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Climate Risks and Agricultural Changes in Conflict-affected Myanmar

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ABSTRACT

Climate change and conflict are increasingly shaping livelihoods in Myanmar, with agricultural households among the most directly affected. Yet, empirical evidence on how these stressors affect farmers' adaptation strategies and agricultural assets remains limited. We draw on unique large-scale primary surveys: Over a three-year period, we conducted bi-annual surveys with nearly 5,000 farmers, collecting data on exposure to conflict, natural risks, climate change perceptions, agricultural adaptation, and agricultural land valuation. The key findings are the following:

- **Weather challenges rank high among the major reported challenges faced by farmers, especially in more recent years.** Between 2021 and 2024, an average of 18 percent of farmers identified weather as a primary challenge for farming. On average, across each season over the three survey years, 7 percent of farmers reported that crop production was affected by drought during the monsoon and dry seasons, while 5 and 4 percent, respectively, reported flood impacts during these same seasons. At the level of the largest plot of paddy rice (the major crop grown in the country), farmers experienced an average of 1.4 floods or droughts over a five-year period, pointing to significant weather-related risk.
- **Most farmers indicate that the incidences of floods and droughts are becoming more severe in most recent years compared to previous periods. Moreover, irregular rainfall is increasingly becoming a challenge in farming.**
- **Overall changes in the adoption of Climate-Smart Agricultural (CSA) technologies have been limited over the last six years.** Furthermore, smallholders are significantly less likely than medium or large farms to adopt CSA technologies, particularly in the areas of diversification, crop management, and post-harvest practices. More remote households also show significantly lower rates of adoption.
- **Climatic risks are associated with reduced agricultural land values**—an immobile production factor particularly vulnerable to such risks. Droughts, in particular, have a significant impact: each additional drought event is associated with an 8 percent decrease in rice land value, compared to a 4 percent reduction per additional flood. This may indicate that droughts cause greater losses and damage than floods.
- **Conflicts also negatively affect land values, aligning with the observed decline in agricultural profitability in conflict-affected areas,** albeit with a temporal lag.
- **There is large variation by agro-ecological zone in conflict exposure, weather-related risks, as well as in the adoption of climate-smart agriculture (CSA) technologies.** We find significant spatial differences in perceived insecurity, with significantly higher levels in the Dry Zone and Coastal areas. Based on data from the largest rice plots, the Coastal region faces the highest overall climatic risk, while the Hills and Mountains region experiences the lowest. Floods and droughts were reported with equal frequency at the national level, each affecting plots an average of 0.7 times over the past five years, while regional patterns vary substantially: floods were more commonly reported in the Delta and Coastal areas, whereas droughts were more prevalent in the Dry Zone. Adoption rate changes of CSA technologies are significantly higher in the Delta, the more commercial area in the country.

- Our findings underscore the significant impact of climate shocks and conflict on the agricultural sector—evident in lower land values in more severely affected areas, alongside limited change in the adoption of mitigating CSA technologies. Moreover, we find large differences by agro-ecological zone. This has several important implications:
 - **The promotion of appropriate agricultural technologies in conflict- and climate risk-affected areas requires targeted attention**, given the heightened vulnerability of livelihoods in these contexts.
 - The substantial heterogeneity in perceived climate risks across agro-ecological zones underscores **the need for differentiated strategies in the promotion of climate-smart agriculture (CSA) and agricultural extension services**.
 - **Particular focus should be placed on remote households and smallholders, who exhibit markedly lower capacity for coping and adaptation**, and are therefore more exposed to adverse impacts.

1. INTRODUCTION

Conflicts and climate change are emerging as major global threats to livelihoods, affecting a significant proportion of the world's population and driving rapid increases in food insecurity: the number of people facing acute hunger has tripled since 2016 and doubled since 2020 (FSIN and GNAFC, 2025). During this period, global conflicts have intensified, with e.g. the number of conflict events doubling between 2019 and 2024; in 2024, an estimated one in eight individuals worldwide was exposed to conflict (ACLED, 2025). At the same time, climate change is accelerating more rapidly than previously projected. The likelihood of achieving the 2015 Paris Agreement target of limiting global temperature rise to below 1.5°C is diminishing, with extreme weather events becoming increasingly frequent and severe (Rosegrant et al., 2025).

