Conflict worsens the impact of flood on food insecurity: Evidence from the Nargis cyclone in Myanmar

Thorsten Rogall[a], Ida Rudolfsen[b], Paola Vesco[a,b]

[a] *Department of Peace and Conflict Research, Uppsala University , Gamla Torget 3, Uppsala, 75210, Sweden*
[b] *Peace Research Institute Oslo (PRIO), Hausmanns Gate 3, Oslo, 0186, Norway*

Abstract

Conflicts and climate hazards are among the main drivers of food insecurity globally. Some of the most severe famines in modern history have occurred in locations where conflict intersects with climate hazards, such as the Ethiopian famine of the 1980s and more recent crises in Yemen and South Sudan. Yet, existing research tends to focus on climate hazards and conflict as separate drivers of food insecurity, and there is limited systematic evidence on their combined impact. We address this gap by investigating the effect of the 2008 flood in Myanmar on medium-term food security in the affected population, and testing the role of ongoing conflict in shaping this impact. Preliminary findings reveal that the 2008 flood itself increased food insecurity by 7–18%. However, this effect goes up by 61–106% for every one standard-deviation increase in conflict experienced in a location that was exposed to flood. In particular, children in conflict-affected areas displayed lower weight and height for their age compared to children in non-exposed locations. Our findings point to the importance of achieving and sustaining peace as a valuable strategy for reducing local vulnerability to climate impacts. These results may contribute to actionable insights for policymakers to design disaster risk management and adaptation strategies that account for the unique vulnerabilities of conflict-affected regions.

Keywords: food insecurity, flooding, armed conflict, compound hazards

---

1. Introduction

In 2023, 282 million people globally suffered from acute food insecurity[53]. Violence and climate-related extremes – the two main drivers of food crises [19] – have been on the rise in the past decade [63, 37], carrying devastating effects on agricultural production, access to and prices of food, undermining individuals' ability to meet their food needs [e.g. 137, 133, 134].

As climate-related disasters grow in frequency and intensity, they heavily impact economies, communities and livelihoods [49, 34]. Agriculture, deeply reliant on weather and climate, is especially vulnerable, with recurrent disasters threatening food security and the sustainability of food systems [11]. A growing literature has examined the effect of weather extremes on food security, and especially of flood events, the dominant type of extreme weather events [e.g. 92, 100, 140]. These studies find that flood exposure is associated with lower food consumption, and higher levels of hunger and malnutrition [140, 100, 92], with potentially long-lasting consequences for the health and well-being of exposed individuals [39]. Existing studies also point to the negative effects of armed conflict on food security, both in the short and long term [113]. Conflicts destruct and disrupt crop harvests and land [43], deteriorate local income, labor, and means of production [129, 38], impair food markets and agricultural output [42, 2], cause spikes in food prices [42] and overall increase the risk of hunger and malnutrition, with long-lasting consequences for exposed populations, and especially infants and children [86].

Previous research has not only estimated the negative impacts of armed conflict and flood events on food security; they have also highlighted how these impacts vary over space and across groups, enabling considerable progress in enhancing preparedness and humanitarian relief. Despite this progress, the existing literature tends to study each of these drivers of food insecurity in isolation, thus overlooking the possible compound effects of armed conflict and weather-related hazards. As some of the most severe food crises have occurred in locations exposed to both violence and climate-related extremes [8], understanding how these shocks interact and combine is fundamental to improve the effectiveness of monitoring, early warning, and relief programs and thus minimize the risk of widespread food insecurity and famines.

The present paper aims at improving our understanding of the compound effect of exposure to armed conflict and flood on food insecurity. To this end, we present a novel theoretical framework that illustrates how armed conflict amplifies the impacts of flood on food insecurity on the individual level. We focus on the effect of cyclone Nargis that hit Myanmar in 2008, with human costs that were unprecedented in the history of the country. Although the extent of the inundated area in 2008 was lower than previous floods in the region – the flood that hit Myanmar and Bangladesh in 2003 covered a 10 times wider area – Nargis claimed considerably higher deaths [124] and caused severe impacts on food security [108]. This was partially due to exposure, as the flood hit a coastal area that was densely populated (Figure 1). However, the extent and duration of the 2008 flood, along with the population exposed, cannot fully explain its devastating impacts. We argue that these impacts were primarily driven by a lack of preparedness and heightened vulnerability resulting from armed conflict, which amplified the negative effects of the flood on food insecurity by damaging critical infrastructure, increasing displacement, heightening vulnerability, and reducing coping capacity.

We combine sub-national data on armed conflict, satellite-derived information on flood extent and exposure, and survey data on food insecurity to investigate the role of conflict in exacerbating the impact of the 2008 flood on food insecurity. We find that the 2008 flood increased food insecurity by 7%–18%. However, this effect soars to 61%–106% if a location is concurrently exposed to armed conflict and its severity increases by one standard deviation. In particular, children in conflict-affected areas displayed considerably lower weight and height for their age compared to children in non-exposed locations. These effects are long-lasting, as evident in the impact of flood and armed conflict on children's height seven years after Nargis.

Our findings contribute to the literature in three key ways. First, we provide robust empirical evidence for the role of armed conflict exposure in shaping the effect of floods on food security, breaking the disciplinary silos that characterize existing analyses of food crises. Further, we utilize spatially and temporally disaggregated data to capture localized dynamics and variations. High-quality satellite data on flood extent enable us to estimate exposure at the sub-national level, going beyond traditional country-level assessments of food systems [40]; systematic, granular information on armed conflict fatalities and duration allow us for a more nuanced assessment of the impacts of violence, beyond large-scale and high-intensity wars which are over-represented in the literature [40]. Lastly, our focus on Myanmar overcome the traditional 'African bias' observed in both peace and conflict and food research [60, 40].

In line with SDG16 advocating for peace, justice, and strong institutions, our findings point to the importance of achieving and sustaining peace as a valuable strategy for reducing local vulnerability to floods, and minimizing food insecurity in flood-affected locations. As extreme weather events are anticipated to become increasingly frequent [63], policymakers require solid scientific insights in different temporal and spatial contexts to tailor effective disaster risk management and adaptation strategies — such as those involving infrastructure, technology, management, and insurance. These measures are essential to safeguard the most vulnerable populations and support global food security.

The remainder of the paper is organized as follows: in the first section, we review the literature examining armed conflict and weather extremes as drivers of food insecurity; next, we present our theoretical framework that connects exposure to floods, exposure to violence, and increased food insecurity. The following subsection briefly introduces the case of Myanmar and presents the data and methods employed in the analysis. The final sections discuss the results and conclude.

2. Literature review

Flooding and armed conflict are critical drivers of food insecurity, each with distinct yet interconnected impacts on agricultural production, livelihoods, and access to food. Here we present a brief overview of key findings in the literature on the individual impacts of flooding and armed conflict on food insecurity.

2.1. Flooding and food insecurity

Climate change alters the timing, duration, and intensity of seasonal rainfall, amplifying variability in river flows and increasing the frequency and intensity of floods [51, 125, 48]. The effect of flood on food security is highly heterogeneous, and dependent on localized dynamics such as losses in subsistence crop production, damage to infrastructure or livelihoods, and issues like waterborne diseases and poor sanitation that impair food utilization [101]. Flood exposure therefore has significant yet heterogeneous implications for food security.

Flooding is already the most widespread environmental hazard globally, and projections indicate that the proportion of people exposed to floods will continue to rise due to climate change [75]. Indeed, using satellite imagery to estimate flood and population exposure for over 900 flood events between 2000 and 2018, Tellman et al. [124] find that between 255 and 290 million people were directly affected by floods. Also, Reed et al. [100] investigate to what extent flooding affects food security levels in Africa, and find that approximately 12% of people experiencing food insecurity between 2009 and 2020 were affected by flooding.

Floods directly reduce food availability by destroying crops and livestock, eroding soil quality, and damaging agricultural infrastructure such as irrigation systems and farmland [107]. Recovery from flood-induced crop loss often has prolonged consequences, with impacts on food production and availability persisting across multiple seasons. For example, Yiran et al. [139] investigate the effect of recurrent annual floods on food production in Ghana. They find that flooding results in a decline in food production among subsistence farmers, increasing household food insecurity in affected communities. In the same vein, Sam et al. [107] find that floods obstruct agricultural production, destroy infrastructure, and disrupt livelihoods, ultimately affecting household food security in flood-prone areas of India.

In addition to these direct effects, floods also disrupt food access, both physical and economic. Flooding can destroy markets, disrupt supply chains, and damage roads and storage facilities, impeding the transportation of food to affected areas and limiting the ability of affected populations to obtain food from elsewhere. Such disruptions frequently result in localized shortages and increased food prices due to reduced supply and economic spillovers [34, 7]. For example, Breisinger et al. [18] find that in addition to deteriorating household incomes in flood-affected areas due to reduced farm household incomes, significant losses and increases in food insecurity also manifested in areas unaffected by the flood, due to economic spillover effects.

Furthermore, floods exacerbate economic vulnerabilities by causing job and income loss, destroying cash crops, and increasing migration pressures. These factors collectively limit households' ability to purchase food, compounding the challenges of food access, particularly for displaced populations [99]. In a study of rural riverine households in Punjab, Pakistan, Ahmad and Afzal [4] find that food insecurity among households increased during flooding, mostly due to migration leaving households with limited employment opportunities and reduced access to land and farming activities [see also 114].

Despite recent advancements in the study of how climate-related shocks affect food insecurity, however, there is an incomplete assessment and understanding of food insecurity at the individual and household level after climate-related shocks in the literature (see e.g. Hadley et al. [57] for a comprehensive review).

