308-325.

28          Alexander Thurston, *Boko Haram: the history of an African jihadist movement* (Princeton: Princeton University Press, 2017).

29          Virginia Comolli, *Boko Haram: Nigeria's Islamist insurgency* (New York: Oxford University Press, 2015); Mike Smith *Boko Haram: Inside Nigeria's unholy war* (London: IB Tauris, 2015).

30          "How Boko Haram is killing off farms," *IRIN News*, December 17, 2015, http://www.irinnews.org/analysis/2015/12/17.

31          "Boko Haram blamed for farmers deaths in Maiduguri," *Al Jazeera*, May 15, 2017, https://www.aljazeera.com/news/2017/05/boko-harm-kills-nigerian-farmers-170515134702648.html; Mustapha Muhammad; "Boko Haram Conflict Cuts Nigeria Wheat Crop as Farmers Flee," *Bloomberg*, April 20, 2017, https://www.bloomberg.com/news/articles/2017-04-19/boko-haram-conflict-erodes-nigeria-s-wheat-crop-as-tems in development and planning processes: Multilevel implementation of Sendai framework in Indus and Sahel," *International Journal of Disaster Risk Science* 6, no. 2 (2015): 189-199. farmers-flee.

32        This is a result of increased pressure on what are already fragile food systems. For example, in the Adamawa state of northeastern Nigeria, a massive influx of IDPs has exacerbated existing climatic pressures and land constraints on agricultural systems. Most migrants are farmers, thus their coping strategies revolve around agricultural activities in their homes. This causes increased land disputes, expansion of conflict and food system deterioration, which leads to reduced output. Emmanuel Akinwotu, "Drought worsens deadly battle between Fulani herdsmen and farmers in Nigeria," *The Guardian*, January 3, 2017.

33        This is increasingly a concern as IDPs relocate back to their traditional homes, which have severely degraded infrastructural and agronomic characteristics, which will combine with farmer vulnerability and limited access of aid, making recovery extremely difficult. "FAO in emergencies and Western Africa and the Sahel," *Food and Agricultural Organization (FAO) of the United Nations*, 2017, http://www.fao.org/emergencies/regions/western-africa/intro/en/.

34        "Nigeria: Grain and Feed Annual," *USDA Foreign Agricultural Service*, April 6, 2017, https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Lagos_Nigeria_4-6-2017.pdf.

35        "Instruments of Pain (IV): The Food Crisis in North East Nigeria," *International Crisis Group*, May 18, 2017.

36        Interview, Médecins Sans Frontières (MSF) logisticien, Mali, August 2018.

37        Interview with a military officer from Niger who has had to deal with the inadequacy of the Nigerian military, October 2018.