The agricultural sector is hugely affected by these developments. Weather changes can adversely affect crop production because shifts in temperature, moisture, or sunlight disrupt plant growth processes, leading to reduced yield and increased vulnerability to pests and diseases, while conflict affects access to agricultural markets. This is especially worrisome in low- and middle-income countries, given low adaptation mechanisms (Rosegrant et al., 2025; Shemyakina, 2022). However, the effects of conflict and climate change on farming are not well understood and are mostly based on simulations, given the complications of primary data collection in these contexts. It is especially rare to have a situation where data on both stressors are available at once.

In this paper, we study the intersections of conflict, climate shocks, and agriculture and aim to pursue three specific objectives. First, we assess how farmers across different agro-ecological zones perceive climate change and insecurity in Myanmar, where both stressors are highly prevalent. Second, we analyze the types of technological adaptation strategies farmers are adopting—in particular the uptake of climate-smart agricultural (CSA) technologies—and the factors associated with these changes. Third, we investigate the effects of conflict and climate shocks on the valuation of agricultural land, an immobile and crucial production asset that is particularly vulnerable to such shocks. Given its immobility and role as a long-term investment, agricultural land prices provide a clear metric to test how conflict and climate risks are reflected in farm asset values. The second and third questions are closely linked: while technology adoption reflects households' active strategies to cope with shocks, land values embody the broader market prices in these risks. Together, they capture both the micro-level behavioral responses of farmers and the macro-level economic signal embedded in land markets, offering a more complete picture of how rural communities adapt to and internalize conflict and climate risks.

We focus on Myanmar, a prime example of a context where both crises are highly significant. Myanmar is one of the most vulnerable countries to climate change (Shaw et al., 2022; Adil et al., 2025) with enormous implications on agriculture, the mainstay for the majority of the population and one of Myanmar's most important economic sectors. In Myanmar, we find that average temperatures increased approximately by 1°C—from 27.5°C to 28.5°C—between 1980 and 2024, while annual rainfall has declined by about 5 percent over that period. Moreover, Myanmar is affected by widespread conflict following a military coup in early 2021, which led to Myanmar being ranked second on the Global Conflict Index in 2024 (ACLED, 2025).

In our empirical approach to analyze these research questions, we draw on unique large-scale primary surveys in Myanmar. Over a three-year period, we conducted bi-annual surveys with nearly 5,000 farmers, collecting data on exposure to conflict, natural risks, climate change perceptions, agricultural adaptation, and agricultural land valuation. We use these datasets for an observational study and provide a broad descriptive overview of conflict, climate change, and agriculture over that period.

Violent events have increased dramatically in Myanmar after the coup, with important implications for the farming population, as they are clearly and directly affected by this increased insecurity in the country, due to difficulty of traveling as well as fear of storage of produce, among others. Weather challenges rank high among the major reported challenges faced by farmers in this context, especially in the more recent years. On average, across each season over the three survey years, 7 percent of farmers reported that crop production was affected by drought during the monsoon and dry seasons, while 5 and 4 percent, respectively, reported flood impacts during these same seasons. At the level of the largest plot of paddy rice (the major crop grown in the country), farmers experienced an average of 1.4 floods or droughts over a five-year period, pointing to significant weather-related risk.

Most farmers indicate that the incidences of floods and droughts are becoming more severe in the most recent years compared to previous periods. Moreover, irregular rainfall is increasingly becoming a challenge in farming. When examining the adoption of climate-smart agriculture (CSA) strategies, such as agricultural diversification, water and soil management, pest and disease control, risk management, and post-harvest practices, we find that overall changes in the adoption of CSA technologies have been limited over the last six years. Furthermore, smallholders are significantly less likely than medium or large farms to adopt CSA technologies, particularly in the areas of diversification, crop management, and post-harvest practices. More remote households also show significantly lower adoption rate changes.

Hedonic land valuation is regarded as a reliable method for assigning value to amenities that are not directly traded in markets, such as weather-related and conflict risks (Mendelsohn and Olmstead, 2009). We find that both climatic risks and conflict are associated with reduced agricultural land values. Land exposed to higher weather-related risks has significantly lower valuation. Droughts, in particular, have a significant impact: each additional drought event is associated with an 8 percent decrease in rice land value, compared to a 4 percent reduction per additional flood. This may indicate that droughts cause greater losses and damage than floods, a pattern consistent with findings in other contexts (Elagib et al., 2023). Conflicts also negatively affect land values, aligning with the observed decline in agricultural profitability in conflict-affected areas (MAPSA, 2024), albeit with a temporal lag. Overall, our findings underscore the significant impact of climate shocks and conflict on the agricultural sector—evident in lower land values in more severely affected areas, alongside limited change in the adoption of mitigating CSA technologies.