2.2. Armed conflict and food insecurity

Existing literature also point to armed conflict as a significant predictor of food insecurity through its effect on food availability and access. Studies show that conflict disrupts food systems, destroys infrastructure, reduces farming activities and output, and limits market access, leading to increased food prices and reduced availability [for comprehensive reviews, see e.g. 19, 77, 113, 84].

The decline in food availability often results from the destruction and disruption caused by conflict, which lowers total factor productivity and economic efficiency through resource depletion, land abandonment, displacement of workers, and loss of life [30]. Furthermore, conflict can indirectly decrease food production by displacing people to less fertile areas or prompting a shift toward low-risk subsistence crops that prioritize household needs but reduce overall agricultural output [69, 14, 111, 70, 43]. Previous research suggests that violence undermines food security by reducing agricultural output and crop and livestock holdings [see e.g. 103, 10, 2]. For example, Olsen et al. [91] found that armed conflict in South Sudan led to cropland abandonment (a 16% reduction in cultivated croplands between 2016 and 2018), contributing to decreasing levels of food supply and increasing food insecurity levels. Fighting also disrupts infrastructure and trade routes. For example, Tandon and Vishwanath [122] find that the ongoing conflict in Yemen has disrupted supply chains and caused widespread food insecurity beyond just the immediate locations of violence.

Second, armed conflict has well-documented impacts on food consumption patterns, nutrition, and resilience [55, 86, 6, 1], with consequences that extend through demand-side channels as well [33, 20]. Investigating the impact of violent conflict and food security in Malawi and Ethiopia, Muriuki et al. [87] find that exposure to violence on average decreases food consumption scores by 16%. Looking at the impact of armed conflict on household food insecurity in Tigray, Ethiopia, Weldegiargis et al. [133] find that household food insecurity access, food insecurity experience, and hunger scales increased by 43.3 percentage points compared to the prewar period. Households located near conflict zones often face limited market access and higher prices for goods [126]. For example, higher food prices during war time leads to poorer diets and higher levels of hunger [see e.g. 105, 3, 126, 54]. Studies also find that food insecurity increases due to forced displacement, reducing both the quantity and quality of accessible food [83, 130]. Even in the absence of direct violence, conflict can lead to the loss of family members, community networks, and primary caregivers, which undermines household income, reduces purchasing power, and weakens support systems [3]. Also, conflict restricts the movement of individuals, which in turn limits access to food. Roadblocks, market closures, safety concerns, and movement restrictions during or after conflict hinder access to food markets [22, 41, 65]. Fear of danger may also drive individuals to rely on nearby food sources that are often lower in both quality and quantity [123, 102, 12].

Thus, armed conflict affects food security both directly and indirectly by reducing agricultural output, disrupting transportation and market networks, increasing food prices, and diminishing household income through higher unemployment and lower wages. These factors collectively contribute to reduced food availability and access.

2.3. Research gaps and contribution of the study

While significant progress has been made in understanding the individual effects of flooding and armed conflict on food insecurity, key gaps remain. Importantly, there is a notable lack of research examining the compound effects of floods and armed conflict on food security. More broadly, studies investigating the intersection of conflict and extreme weather events remain sparse, despite growing evidence that these compound hazards have unique and severe implications for food systems. In addition, much of the existing literature on flooding and food insecurity is geographically concentrated in Africa, leaving other regions underexplored [60, 40]. This study addresses these gaps by investigating the combined impact of flooding and armed conflict on food insecurity, contributing to a more nuanced understanding of the factors driving vulnerability in conflict-affected regions.

3. Theoretical framework

The prevalence of food insecurity is unequally distributed and shaped by spatial and temporal variations across key drivers. Crucially, the presence of multiple vulnerabilities likely exacerbates the level of food insecurity and associated health consequences [32]. However, the interplay and effects of compound hazards influencing food insecurity is currently unknown. The compound impact of extreme weather events and violent conflict is likely more detrimental to food security than the isolated effect of conflict or climate extremes. We therefore present a novel theoretical framework that outlines a compound vulnerability[1] model to illustrate how different hazards contribute to compound risks for food security. Our theoretical framework illustrates how the effects of flood are exacerbated by armed conflict, leading to both short and long-term effects on food security.

3.1. Armed conflict shapes the effect of flood exposure on food security

Based on the above discussion, we contend that exposure to armed conflict would be a compound factor that further intensifies the negative effect of flooding on individual level food insecurity. Violence shapes the impact of extreme events on societies and increase disaster risk by contributing to create and intensify hazards, altering hazard exposure, and enhancing the vulnerability of affected populations [95]. Here, we present four channels through which armed conflict exposure is likely to intensify the negative effect of flood on food insecurity: through damages to critical infrastructure, increased displacement, heightened vulnerability, and reduced coping capacity to recover from the flood impact.

In the short term, armed conflict can contribute to increase the likelihood and intensity of floods by causing large-scale damages to the environment and critical infrastructure, impairing the maintenance and operation of technical systems, and forcing engineers and technical staff to flee the conflict areas, with a consequent loss of information and management capacity [95, 23, 13, 95]. For instance, the escalation of violence in Sudan disrupted maintenance efforts, leaving drainage systems ill-prepared to cope with flood events and increasing flood risk [13]. These effects can also be long-lasting: a study of the effects of the war in Korea finds that the use of incendiary bombs as part of a 'scorched-earth' strategy and the destruction of hydraulic dams had long-term consequences on the Korean environment, and contributed to increasing

[1]In line with the widely acknowledged definition provided by the Intergovernmental Panel on Climate Change [63], vulnerability is here understood as the propensity to be adversely affected by exogenous or endogenous shocks, decreasing the capacity of individuals, households, and communities to prepare for, mitigate, and recover from the impacts of conflict and climate hazards on food insecurity. We understand food insecurity as a state where the ability to acquire adequate and safe food is limited or uncertain, as opposed to a situation of food security, where '[...] all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life' [47].

public health risks in the following decades [62]. The magnitude and extent of the 2010 flood in Pakistan were intensified by the massive deforestation induced by the Taliban insurgency and anti-state military activities in the years prior to the flood [88].

Second, conflict increases exposure to flood by displacing large populations, leaving them significantly more susceptible to hazards in their new locations compared to their original homes [104, 36]. In the short-term, internally displaced persons (IDPs) may be more exposed to flooding as they are forced to live in precarious conditions, where they rely on aid, provided rations, vouchers, or cash for food and have less opportunities to meet their basic food needs [90]. Displaced communities also lose their support systems and display lower social capital, with detrimental implications for their vulnerability to climate hazards [67]. This lost social network and heightened vulnerability may have long-lasting impact. Following the end of the Sierra Leone Civil War (1991–2002), large numbers of people migrated to Freetown, in search for better livelihood opportunities. Many, particularly poor migrants and conflict survivors, constructed substandard shelters in high-risk areas such as floodplains, which had long-term negative impacts on their exposure to climate hazards [95]. Similarly, conflict-induced migration and displacement heightened the exposure of conflict-affected populations in Colombia to landslides and flooding [117].

Third, conflict makes affected individuals and groups more vulnerable to the negative impacts of flood by deteriorating households' welfare, disrupting healthcare, and weakening governance and institutions which fail to enforce disaster management laws, or implement adequate preparedness measures [104, 13]. Conflicts harm access to healthcare and basic service provision, and overall impairs health and well-being [131, 26, 45, 66, 128], making individuals more vulnerable to the effects of flood on food insecurity. Violence deteriorates livelihood and reduces income opportunities and economic productivity [28, 29]. As economic conditions deteriorate, households may be forced to reallocate expenditures and resort to precarious livelihood strategies to cope, such as borrowing or purchasing food on credit, selling assets, taking on hazardous jobs, or even child labor [27]. In turn, direct destruction or deterioration of livelihoods and income shape the impact of flood on food security [101]. For example, the conflict in Pakistan exacerbated people's vulnerability to the 2010 flood by deteriorating rural livelihood [88]. Armed conflicts are also likely to reduce social capital, exacerbating communities' vulnerability to flood impacts. A study of Sri Lanka finds that internally displaced people (IDPs) are more vulnerable to the impact of natural-related disasters, due their lower levels of social capital and the loss of community connections, trust, and access to informal institutions [68].

Fourth, we argue that exposure to conflict also fundamentally hampers individuals, communities and governments' coping capacity. Although armed conflict do not seem to reduce the availability of accurate and timely warnings ahead of flood events in conflict-affected areas [64], military activities damage critical infrastructure and networks [56], hindering emergency response capacity during flood events, and leading to an increased susceptibility to weather extremes [95, 13, 59]. Areas with recent or ongoing conflicts may also have low or limited access to a robust support systems for flood victims, deepening the impact of food insecurity. For example, the protracted conflict situation in Afghanistan hindered climate-related disaster risk operations and activities due to logistical challenges, generalized insecurity, and lack of trust and legitimacy, which hampered the efforts of NGOs and international donors involved in disaster risk reduction [85].

Conflict often limits government and NGO reach, complicating post-disaster recovery efforts. In the Philippines, the war exacerbated vulnerability to tropical cyclones by reducing resources for disaster response – partly because the military, a key player in disaster relief operations, was preoccupied with combat – as well as through insurgents' intentional efforts to disrupt humanitarian aid [59]. Armed groups and/or the government may purposefully prevent humanitarian aid to reach the affected population as a way to exacerbate food crises, as recently witnessed in the conflicts in Somalia, Syria, Yemen, Ethiopia, and South Sudan [73]. In conflict areas, governments may use food deprivation as a weapon to deter residency in contested territories or to encourage mobilization [79].

In the long term, conflicts also affect political structures and governance, promoting corruption, and increasing exclusion and marginalization, which reduce governments and communities' capacity to cope against flood impacts and exacerbate their effects on food insecurity. Corruption often thrives in conflict-affected areas, as neo-patrimonial practices prosper in highly uncertain environments [78, 44, 136]. In turn, capacity to cope against the effects of floods is likely to decline in clientelistic regimes, which have have lower incentives to engage in collective action problems [50]. Keefer et al. [72], for example, find that earthquake mortality is higher when governments have less incentives to provide public goods, such as in autocracies and corrupt states. In Bangladesh, bribery and extortion practices, which force local populations to over-extract environmental resources, have exacerbated their vulnerability to climate-related hazards [98]. Corruption often obstructs the development of adaptation projects, promoting a misallocation of funding away from the most affected regions, in favour of the politically privileged [46].

Armed conflicts also shape vulnerability to floods by exacerbating systemic inequalities [35] which worsen the impacts of floods on food security especially for some groups. Armed conflict increases income inequality within countries, with effects that last for 10 years after the hostilities end and are particularly pronounced for high-intensity conflicts [15]. In turn, inequality may represent an important channel through which armed conflict exacerbates the impacts of climate hazards: Income inequality is one of the strongest predictors of flood-related mortality, even when accounting for economic development and flood exposure [80]. In the United States, excess deaths after tropical cyclones are more prevalent in counties characterised by poor housing and lower socio-economic status [93]. Inequity in the distribution of resources and practices, including barriers in the access to land and food, are major factors shaping the impact of climate hazards on food security [74, 106].

Lastly, armed conflict fosters marginalization and exclusion [58]. Identity-based conflicts exacerbate vulnerability by reflecting and reinforcing broader societal divides [36], which further deepen disparities in food access and security [94]. The experience and politics of violence influence disaster management and the provision of relief [85], shaping who receives support and how vulnerabilities are addressed. Politically dominant groups which have greater access to political resources are more likely to secure funding to mitigate, respond and adapt to climate-related impacts [9, 115]. By contrast, groups excluded from political and economic systems often receive less institutional support during disasters, making recovery slower and food insecurity more pronounced due to structural inequality [110]. Marginalized groups frequently endure long-lasting and deep-rooted vulnerabilities due to systemic discrimination [106]. In Mexico, inequality in entitlements and long-lasting marginalization have created unequal patterns of exposure and vulnerability to flood hazards and unequal risks [31]. Similarly, historical patterns of marginalization and exclusion, shaped by the long-lasting legacy of slavery and colonialism, are root causes of vulnerability to climate hazards in the Caribbean [82, 112].

Overall, the intersection of floods and armed conflict may give rise to complex emergencies which severely hamper domestic and international emergency response [76]. Conflicts, in other words, are a catalyst for disasters, increasing the likelihood that weather-related hazards precipitate into humanitarian crises [116, 97, 96, 21]. The above discussion leads us to formulate the following hypothesis:

Hypothesis: *Armed conflict exacerbates the negative effect of flood exposure on individual-level food insecurity.*

4. Armed conflict and flooding in Myanmar

The main goal of the study is to account for and measure compound hazards regarding exposure to flooding and armed conflict and its impact on individual level food insecurity. We test our hypotheses based on individual-level survey data from Myanmar.

The chosen case is particularly well suited to address the research question in four main regards. First, Myanmar exemplifies the intersection of climate hazards and conflict [16, 71, 61]. The flood hazard provide a strong foundation for quantifying its consequences on food insecurity [127]. Cyclone Nargis in 2008 led to one of the most disastrous crises ever recorded, which impacted millions of people, and caused over 100 000 fatalities [109, 124, 17, 52, 119]. The lack of response from the military junta and its blockade of international aid operations received massive critique by the international community in its aftermath [121].

The continued flood hazard in Myanmar makes it a critical case for studying climate-induced food insecurity. Second, Myanmar's history of prolonged conflict, including ethnic tensions and armed struggles [see e.g. 89, 118, 24, 25], allows for analyzing how conflict exacerbates climate vulnerability. The diversity of Myanmar's conflict zones allows us to explore how localized and systemic conflicts interact with climate shocks. Third, findings from Myanmar can inform broader theoretical frameworks and policymaking for similar contexts in conflict-prone and climate-vulnerable regions. Thus, we argue that Myanmar is a most likely or critical case, where both climate hazards and conflict are likely to be significant drivers of vulnerability. This makes it ideal for testing the combined impact of these factors.

Moreover, Myanmar shares key characteristics with other South and Southeast Asian, such as agriculturally dependent economies vulnerable to social instability and climatic hazards, including Bangladesh, Cambodia and the Philippines. These similarities enhance the generalizability of the findings to comparable regions. However, Myanmar's unique political and socio-economic context may limit the extent of this generalizability. To comprehensively assess the external validity of these findings, similar analysis should also be conducted in other settings.

5. Data and methods

We rely on a combination of satellite-derived granular information and survey-based data to represent flood extent, armed conflict exposure, and food insecurity at a spatially granular level.

5.1. Data sources

Our main dependent variables are the weight for age and height for age of children aged 0-5, drawn form the Demographics and Health Surveys (DHS). DHS collected data on households in Myanmar between December 2015 and July 2016. Weight (height) for age is provided by DHS and measures the weight (age) of each child in the surveyed household, relative to the average weight (age) distribution for children of the same age. Both measures are commonly used in the literature to proxy food insecurity and malnutrition [see e.g. 5, 126]. As height responds more slowly to nutrition changes and captures variations in growth and development, height for age is generally used to capture medium to long-term effects on food security [81, 132].

Relying on DHS' geo-location, we overlay this measure of food insecurity with geo-referenced data on flood exposure and conflict exposure. This data structure creates observations for 4,689 children for Myanmar in 2008.

Our measure of flood exposure is drawn from the Global Flood Database [GFD 124]. GFD combines textual information on flood events from the Dartmouth Flood Observatory with satellite imagery from MODIS to map flood extent and duration globally in 2000-2018. As event-based data may under-represent the maximum flood extent, owing to uncertainty in news reporting, satellite-enhanced mapping enables a more accurate and reliable representation of flood exposure [124]. We spatially overlay the flood extent map provided by GFD with the household location drawn from DHS to obtain a flood exposure dummy, coded as 1 if a household was within the inundated area and 0 otherwise. We also include a measure of flood duration as provided by GFD.

Our conflict variable is derived from the geo-referenced version of the Uppsala Conflict Data Program [UCDP 37, 120]. The UCDP provides monthly 'best estimates' of armed conflict fatalities related to organized political violence of all types. Armed conflict is defined as the use of armed force leads to at least 25 deaths in a calendar year [37]. Similarly to the flood exposure variable, we construct a binary measure of conflict exposure by drawing a 25km buffer area around UCDP geo-location of any armed conflict event in 2006-2008, and overlaying it with geo-located household data from DHS.[2]

Lastly, we construct a measure of 'compound´ exposure which interacts the number of battle-related deaths in 2006-2008 with the flood exposure indicator, to measure the number of fatalities related to armed conflict in the flooded area.

Figure 1 visualizes the households (red dots) exposed to the 2008 flood (blue) and to armed conflict (yellow circle).

5.2. Empirical strategy and specification

Our identification strategy relies on a spatial regression discontinuity design (SRDD). Ideally, SRDD would compare households located very close to either side of the flood border. This approach minimizes differences in unobservable characteristics, such as baseline geography, infrastructure, or socio-economic conditions, and ensures that households differ only in their exposure to the flood, thus providing a strong basis for causal inference. However, due to data limitations, narrowing our analysis to households near the flood border would lead to a significant reduction in sample size, weakening statistical power.

To address these practical challenges, we estimate our models based on the whole sample of households but maintain the central logic of SRDD by implementing key adjustments. First, we explicitly control for distance to the flood border – the running variable – by including polynomials of distance in the regression model. These polynomials capture how food insecurity changes smoothly with increasing distance from the flood. A second-order polynomial ensures that the effect of distance is accounted for, while isolating the sharp discontinuity in food insecurity that is expected at the flood border due to exposure. Despite using the whole sample, the flood border remains the critical treatment threshold, and the model is designed to identify the

[2]Note that we drop conflict events with insufficient geographic precision.