Finally, we observe large variation by agro-ecological zone in conflict exposure, weather-related risks, as well as in the adoption of climate-smart agriculture (CSA) technologies. We find significant spatial differences in perceived insecurity, with significantly higher levels in the Dry Zone and Coastal areas. Based on data from the largest rice plots, the Coastal region faces the highest overall climatic risk, while the Hills and Mountains region experiences the lowest. Floods and droughts were reported with equal frequency at the national level, each affecting plots an average of 0.7 times over the past five years, while regional patterns vary substantially: floods were more commonly reported in the Delta and Coastal areas, whereas droughts were more prevalent in the Dry Zone. Adoption rate changes of CSA technologies are significantly higher in the Delta, the more commercial area in the country.

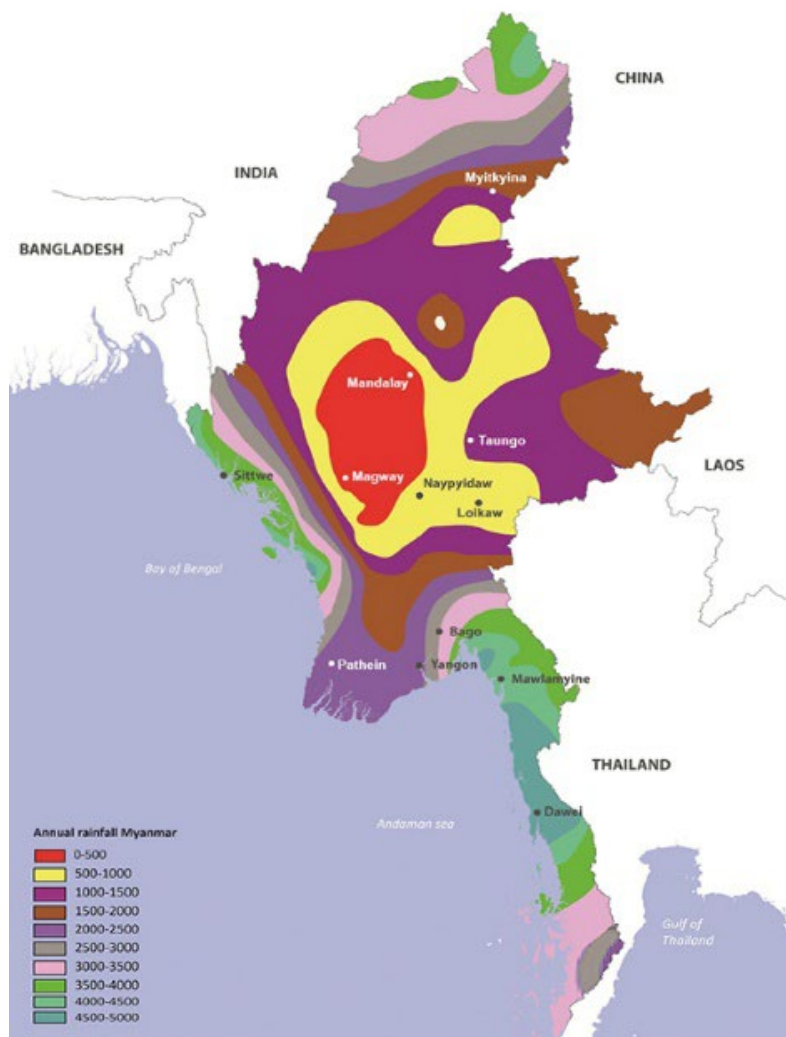
The rest of the paper is set up as follows. In section 2, we present background information on the agricultural sector and climate in Myanmar. Section 3 discusses the data and methodology. The conflict situation in Myanmar is described in Section 4. Reports on climate shocks and perceptions on climate change by farmers are explored in more detail in Section 5 while changes in the adoption of CSA technologies are looked at in Section 6. We assess associations of climate and conflict with land valuation in Section 7 and conclude in Section 8.