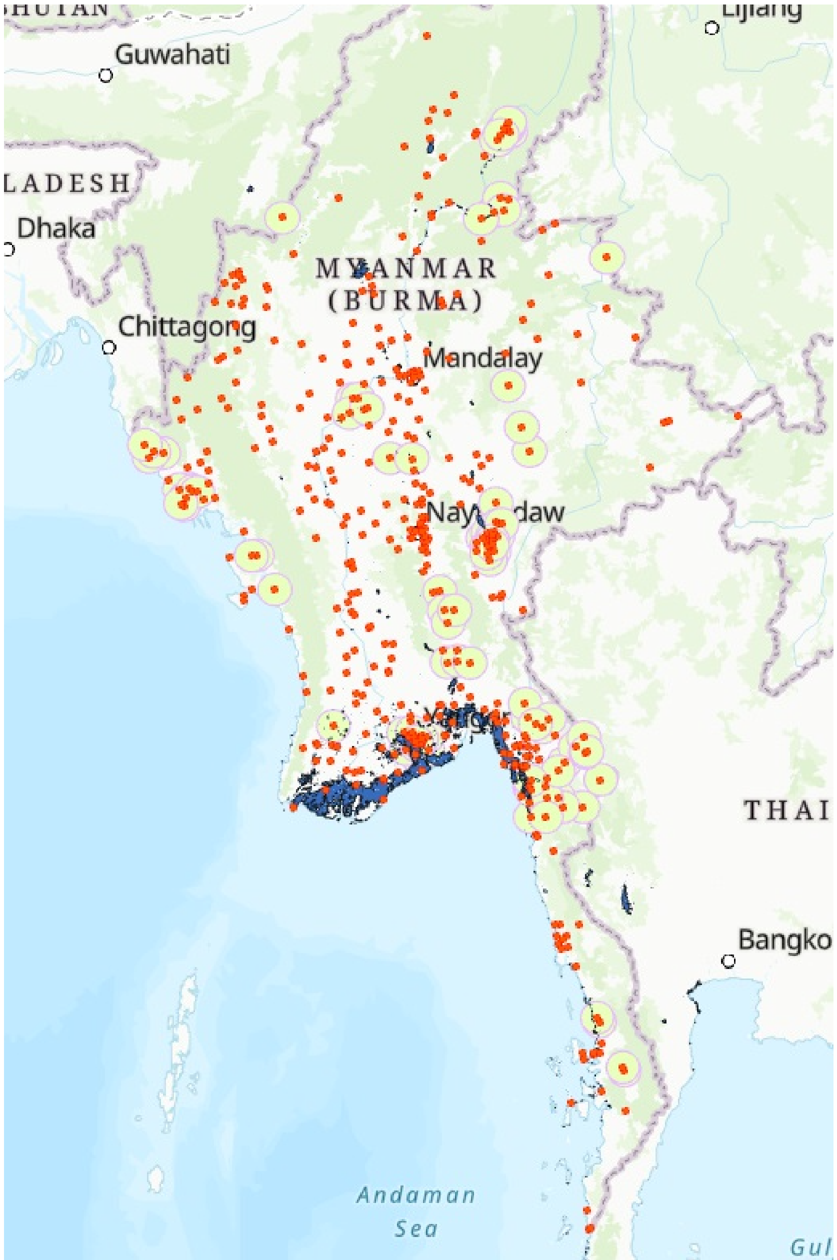

Figure 1: **DHS households exposed to flood and armed conflict, Myanmar, 2008.** The red dots represent the households surveyed by DHS in 2015-2016; the blue area covers the extent of the 2008 flood event as reported by GFD; the yellow circles represent the 25km buffer area drawn around the armed conflict event reported by UCDP in 2006-2008.

causal effect of crossing this boundary.

Second, we include region fixed effects to ensure that comparisons are only made between households within the same context. This adjustment addresses potential confounding factors arising from broader regional differences, such as static or slow-changing differences in governance, infrastructure, or disaster response mechanisms.

Thus, to estimate the effects of flood exposure on food insecurity we run the following regression:

$$y_{icr} = \alpha + \beta F_{cr} + \lambda C_{cr} + \delta f(Distance_{cr}) + X_{icr}\pi + G_{cr}\zeta + \gamma_r + \epsilon_{icr}, \quad (1)$$

where y_{icr} is our measure of food security for child i in DHS cluster c and region r; F_{cr} is the flood exposure dummy; and C_{cr} is the conflict exposure dummy. $f(Distance_{cr})$ is a polynomial in distance of each cluster to the closest flood area border. Our preferred specification uses a second-order polynomial but results are robust to alternative choices. The vector X_{icr} collects individuals and household level controls such as age , sex and age of the household head, number of household members. With G_{cr} we capture cluster-level controls such as slope, local past rainfall and temperature, urban or rural classification, or month of the interview. As the DHS survey was conducted in 2015–2016 right after another flood hitting the country, we also control for the extent of the 2015 flood to exclude that the effect is driven by the most recent flood event. Region fixed effects γ_r capture broad geographic and institutional factors and ϵ_{icr} is the error term. Finally, we control for the number of people exposed to flood using gridded data on population from WorldPop [138], provided at a 1 kilometer resolution, and adjusted to match country-level estimates from UNDP.

6. Results

Table 1 presents the summary statistics for the full sample. The average levels of weight and height, corresponding to the 19–21 percentile of the standard values recommended by the World Health Organization, are considerably lower than the recommended standard for 0-5 years old children [135]. As shown in the Table, the 2008 flood exposed 5% of the individuals included in the DHS survey in 2015–2016. However, households display considerable heterogeneity in their proximity to the flood border, from a mean distance of

33.56 kilometers, up to 250.61 kilometers. Household characteristics suggest moderate education levels among mothers (with a mean lower than 3 years) and an average household size of shy of 6 members.

Table 1: Summary Statistics

	Mean	Min	Max	SD	Count
A. Dependent Variables					
Weight for age	1906.09	0.00	9980.00	2345.62	4689
Height for age	2155.00	0.00	9980.00	2516.54	4689
B. Independent Variables					
2008 Flood, dummy	0.05	0.00	1.00	0.21	4689
2008 Flood duration	0.11	0.00	7.00	0.63	4689
2015 Flood, dummy	0.02	0.00	1.00	0.13	4689
Distance to flood border	33.56	0.00	250.61	45.54	4689
Slope	1.87	0.02	12.85	2.60	4689
Rainfall, 2000	2309.23	638.00	4748.00	1090.20	4634
Rainfall, 2005	2381.71	642.00	5097.00	1122.02	4634
Child's sex	1.48	1.00	2.00	0.50	4689
Child's age in months	30.20	0.00	59.00	16.98	4689
Mother's education	2.89	0.00	6.00	1.92	4314
Sex of household head	1.17	1.00	2.00	0.38	4689
Age of household head	45.22	18.00	98.00	14.51	4689
Household size	5.98	2.00	24.00	2.36	4689
Fatalities, 2006-2008	6.69	0.00	137.00	26.27	4689

Table 2 presents the results from our spatial discontinuity analysis, reporting the impact of flood and exposure on two measures of food insecurity: weight for age (models 1–4) and height for age (models 5–8).

The results indicate that exposure to flood events is significantly associated with reduced weight for age and height for age in exposed children. The estimates from models 1 and 2, using the binary flood exposure indicator as the main independent variable, suggest that children exposed to floods weigh, on average, 308.10 to 346.07 units less compared to non-exposed children. When interpreted as a percentage of the average weight for age (1906.09), this corresponds to a decrease of about 16.16–18.15%, indicating a significant negative effect of flood exposure on children's weight. For height for age, the results also show negative effects, although the magnitude is slightly smaller, with an effect of around 6.7%–14.70% (models 5–6).

We also observe consistent negative effects of flood duration on both weight for age and height for age. Specifically, the coefficients for flood duration in models 3–4 suggest that each additional year of flood exposure leads to a reduction of 99.857–114.106 units in weight for age, which translate to a 5.2%–5.9% decrease. Similarly, flood duration results in a 3.8%–5% decrease in height for age (models 7–8), with the effect remaining significant across both outcomes. These findings highlight that longer exposure to floods exacerbates food insecurity and underscore the long-term impacts of the flood on child development.

The results are robust to different model specifications, suggesting that the negative effects of flood exposure on food security are not merely driven by confounding household or regional factors. Notably, the coefficients on flood exposure and duration remain robust after controlling for distance, suggesting that even children living farther from the flood border experience significant nutritional deficits, albeit to a lesser degree. These results also underscore the spatial spillover effects of floods, likely due to the disruption of regional infrastructure, food systems, and healthcare access.

Crucially, the effects are considerably higher for individuals that were exposed to armed conflict, as reported in Table 3. The results of the interaction term, indicating whether households in the inundated area were also affected by armed conflict, confirm our hypothesis on the role of armed conflict in shaping the impact of flood on food security.

The results show that, for weight for age, the coefficients for the interaction terms are consistently negative and considerably higher in magnitude than the the isolated effects of flood exposure. For locations exposed to both flood and violence, if armed conflict fatalities increase by one standard deviation, the effect of flood exposure on weight for age soars to 61%. Similarly, 1-standard deviation increase in armed conflict fatalities in areas exposed to both flood and conflict is associated with a reduction in children's height for age such by 106% [3] This suggests that, although the 2008 flood had a negative and significant impact on food security by itself this impact was considerably worsened by the exposure to and the increase in the intensity of armed conflict. Exposure to violence and flood had severe implications on food security, and was especially detrimental to children's height for age, casting a long shadow on children's development and growth. The results reflect the complex interaction between climate hazards and political drivers

[3]These effects are computed from the coefficients reported in columns 2 and 4 of Table 3. We first multiply the coefficients for armed conflict fatalities by the standard deviation of armed conflict fatalities (26.27); we then divide the standardized coefficient by the isolated effect of flood exposure on each outcome, as reported in Table 2 (models 2–6) to obtain the relative increase.

of vulnerability, whereby armed conflict and flood hazard intertwine to give rise to disproportionately severe consequences. This has important policy implications, emphasizing the need for integrated intervention strategies that address both immediate disaster relief and the broader socio-political context in conflict-affected areas.

Dependent variable:	**Weight for age**				**Height for age**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Flood	-346.067	-308.103			-316.827	-145.140		
	(76.764)***	(117.346)**			(192.391)	(198.683)		
Flood duration			-114.106	-99.857			-109.044	-83.756
			(24.437)***	(30.893)***			(48.348)**	(46.247)*
Distance polynomial	yes	yes	yes	yes	yes	yes	yes	yes
Sex by age effects	yes	yes	yes	yes	yes	yes	yes	yes
Region fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Geography controls	yes	yes	yes	yes	yes	yes	yes	yes
Urban indicator	yes	yes	yes	yes	yes	yes	yes	yes
Exposed population	no	yes	no	yes	no	yes	no	yes
Household controls	no	yes	no	yes	no	yes	no	yes
2015 Flood	no	yes	no	yes	no	yes	no	yes
R^2	0.28	0.32	0.28	0.32	0.21	0.24	0.21	0.24
N	4689	3849	4689	3849	4755	3904	4755	3904

Table 2: Impact of flood exposure on children's weight for age (1–4) and height for age (5–8). Models 1-2 and 5-6 use the binary flood exposure indicator as main independent variable; Models 3-4 and 7-8 use flood duration.

Dependent variable:	**Weight for age**		**Height for age**	
	(1)	(2)	(3)	(4)
Flood	-263.751	-254.326	-263.953	-117.137
	(100.811)**	(142.448)*	(217.276)	(211.457)
... × Fatalities, 06-08	-8.160	-7.198	-4.618	-5.903
	(1.176)***	(1.476)***	(1.942)**	(2.139)**
Distance Polynomial	yes	yes	yes	yes
Sex by Age Effects	yes	yes	yes	yes
Region Fixed Effects	yes	yes	yes	yes
Geography Controls	yes	yes	yes	yes
Urban Indicator	yes	yes	yes	yes
Population and Household Controls	no	yes	no	yes
2015 Flood	no	yes	no	yes
R^2	0.29	0.32	0.21	0.24
N	4689	3849	4755	3904

Table 3: Impact of flood and conflict exposure on children's weight for age (1–1) and height for age (3–4).

7. Conclusion

Our study of the 2008 flood in Myanmar highlights the role of armed conflict exposure in exacerbating flood impacts on food security, with long-term implications on children's nutritional status and development. The 2008 flood had a significant negative effect on food security, yet the exposure to armed conflict worsened this impact substantially.

Our study underscores the need for targeted interventions in flood-prone areas, and suggest the potential of pursuing peace-building and conflict prevention programmes as effective strategies to mitigate the impacts of floods on food security.

References

[1] Acharya, Y., Luke, N., Naz, S., Sharma, D., 2020. Exposure to conflict-related violence and nutritional status of children in iraq. SSM - Population Health 11, 100585.

[2] Adejala, A., George, S., 2019. Effects of conflict on agriculture: Evidence from the Boko Haram insurgency. World Development 117, 184–195.

[3] Adong, A., Kornher, L., Kiptoo Kirui, O., von Braun, J., 2021. Conflict exposure and food consumption pathways during and after conflict: Evidence from Northern Uganda. World Development 147, 105636.

[4] Ahmad, D., Afzal, M., 2020. Flood hazards, human displacement and food insecurity in rural riverine areas of Punjab, Pakistan: Policy implications. Environmental Science and Pollution Research 28, 10125–10139.

[5] Akresh, R., Bhalotra, S., Leone, M., Osili, U.O., 2012. War and stature: Growing up during the nigerian civil war. American Economic Review .

[6] Akresh, R., Caruso, G.D., Thirumurthy, H., 2022. Detailed geographic information, conflict exposure, and health impacts. World Development 155, 105890.

[7] Alam, G.M.M., Alam, K., Mushtaq, S., Sarker, M.N.I., Hossain, M., 2020. Hazards, food insecurity and human displacement in rural riverine Bangladesh: Implications for policy. International Journal of Disaster Risk Reduction 43, 101364.

[8] Anderson, W., Taylor, C., McDermid, S., Ilboudo-Nébié, E., Seager, R., Schlenker, W., Cottier, F., de Sherbinin, A., Mendeloff, D., Markey, K., 2021. Violent conflict exacerbated drought-related food insecurity between 2009 and 2019 in sub-Saharan Africa. Nature food 2, 603–615. URL: `https://www.nature.com/articles/s43016-021-00327-4`, doi:10.1038/s43016-021-00327-4.

[9] Anguelovski, I., Shi, L., Chu, E., Gallagher, D., Goh, K., Lamb, Z., Reeve, K., Teicher, H., 2016. Equity Impacts

of Urban Land Use Planning for Climate Adaptation: Critical Perspectives from the Global North and South. Journal of Planning Education and Research 36, 333–348. URL: http://journals.sagepub.com/doi/10.1177/0739456X16645166, doi:10.1177/0739456X16645166.

[10] Appau, S., Awaworyi Churchill, S., Smyth, R., Trinh, T.A., 2021. The long-term impact of the Vietnam War on agricultural productivity. World Development 146, 105613. doi:https://doi.org/10.1016/j.worlddev.2021.105613.

[11] Bandara, J.S., Cai, Y., 2014. The impact of climate change on food crop productivity, food prices and food security in South Asia. Economic Analysis and Policy 44, 451–465.

[12] Bar-Nahum, Z., Finkelshtain, I., Ihle, R., Rubin, O.D., 2020-06. Effects of violent political conflict on the supply, demand and fragmentation of fresh food markets. Food Security 12, 503–515. URL: http://link.springer.com/10.1007/s12571-020-01025-y, doi:10.1007/s12571-020-01025-y.

[13] Basheer, M., Elagib, N.A., 2024. Armed conflict as a catalyst for increasing flood risk. Environmental Research Letters 19, 104034. URL: https://iopscience.iop.org/article/10.1088/1748-9326/ad6fb6, doi:10.1088/1748-9326/ad6fb6.

[14] Baumann, M., Radeloff, V.C., Avedian, V., Kuemmerle, T., 2014. Land-use change in the caucasus during and after the nagorno-karabakh conflict. Regional Environmental Change 15, 1703–1716.

[15] Bircan, C., Brück, T., Vothknecht, M., 2017. Violent conflict and inequality. Oxford Development Studies 45, 125–144. URL: https://www.tandfonline.com/doi/full/10.1080/13600818.2016.1213227, doi:10.1080/13600818.2016.1213227.

[16] Borras, S.M., Franco, J.C., Nam, Z., 2020. Climate change and land: Insights from myanmar. World Development 129, 104864. URL: https://www.sciencedirect.com/science/article/pii/S0305750X19305133, doi:https://doi.org/10.1016/j.worlddev.2019.104864.

[17] Brakenridge, G., Syvitski, J., Niebuhr, E., Overeem, I., Higgins, S., Kettner, A., Prades, L., 2017. Design with nature: Causation and avoidance of catastrophic flooding, myanmar. Earth-Science Reviews 165, 81–109. URL: `https://www.sciencedirect.com/science/article/pii/S0012825216302719`, doi:https://doi.org/10.1016/j.earscirev.2016.12.009.

[18] Breisinger, C., Ecker, O., Thiele, R., Wiebelt, M., 2015. Effects of the 2008 flood on economic performance and food security in yemen: A simulation analysis. Disasters 40.

[19] Brown, M.E., Backer, D., Billing, T., White, P., Grace, K., Doocy, S., Huth, P., 2020. Empirical studies of factors associated with child malnutrition: Highlighting the evidence about climate and conflict shocks. Food Security 12, 1241–1252.

[20] Brück, T., d´Errico, M., Pietrelli, R., 2019. The effects of violent conflict on household resilience and food security: Evidence from the 2014 gaza conflict. World Development 119, 203–223.

[21] Buhaug, H., von Uexkull, N., 2021. Vicious Circles: Violence, Vulnerability, and Climate Change. Annual Review of Environment and Resources 46, 545–568. doi:10.1146/annurev-environ-012220-014708. https://www.annualreviews.org/doi/10.1146/annurev-environ-012220-014708.

[22] Calì, M., Miaari, S.H., 2018. The labor market impact of mobility restrictions: Evidence from the west bank. Labour Economics 51, 136–151.

[23] Caso, N., Hilhorst, D., Mena, R., 2023. The contribution of armed conflict to vulnerability to disaster: Empirical evidence from 1989 to 2018. International Journal of Disaster Risk Reduction 95, 103881. doi:10.1016/j.ijdrr.2023.103881. https://linkinghub.elsevier.com/retrieve/pii/S2212420923003618.

[24] Cheesman, N., 2017. Introduction: Interpreting communal violence in myanmar. Journal of Contemporary Asia 47, 335–352. URL: `https://tinyurl.com/ycubfd7d`, doi:https://doi.org/10.1080/00472336.2017.1305121.

[25] Christensen, D., Nguyen, M., Sexton, R., 2019. Strategic violence during democratization: Evidence from myanmar. World Politics 71, 332 – 366. URL: https://api.semanticscholar.org/CorpusID:159055587.

[26] Christoplos, I., Longley, C., Slaymaker, T., 2004. The Changing Roles of Agricultural Rehabilitation: Linking Relief, Development and Support to Rural Livelihoods. Technical Report. Overseas Development Institute, Humanitarian Policy Group. Accessed: March 22, 2024.

[27] Churchill, S.A., Smyth, R., Trinh, T.A., 2022. The Intergenerational Impacts of War: Bombings and Child Labour in Vietnam. The Journal of Development Studies 58, 2290–2306. doi:10.1080/00220388.2022.2081500. https://www.tandfonline.com/doi/full/10.1080/00220388.2022.2081500.

[28] Collier, P., 1999. On the economic consequences of civil war. Oxford Economic Papers – New Series 51, 168–183.

[29] Collier, P., Duponchel, M., 2013. The Economic Legacy of Civil War: Firm-level Evidence from Sierra Leone. Journal of Conflict Resolution 57, 65–88. doi:10.1177/0022002712464847. https://journals.sagepub.com/doi/10.1177/0022002712464847.

[30] Collier, P., Elliot, L., Hegre, H., Hoeffler, A., Reynal-Querol, M., Sambanis, N., 2003. Breaking the Conflict Trap. Civil War and Development Policy. Oxford University Press, Oxford.

[31] Collins, T.W., 2010. Marginalization, Facilitation, and the Production of Unequal Risk: The 2006 Paso del Norte Floods. Antipode 42, 258–288. URL: https://doi.org/10.1111/j.1467-8330.2009.00755.x, doi:10.1111/j.1467-8330.2009.00755.x. publisher: John Wiley & Sons, Ltd.