2. BACKGROUND

2.1. Climate

Myanmar has a tropical monsoon climate (FAO, 2011), with approximately 90 percent of annual rainfall occurring during the southwest monsoon season, from May to October. Rainfall distribution varies significantly across the country. Coastal regions such as Rakhine, Tanintharyi, and Mon receive high annual rainfall ranging from 3,500 to 5,000 mm. In contrast, the central dry zone—including Magway, Mandalay, and Nay Pyi Taw—receives significantly less, between 0 and 1,000 mm annually (Figure 1). Intermediate rainfall levels, ranging from 1,500 to 3,000 mm per year, are observed in the delta regions (Ayeyarwady, Bago, and Yangon) and on the Shan plateau.

Figure 1. Average annual rainfall in different regions of Myanmar



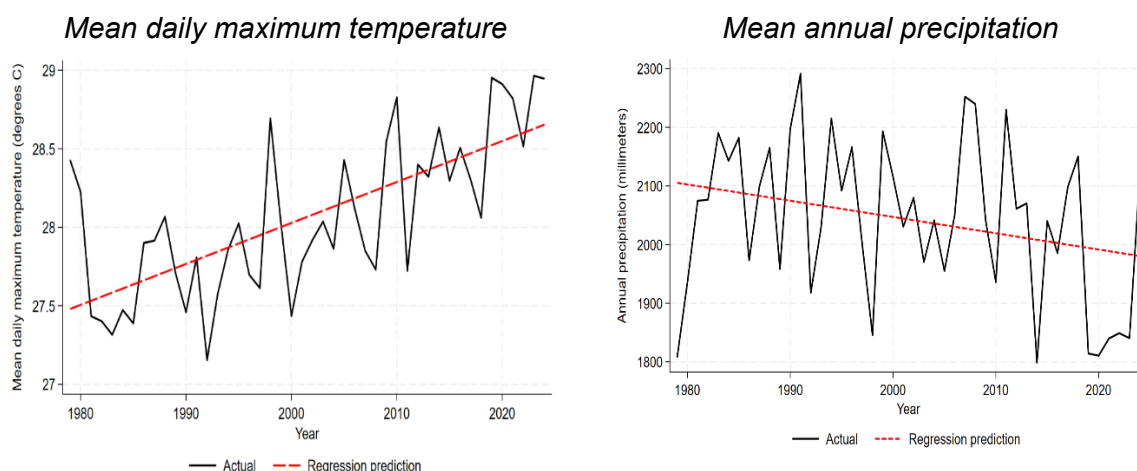
Source: Government of Myanmar¹

Similar to trends observed globally and across Asia (Shaw et al., 2022), rainfall patterns and average temperatures in Myanmar are undergoing significant changes (Figure 2). Relying on the Multi-Source Weather database (MSWX, 2025) – a high-resolution, bias-corrected meteorological product with global coverage from 1979 onwards – we find that while annual variability remains high, annual rainfall has declined, on average, by just over 100 mm, representing a decrease of about 5

¹ Downloaded from <https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=156220§ion=3>

percent, between 1980 and 2024. Over the same period, average temperature increased by approximately 1°C—from 27.5°C to 28.5°C. Such changes in temperature and rainfall have important implications for agriculture (Rosengrant et al., 2025).

Figure 2. Changing temperatures and precipitation in Myanmar, 1980-2024



Source: Calculations based on MSWX (2025) and Beck et al. (2022)²

Natural disasters pose a significant threat in Myanmar, as it is frequently affected by extreme weather events. According to the Climate Risk Index, Myanmar ranks 4th globally in terms of vulnerability to such events (Adil et al., 2025), falling into the category of countries exposed to highly unusual and severe weather extremes. The country is vulnerable to multiple natural hazards, including droughts, floods, cyclones, storm surges, and intense rainfall. While Myanmar faces high and increasing exposure to climate hazards, it remains among the least prepared to implement adaptation and climate-related responses. In 2023, it was ranked 163rd out of 187 countries on a vulnerability index to climate disruptions (ND-GAIN, 2024). Within South-East Asia - a region highly vulnerable to climate change - Myanmar ranks as most vulnerable, with most vulnerable 'agriculture capacity' and second most vulnerable food supply. Myanmar also has the lowest 'readiness' score in South-East Asia (which captures the ability to adapt to climate change). Other assessments also suggest a concerning picture. The 2025 Environmental Performance Index (World Population Review, 2025) ranks Myanmar among the worst-performing countries in environmental health, ecosystem vitality, and climate mitigation.

Figure 3 provides an overview of major disasters in recent years, the most devastating being Cyclone Nargis in 2008, which is estimated to have caused nearly 140,000 deaths.

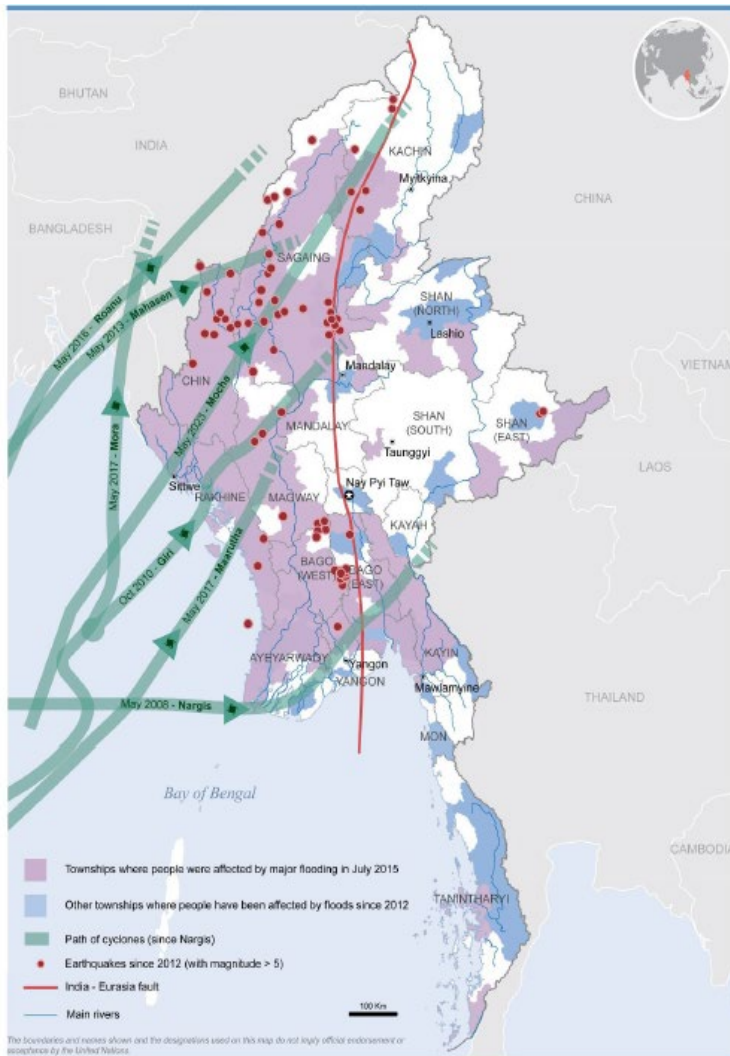
These risks are expected to intensify with climate change. For instance, there has been a noticeable increase in the intensity and frequency of cyclones and strong winds. Between 1980 and 2020, such events occurred approximately once every three years; however, since 2000, they have become annual occurrences (Noble, 2023). In recent years, Myanmar has experienced several major natural disasters: Cyclone Mocha in May 2023 affected 5.4 million people (OCHA, 2024); Typhoon Yagi in early September 2024 impacted 2.4 million people; and a severe earthquake in late March 2025 affected 17 million people (World Bank, 2025).

While Myanmar faces high and increasing exposure to climate hazards, it remains among the least prepared to implement adaptation and climate-related responses. In 2023, it was ranked 163rd out of 187 countries on a vulnerability index to climate disruptions (ND-GAIN, 2024). Within South-East Asia - a region highly vulnerable to climate change - Myanmar ranks as most vulnerable, with

² We thank Timothy Thomas for sharing these calculations.