[32] Connolly-Boutin, L., Smit, B., 2016. Climate change, food security, and livelihoods in sub-Saharan Africa. Regional Environmental Change 16, 385–399.

[33] Corley, A.G., 2021. Linking armed conflict to malnutrition during pregnancy, breastfeeding, and childhood. Global Food Security 29, 100531.

[34] Coronese, M., Lamperti, F., Keller, K., Chiaromonte, F., Roventini, A., 2019. Evidence for sharp increase in the economic damages of extreme natural disasters. Proceedings in the National Academy of Sciences 116, 21450–21455.

[35] Dahlum, S., Nygård, H.M., Rustad, S.A., Østby, G., 2019. The Conflict–Inequality Trap: How Internal Armed Conflict Affects Horizontal Inequality. Technical Report 2-2019. United Nations Development Programme (UNDP).

[36] Danielak, S., 2022. Risk, vulnerability, and pragmatic inevitability: The conflict–disaster nexus and urban governance in Johannesburg, South Africa. Disasters 46, 271–295. doi:10.1111/disa.12461. https://onlinelibrary.wiley.com/doi/10.1111/disa.12461.

[37] Davies, S., Engström, G., Pettersson, T., Öberg, M., 2024. Organized violence 1989–2023, and the prevalence of organized crime groups. Journal of Peace Research 61, 673–693. doi:10.1177/00223433241262912. https://journals.sagepub.com/doi/10.1177/00223433241262912.

[38] Di Maio, M., Leone Sciabolazza, V., 2023. Conflict exposure and labour market outcomes: Evidence from longitudinal data for the Gaza Strip. Labour Economics 85, 102439. URL: https://linkinghub.elsevier.com/retrieve/pii/S0927537123001148, doi:10.1016/j.labeco.2023.102439.

[39] Douglas, I., 2009. Climate change, flooding and food security in south Asia. Food Security 1, 127–136. doi:10.1007/s12571-009-0015-1. http://link.springer.com/10.1007/s12571-009-0015-1.

[40] Dowd, C., Polzin, S.S., Gleason, K., Yang, R., Narang, P., Patel, R., 2024. Conflict's impacts on food systems: Mapping available evidence of interactions. Journal of International Development 36, 2152–2171. URL: https://onlinelibrary.wiley.com/doi/10.1002/jid.3899, doi:10.1002/jid.3899.

[41] Dunn, G., 2018. The impact of boko haram insurgency in northeast nigeria on childhood wasting: A double-difference study. Conflict and Health 12, 1–12.

[42] D´Souza, A., Jolliffe, D., 2013. Conflict, food price shocks, and food insecurity: The experience of afghan households. Food Policy 42, 32–47.

[43] Eklund, L., Degerald, M., Brandt, M., Prishchepov, A.V., Pilesjö, P., 2017. How conflict affects land use: Agricultural activity in areas seized by the islamic state. Environmental Research Letters 12, 054004.

[44] Erdmann, G., Engel, U., 2007. Neopatrimonialism Reconsidered: Critical Review and Elaboration of an Elusive Concept. Commonwealth & Comparative Politics 45, 95–119. URL: http://www.tandfonline.com/doi/full/10.1080/14662040601135813, doi:10.1080/14662040601135813.

[45] Eriksen, S., Lind, J., 2009. Adaptation as a Political Process: Adjusting to Drought and Conflict in Kenya's Drylands. Environmental Management 43, 817–835. doi:10.1007/s00267-008-9189-0. https://doi.org/10.1007/s00267-008-9189-0.

[46] Eriksen, S., Schipper, E.L.F., Scoville-Simonds, M., Vincent, K., Adam, H.N., Brooks, N., Harding, B., Khatri, D., Lenaerts, L., Liverman, D., Mills-Novoa, M., Mosberg, M., Movik, S., Muok, B., Nightingale, A., Ojha, H., Sygna, L., Taylor, M., Vogel, C., West, J.J., 2021. Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? World Development 141, 105383. URL: https://www.sciencedirect.com/science/article/pii/S0305750X20305118, doi:10.1016/j.worlddev.2020.105383.

[47] FAO, 2008. An introduction to the basic concepts of food insecurity. URL: http://www.fao.org/docrep/013/al936e/al936e00.pdf. last accessed 05.09.16. Url: http://www.fao.org/docrep/013/al936e/al936e00.pdf.

[48] FAO, 2015. The impact of natural hazards and distasters on agriculture and food security and nutrition: A call for action to build resilient livelihoods. Rome. Available at: https://openknowledge.fao.org/server/api/core/bitstreams/a9b93dc0-9b13-4644-96d0-fd8879e66007/content.

[49] FAO, 2023. The impact of disasters on agriculture and food security: Avoiding and reducing losses throughinvestment in resilience. Rome. Available at: https://doi.org/10.4060/cc7900en.

[50] Fergusson, L., Molina, C.A., Robinson, J.A., 2022. The Weak State Trap. Economica 89, 293–331. URL: https://onlinelibrary.wiley.com/doi/10.1111/ecca.12399, doi:10.1111/ecca.12399.

[51] Ficchì, A., Stephens, L., 2019. Climate variability alters flood timing across Africa. Geophysical Research Letters 46, 8809–8819.

[52] Fritz, H.M., Blount, C.D., Thwin, S., Thu, M.K., Chan, N., 2009. Cyclone nargis storm surge in myanmar. Nature Geoscience 2, 448–449.

[53] FSIN, Global Network Against Food Crises, 2024. 2024 Global Report on Food Crises. URL: https://www.fsinplatform.org/report/global-report-food-crises-2024/#download.

[54] Gates, S., Hegre, H., Nygård, H.M., Strand, H., 2012. Development consequences of armed conflict. World Development 40, 1713–1722.

[55] George, J., Adelaja, A., Weatherspoon, D., 2020. Armed conflicts and food insecurity: Evidence from Boko Haram's attacks. American Journal of Agricultural Economics 102, 114–131. URL: https://onlinelibrary.wiley.com/doi/abs/10.1093/ajae/aaz039, doi:10.1093/ajae/aaz039.

[56] Guo, Z., Abushama, H., Siddig, K., Kirui, O.K., Abay, K., You, L., 2024. Monitoring indicators of economic activities in sudan amidst ongoing conflict using satellite data. Defence and Peace Economics , 1–17.

[57] Hadley, K., Wheat, S., Rogers, H.H., Balakumar, A., Gonzales-Pacheco, D., Davis, S.S., Linstadt, H., Cushing, T., Ziska, L.H., Piper, C., Sorensen, C., 2023. Mechanisms underlying food insecurity in the aftermath of climate-related shocks: A systematic review. The Lancet: Planetary Health 7, e242–e250.

[58] Halabi, Z., 2004. Exclusion and identity in Lebanon's Palestinian refugee camps: A story of sustained conflict. Environment and Urbanization 16, 39–48. doi:10.1177/095624780401600221. https://journals.sagepub.com/doi/10.1177/095624780401600221.

[59] Hänze, N., 2024. When conflict becomes calamity: Understanding the role of armed conflict dynamics in natural disasters. Journal of Peace Research doi:10.1177/00223433241265028. https://tinyurl.com/bt5brjk6.

[60] Hendrix, C.S., 2017. The streetlight effect in climate change research on Africa. Global Environmental Change 43, 137–147. doi:10.1016/j.gloenvcha.2017.01.009. https://linkinghub.elsevier.com/retrieve/pii/S0959378016302412.

[61] Huang, X., Ziniti, B., Torbick, N., 2019. Assessing conflict driven food security in rakhine, myanmar with multisource imagery. Land 8. URL: `https://www.mdpi.com/2073-445X/8/6/95`, doi:10.3390/land8060095.

[62] Hwang, S.k., 2021. The Korean War and the environment. Critical Asian Studies 53, 517–537. doi:10.1080/14672715.2021.1967179. https://www.tandfonline.com/doi/full/10.1080/14672715.2021.1967179.

[63] IPCC, 2023. Climate Change 2023. IPCC AR6 Synthesis Report. Intergovernmental Panel on Climate Change (IPCC). Geneva, Switzerland. URL: `https://tinyurl.com/ydx76ups`.

[64] Jaime, C., Coughlan De Perez, E., Van Aalst, M., Raju, E., Sheaffer, A., 2022. What was known: Weather forecast availability and communication in conflict-affected countries. International Journal of Disaster Risk Reduction 83, 103421. doi:10.1016/j.ijdrr.2022.103421. https://linkinghub.elsevier.com/retrieve/pii/S2212420922006409.

[65] Jakiela, P., Ozier, O., 2019. The impact of violence on individual risk preferences: Evidence from a natural experiment. The Review of Economics and Statistics 101, 547–559.

[66] Jaspars, S., O'Callaghan, S., 2010. Livelihoods and protection in situations of protracted conflict. Disasters 34.

doi:10.1111/j.1467-7717.2010.01152.x. https://onlinelibrary.wiley.com/doi/10.1111/j.1467-7717.2010.01152.x.

[67] Jayawardana, J., Priyantha, R., Magni, M., Marincioni, F., 2019a. Disaster resilience among war-affected people resettled in Northern Sri Lanka: Challenges revisited. International Journal of Disaster Risk Reduction 34, 356–362. doi:10.1016/j.ijdrr.2018.12.005. https://linkinghub.elsevier.com/retrieve/pii/S2212420918308343.

[68] Jayawardana, J., Priyantha, R., Magni, M., Marincioni, F., 2019b. Disaster resilience among war-affected people resettled in Northern Sri Lanka: Challenges revisited. International Journal of Disaster Risk Reduction 34, 356–362. doi:10.1016/j.ijdrr.2018.12.005. https://linkinghub.elsevier.com/retrieve/pii/S2212420918308343.

[69] Justino, P., 2012. Nutrition, givernance and violence: A framework for the analysis of resilience and vulnerability to food insecuirty in contexts of violent conflict. URL: `https://tinyurl.com/5767nm5f`. hiCN Working Paper 132.

[70] Kafando, W.A., Sakurai, T., 2024-01. Armed conflicts and household food insecurity: Effects and mechanisms. Agricultural Economics , agec.12814URL: `https://onlinelibrary.wiley.com/doi/10.1111/agec.12814`, doi:10.1111/agec.12814.

[71] Kawasaki, A., Kawamura, G., Zin, W.W., 2020. A local level relationship between floods and poverty: A case in myanmar. International Journal of Disaster Risk Reduction 42, 101348. URL: `https://tinyurl.com/mupcnvwp`, doi:https://doi.org/10.1016/j.ijdrr.2019.101348.

[72] Keefer, P., Neumayer, E., Plümper, T., 2011. Earthquake Propensity and the Politics of Mortality Prevention. World Development 39, 1530–1541. URL: `https://linkinghub.elsevier.com/retrieve/pii/S0305750X11000295`, doi:10.1016/j.worlddev.2011.02.010.

[73] Kemmerling, B., Schetter, C., Wirkus, L., 2022-06. The logics of war and food (in)security. Global Food Security 33, 100634. URL: `https://tinyurl.com/nbz8eubz`, doi:10.1016/j.gfs.2022.100634.

[74] Kmoch, L., Palm, M., Persson, U.M., Jepsen, M.R., 2021. Cyclone Komen's aftermath: Local knowledge shows how poverty and inequalities fuel climate risk in western Myanmar. Regional Environmental Change 21, 111. doi:10.1007/s10113-021-01847-2. https://link.springer.com/10.1007/s10113-021-01847-2.

[75] Kruczkiewicz, A., Cian, F., Monasterolo, I., Di Baldassarre, G., Caldas, A., Royz, M., Glasscoe, M., Ranger, N., van Aalst, M., 2022. Multiform flood risk in a rapidly changing world: What we do not do, what we should and why it matters. Environmental Research Letters 17, 081001.

[76] Kruczkiewicz, A., Klopp, J., Fisher, J., Mason, S., McClain, S., Sheekh, N.M., Moss, R., Parks, R.M., Braneon, C., 2021. Compound risks and complex emergencies require new approaches to preparedness. Proceedings of the National Academy of Sciences 118, e2106795118. doi:10.1073/pnas.2106795118. https://pnas.org/doi/full/10.1073/pnas.2106795118.

[77] Le, K., Nguyen, M., 2023. The impacts of armed conflict on child health: Evidence from 56 developing countries. Journal of Peace Research 60, 243–257.

[78] Le Billon, P., 2003. Buying peace or fuelling war: the role of corruption in armed conflicts. Journal of International Development 15, 413–426.

[79] Lin, T.K., Kafri, R., Hammoudeh, W., Mitwalli, S., Jamaluddine, Z., Ghattas, H., Giacaman, R., Leone, T., 2022. Pathways to food insecurity in the context of conflict: The case of the occupied Palestinian territory. Conflict and Health 16, 38. doi:10.1186/s13031-022-00470-0. https://conflictandhealth.biomedcentral.com/articles/10.1186/s13031-022-00470-0.

[80] Lindersson, S., Raffetti, E., Rusca, M., Brandimarte, L., Mård, J., Di Baldassarre, G., 2023. The wider the gap between rich and poor the higher the flood mortality. Nature Sustainability 6, 995–1005. doi:10.1038/s41893-023-01107-7. https://www.nature.com/articles/s41893-023-01107-7.

[81] Lundeen, E.A., Stein, A.D., Adair, L.S., Behrman, J.R., Bhargava, S.K., Dearden, K.A., Gigante, D., Norris, S.A., Richter, L.M., Fall,

C.H.D., Martorell, R., Sachdev, H.S., Victora, C.G., COHORTS Investigators, 2014. Height-for-age z scores increase despite increasing height deficits among children in 5 developing countries. The American Journal of Clinical Nutrition 100, 821–825. doi:10.3945/ajcn.114.084368.

[82] López-Marrero, T., Wisner, B., 2012. Not in the Same Boat: Disasters and Differential Vulnerability in the Insular Caribbean. Caribbean Studies 40, 129–168. URL: http://www.jstor.org/stable/41917606. publisher: Institute of Caribbean Studies, UPR, Rio Piedras Campus.

[83] Marchesi, K., Rockmore, M., 2022. Conflict and nutrition: endogenous dietary responses in nepal. Food Security doi:https://doi.org/10.1007/s12571-022-01305-9.

[84] Martin-Shields, C.P., Stojetz, W., 2019. Food security and conflict: Empirical challenges and future opportunities for research and policy making on food security and conflict. World Development 119, 150–255.

[85] Mena, R., Hilhorst, D., 2021. The (im)possibilities of disaster risk reduction in the context of high-intensity conflict: The case of Afghanistan. Environmental Hazards 20, 188–208. doi:10.1080/17477891.2020.1771250. https://www.tandfonline.com/doi/full/10.1080/17477891.2020.1771250.

[86] Minoiu, C., Shemyakina, O.N., 2014. Armed conflict, household victimization, and child health in côte d'ivoire. Journal of Development Economica 108, 237–255.

[87] Muriuki, J., Hudson, D., Faud, S., 2023. The impact of conflict on food security: Evidence from househol data in ethiopia and malawi. Agriculture & Food Security 12, 1–20.

[88] Muzamil, M.R., Tschakert, P., Boruff, B., Shahbaz, B., 2021. An extreme climatic event and systemic vulnerabilities in the face of conflict: Insights from the Taliban insurgency in Swat, Pakistan. Regional environmental change 21, 3. doi:10.1007/s10113-020-01738-y. http://link.springer.com/10.1007/s10113-020-01738-y.

[89] Nilsen, M., 2013. Will democracy bring peace to Myanmar? International Area Studies Review 16, 115–141. URL: https://tinyurl.com/4xcz33m2, doi:10.1177/2233865913492961.

[90] Nisbet, C., Lestrat, K.E., Vatanparast, H., 2022. Food Security Interventions among Refugees around the Globe: A Scoping Review. Nutrients 14, 522. doi:10.3390/nu14030522. https://www.mdpi.com/2072-6643/14/3/522.

[91] Olsen, V.M., Fensholt, R., Olofsson, P., Bonifacio, R., Butsic, V., Druce, D., Ray, D., Prishchepov, A.V., 2021. The impact of conflict-driven cropland abandonment on food insecurity in south sudan revealed using satellite remote sensing. Nature Food 2, 990–996. doi:10.1038/s43016-021-00417-3.

[92] Oskorouchi, H.R., Sousa-Poza, A., 2021. Floods, food security, and coping strategies: Evidence from Afghanistan. Agricultural Economics 52, 123–140. doi:10.1111/agec.12610. https://onlinelibrary.wiley.com/doi/10.1111/agec.12610.

[93] Parks, R.M., Kontis, V., Anderson, G.B., Baldwin, J.W., Danaei, G., Toumi, R., Dominici, F., Ezzati, M., Kioumourtzoglou, M.A., 2023. Short-term excess mortality following tropical cyclones in the United States. Sci. Adv. 9, eadg6633. URL: https://www.science.org/doi/10.1126/sciadv.adg6633, doi:10.1126/sciadv.adg6633.

[94] Patel, R., 2008. Stuffed and Starved: Markets, Power and the Hidden Battle for the World Food System. Paperback ed ed., Portobello Books, London.

[95] Peters, L.E., 2021. Beyond disaster vulnerabilities: An empirical investigation of the causal pathways linking conflict to disaster risks. International Journal of Disaster Risk Reduction 55, 102092. doi:10.1016/j.ijdrr.2021.102092. https://linkinghub.elsevier.com/retrieve/pii/S2212420921000583.

[96] Peters, L.E.R., 2022. Disasters as Ambivalent Multipliers: Influencing the Pathways from Disaster to Conflict Risk and Peace Potential

Through Disaster Risk Reduction. Journal of Peacebuilding & Development 17, 151–172. doi:10.1177/15423166221081516. http://journals.sagepub.com/doi/10.1177/15423166221081516.

[97] Peters, L.E.R., Kelman, I., 2020. Critiquing and Joining Intersections of Disaster, Conflict, and Peace Research. International Journal of Disaster Risk Science 11, 555–567. doi:10.1007/s13753-020-00289-4. https://link.springer.com/10.1007/s13753-020-00289-4.

[98] Rahman, M.A., 2018. Governance matters: climate change, corruption, and livelihoods in Bangladesh. Climatic Change 147, 313–326. URL: `http://link.springer.com/10.1007/s10584-018-2139-9`, doi:10.1007/s10584-018-2139-9.

[99] Ramakrishna, G., Gaddam, S.R., Daisy, I., 2014. Impact of floods on food security and livelihoods of idp trbal households: The case of Khamman region of India. International Journal of Development and Economics Sustainability 2, 11–24.

[100] Reed, C., Anderson, W., Kruczkiewicz, A., Nakamura, J., Gallo, D., Seager, R., McDermid, S.S., 2022a. The impact of flooding on food security across Africa. Proceedings of the National Academy of Sciences 119, e2119399119.

[101] Reed, C., Anderson, W., Kruczkiewicz, A., Nakamura, J., Gallo, D., Seager, R., McDermid, S.S., 2022b. The impact of flooding on food security across Africa. Proceedings of the National Academy of Sciences 119, e2119399119. doi:10.1073/pnas.2119399119. https://pnas.org/doi/10.1073/pnas.2119399119.