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Figure 3. Overview of major natural disasters in Myanmar (2008-2024)



Source: OCHA (2024)

2.2 Agriculture in Myanmar

Agriculture, and agrifood systems overall, are very important economic sectors in Myanmar. It was estimated in 2019 that the primary agriculture sector generated 22 percent of total GDP and accounted for almost 50 percent of total employment in the economy (Diao et al., 2024). When other agriculture-related sectors are considered – such as agro-processing, agricultural trade and transport, input supply, and hotels and food service – the share of the agrifood system in Myanmar’s economy was evaluated at 46 percent of total GDP, employing almost two-thirds (64 percent) of all workers in the economy (Diao et al., 2024).

³ See South (2023), Houtman and Vaddhanaphutti (2023), and ISP (2024) for more qualitative assessments on the impact of climate change and conflict in Myanmar.

Myanmar's agriculture is very diverse, linked to highly diverse soils and climate conditions. Four agro-ecological zones (AEZs) are typically distinguished, which we will use in the remainder of the paper (Figure 4):

- The Delta (Ayeyarwady, Bago, Yangon) has a humid tropical climate with heavy rainfall during the monsoon.
- The Coastal area (Rakhine, Tanintharyi, Mon) contains coastal strips and mangrove areas with lowland and upland further inland.
- The central Dry Zone (Mandalay, Magway, Nay Pyi Taw, Sagaing) is the most water stressed of all agro-ecological zones.
- The Hills (Chin, Kachin, Kayah, Kayin, Shan) have adequate rainfall and moderate temperatures that allow for diverse cropping patterns.

Figure 4. Agro-ecological zones in Myanmar



Source: Authors

Paddy plays a critical role in Myanmar's agricultural sector. Paddy accounted for 36 percent of the total sown area in the country during the 2021/22 agricultural year and approximately 60 percent of farmers cultivated paddy in the 2023 monsoon (Boughton et al., 2024). Its significance is particularly pronounced in the Delta and Coastal agro-ecological zones, where it contributed more than half the total value of agricultural production, based on estimates from the most recent national household survey (Minten et al., 2024). In contrast, paddy is relatively less dominant in the Dry Zone

and the Hills AEZs. Other crops play important regional roles. Pulses constitute an important share of agricultural output in the Delta (22 percent) and the Dry Zone (19 percent). Oilseeds are particularly significant in the Dry Zone, contributing 23 percent, while maize and horticultural crops are especially important in the Hills (Minten et al., 2024).

3. DATA

The farm-level data originate from six rounds of the Myanmar Agriculture Performance Survey (MAPS), a phone-based survey conducted with nearly 5,000 respondents across all states and regions of the country during the first and third quarters of a three-year period (2022 – 2024), corresponding to the monsoon and dry seasons, respectively. The survey collected comprehensive information on household characteristics, total cultivated area, use of agricultural inputs, farm management practices, yields, marketing behavior, and perceptions of security. To ensure representativeness of the surveyed crop farmers within each state and region, sampling weights were applied based on the methodology outlined in Lambrecht et al. (2023). In addition, detailed data on farmers' own land valuation for their largest rice plot were collected during the first quarter of 2024, while information on perceptions of weather changes and adoption of CSA technologies was gathered during the mid-year survey in 2024.

Table 1 presents the descriptives on the farmers in the dataset. In 71 percent of the cases, the primary farm management decision maker was male, with an average age of 46 years. Three percent of agricultural decision makers had no formal education, while 58 percent had completed primary school. The average size of a farm family was 4.5 members. The average farm sizes are small, with 6.1 acres owned by farmers and 5.4 acres cultivated.⁴ The majority of the farms surveyed were in the Dry Zone (39 percent) and the Delta (30 percent).

To measure conflict incidence, we rely on a number of alternative measures. First, we use several self-reported measures by farmers, asking them directly about perceptions of security in their communities. For our regression analysis, we rely on publicly available data from the Armed Conflict Location & Event Data Project (ACLED), which tracks incidents of violence, fatalities, and protests worldwide using sources like media reports and civil society organizations (Raleigh et al., 2010). We use data from that database and focus particularly on incidences of violent events, i.e. the numbers of battles, violence against civilians, and explosions/remote violence.

We also constructed several remoteness indicators—measuring travel times from the farm to the township center, the nearest international border, and to the nearest city of at least 10,000 people. The travel time was self-reported by the farmer. Travel times to the nearest city of at least 5,000 people and the border were estimated using transport infrastructure and landscape features, including land use, rivers, lakes, and slope data obtained from the Myanmar Information Management Unit.⁵ Each remoteness variable is converted into a binary (0/1) dummy, using the median distance as the cutoff.