[102] Rockmore, M., 2016. The cost of fear: The welfare effects of risk of violence in northern uganda. World Bank Economic Review 31, 650–669.

[103] Rockmore, M., 2020. Conflict-risk and agricultural portfolios: Evidence from northern uganda. The Journal of Development Studies 56, 1856–1876.

[104] Rosvold, E.L., 2023. Disaster resilience in conflict-affected areas: A review of how armed conflicts impact disaster resilience. Current Opinion in Environmental Sustainability 65, 101381.

doi:10.1016/j.cosust.2023.101381. https://linkinghub.elsevier.com/retrieve/pii/S1877343523001288.

[105] Rudolfsen, I., Bartusevičius, H., van Leeuwen, F., Østby, G., 2024. War and food insecurity in ukraine. World Development 180, 106647.

[106] Salm, L., Nisbett, N., Cramer, L., Gillespie, S., Thornton, P., 2021. How climate change interacts with inequity to affect nutrition. WIREs Climate Change 12, e696. doi:10.1002/wcc.696. https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.696.

[107] Sam, A.S., Abbas, A., Padmaja, S.S., Sathyan, A.R., Vijayan, D., Kächele, H., Kumar, R., Müller, K., 2021. Flood vulnerability and food security in eastern india: A threat to the achievement of the sustainable development goals. International Journal of Disaster Risk Reduction 66, 102589.

[108] Sann, W., 2009. Myanmar: Food insecurity remains a challenge for cyclone survivors. News and Press Release. URL: https://reliefweb.int/report/myanmar/myanmar-food-insecurity-remains-challenge-cyclone-survivors. originally published 1 August 2009.

[109] Seeger, K., Peffeköver, A., Minderhoud, P.S.J., Vogel, A., Brückner, H., Kraas, F., Oo, N.W., Brill, D., 2024. Evaluating flood hazards in data-sparse coastal lowlands: highlighting the ayeyarwady delta (myanmar). Environmental Research Letters 19, 084007. doi:10.1088/1748-9326/ad5b07.

[110] Sen, A., 1981. Poverty and famines: An essay on entitlement and deprivation. Oxford.

[111] Serneels, P., Verpoorten, M., 2015. The impact of armed conflict on ecoonomic performance: Evidence from rwanda. Journal of Conflict Resolution 59, 555–592.

[112] Sheller, M., León, Y.M., 2016. Uneven socio-ecologies of Hispaniola: Asymmetric capabilities for climate adaptation in Haiti and the Dominican Republic. Geoforum 73, 32–46. URL: https://linkinghub.elsevier.com/retrieve/pii/S0016718515002158, doi:10.1016/j.geoforum.2015.07.026.

[113] Shemyakina, O.N., 2022. War, conflict and food insecurity. Annual Review of Resource Economics 14, 313–332.

[114] Sherman, M., Ford, J., Llanos-Cuentas, A., Valdivia, M.J., Group, I.R., 2016. Food system vulnerability amidst the extreme 2010–2011 flooding in the Peruvian Amazon: A case study from the Ucayali region. Food Security 8, 551–570.

[115] Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K., Schenk, T., Seto, K.C., Dodman, D., Roberts, D., Roberts, J.T., VanDeveer, S.D., 2016. Roadmap towards justice in urban climate adaptation research. Nature Climate Change 6, 131–137. URL: http://www.nature.com/articles/nclimate2841, doi:10.1038/nclimate2841.

[116] Siddiqi, A., 2018. Disasters in conflict areas: Finding the politics. Disasters 42. doi:10.1111/disa.12302. https://onlinelibrary.wiley.com/doi/10.1111/disa.12302.

[117] Siddiqi, A., Peters, K., Zulver, J., 2019. 'doble afectación': Living with disasters and conflict in colombia.

[118] Staniland, P., 2017. Armed politics and the study of intrastate conflict. Journal of Peace Research 54, 459–467. doi:10.1177/0022343317698848.

[119] Stone, R., 2009. One year after a devastating cyclone, a bitter harvest. Science 324, 715–715. URL: https://tinyurl.com/yenh64r5, doi:10.1126/science.324_715.

[120] Sundberg, R., Melander, E., 2013. Introducing the ucdp georeferenced event dataset. Journal of Peace Research 50, 523–532. doi:10.1177/0022343313484347.

[121] Suwanvanichkij, V., Murakami, N., Lee, C.I., Leigh, J., Wirtz, A.L., Daniels, B., Mahn, M., Maung, C., Beyrer, C., . Community-based assessment of human rights in a complex humanitarian emergency: The Emergency Assistance Teams-Burma and Cyclone Nargis. Conflict and Health 4, 8. URL: https://conflictandhealth.biomedcentral.com/articles/10.1186/1752-1505-4-8, doi:10.1186/1752-1505-4-8.

[122] Tandon, S., Vishwanath, T., 2020. The evolution of poor food access over the course of the conflict in yemen. World Development 130, 104922. URL: https://tinyurl.com/bd37hmac, doi:https://doi.org/10.1016/j.worlddev.2020.104922.

[123] Tapsoba, A., 2022. The cost of fear: Impact of violence risk on child health during conflict. Journal of Development Economics 160, 102975. doi:https://doi.org/10.1016/j.jdeveco.2022.102975.

[124] Tellman, B., Sullivan, J.A., Kuhn, C., Kettner, A.J., Doyle, C.S., Brakenridge, G.R., Erickson, T.A., Slayback, D.A., 2021. Satellite imaging reveals increase proportion of population exposed to floods. Nature 596, 80–86.

[125] Tramblay, Y., Villarini, G., Zhang, W., 2020. Observed changes in flood hazard in Africa. Environmental Research Letters 15, 1040b5.

[126] Tranchant, J.P., Justino, P., Müller, C., 2020. Political violence, adverse shocks and child malnutrition: Empirical evidence from andhra pradesh, india. Economics and Human Biology 39, 100900.

[127] Tun, T., Lassa, J.A., 2023. Governing disaster risk in myanmar: Institutions and policy pathways during 1885–2015. International Journal of Disaster Risk Reduction 96, 103992. URL: https://tinyurl.com/yuhzx7tk, doi:https://doi.org/10.1016/j.ijdrr.2023.103992.

[128] United Nations Development Programme, 2011. Disaster-Conflict Interface: Comparative Experiences. United Nations Development Programme, Bureau for Crisis Prevention and Recovery, New York. Https://www.undp.org/sites/g/files/zskgke326/files/publications/DisasterConflict72p.pdf.

[129] Verwimp, P., Justino, P., Brück, T., 2019. The microeconomics of violent conflict. Journal of Development Economics 141, 102297. doi:10.1016/j.jdeveco.2018.10.005. https://linkinghub.elsevier.com/retrieve/pii/S0304387818314160.

[130] Verwimp, P., Muñoz-Mora, J.C., 2018. Returning home after civil war: Food security and nutrition among burundian households. The Journal of Development Studies 54.

[131] Vesco, P., Baliki, G., Brück, T., Döring, S., Eriksson, A., Fjelde, H., Guha-Sapir, D., Hall, J., Knutsen, C.H., Leis, M.R., Mueller, H., Rauh, C., Rudolfsen, I., Swain, A., Timlick, A., Vassiliou, P.T., Von Schreeb, J., Von Uexkull, N., Hegre, H., 2025. The impacts of armed conflict on human development: A review of the literature. World Development 187, 106806. doi:10.1016/j.worlddev.2024.106806. https://linkinghub.elsevier.com/retrieve/pii/S0305750X24002766.

[132] Watson, K.M., Dasiewicz, A.S., Bassani, D.G., Chen, C.Y., Qamar, H., O'Callaghan, K.M., Roth, D.E., 2024. Height-Age as An Alternative to Height-For-Age z-Scores to Assess the Effect of Interventions on Child Linear Growth in Low- and Middle-Income Countries. Current Developments in Nutrition 8, 104495. doi:10.1016/j.cdnut.2024.104495. https://linkinghub.elsevier.com/retrieve/pii/S2475299124024296.

[133] Weldegiargis, A.W., Abebe, H.T., Abraha, H.E., Abrha, M.M., Tesfay, T.B., Belay, R.E., Araya, A.A., Gebregziabher, M.B., Godefay, H., Mulutega, A., . Armed conflict and household food insecurity: evidence from war-torn tigray, ethiopia. Conflict and Health 5, 22.

[134] Wheeler, T., von Braun, J., 2013. Climate change impacts on glbal food security. Science 341, 508–513.

[135] (WHO), W.H.O., . Child growth standards. URL: `https://www.who.int/tools/child-growth-standards/standards`.

[136] Williams, P., 2016. War & conflict in Africa. Second edition, fully revised & updated ed., Polity, Cambridge Malden.

[137] World Meteorological Organization, 2024. State of the Global Climate 2023. United Nations, Erscheinungsort nicht ermittelbar.

[138] WorldPop, . Global 1km Population total adjusted to match the corresponding UNPD estimate. URL: `https://www.worldpop.org/doi/10.5258/SOTON/WP00671`, doi:10.5258/SOTON/WP00671.

[139] Yiran, G.A.B., Atubiga, J.A., Kusimi, J.M., Kwang, C., Owusu, A.B., 2022. Adaptation to perennial flooding and food insecurity in the sudan

savannah agroecological zone of ghana. Environmental Research 214, 114037.

[140] Yolchi, J., Wang, H., Pede, V., 2024. Impact of floods on food security in rural Afghanistan. International Journal of Disaster Risk Reduction 112, 104746. doi:10.1016/j.ijdrr.2024.104746. https://linkinghub.elsevier.com/retrieve/pii/S2212420924005089.

Appendix