⁴ Some areas cannot be cultivated in the dry season (or the monsoon), partly explaining the gap between owned and cultivated areas.

⁵ Each road type in the GIS data—major, secondary, tertiary, and tracks/other—was assigned a specific travel speed, ranging from 75 km/h to 10 km/h. These GIS layers were then combined to produce a friction (or impedance) grid, which was converted into raster layers at a 1-kilometer resolution. Slope was also incorporated into the model to account for variations in travel speed due to uphill and downhill movement.

Table 1. Descriptives

	Unit	National	Hills	Dry	Delta	Coastal
<u>Demographics of Farm Management Decision Maker:</u>						
- Gender	% Male	71.3	66.6	72.2	74.5	71.1
- Age (Years)	Mean	46.4	44.3	46.9	47.0	48.3
- Education:						
None	%	2.7	6.2	1.8	0.9	1.9
Primary	%	58.4	62.1	57.5	56.2	58.8
Secondary	%	34.2	28.7	35.0	38.3	34.3
Other	%	4.6	3.0	5.7	4.6	5.0
Household Size (Number)	Mean	4.5	4.7	4.5	4.1	4.7
Crop Area Owned (Acres)	Mean	6.1	5.3	5.7	7.0	6.9
	Median	4.0	3.0	4.0	4.0	4.0
Crop Area Cultivated (Acres)	Mean	5.4	4.5	4.7	6.8	5.9
	Median	3.2	3.0	3.0	4.7	3.0
Number of Observations		28,155	6,632	11,051	7,912	2,560

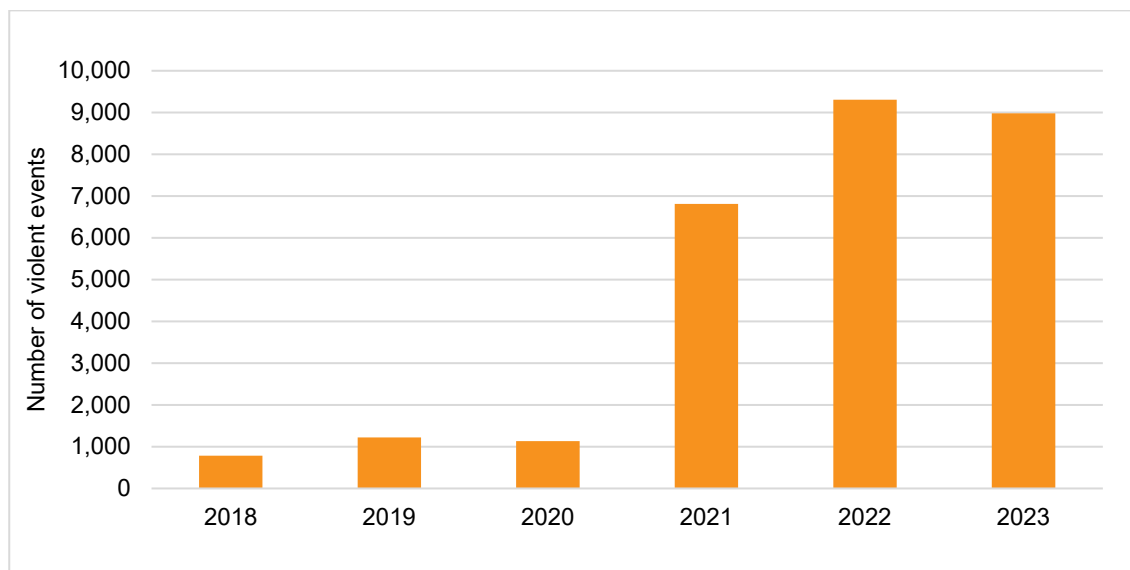
Source: Authors' calculations based on the Myanmar Agricultural Performance Surveys

4. CONFLICT

Myanmar has experienced ongoing conflict since the end of the Second World War (Myint-U, 2007), but the situation worsened significantly following widespread resistance to a military coup in early 2021. Figure 5 shows how the number of violent events has escalated since then, e.g. the number of violent events in 2022 was eight times higher than in 2020. The intensity of violence has varied across regions (Figure 6). The southern part of the country—often referred to as the rice bowl—has remained relatively less affected, while the Dry Zone in central Myanmar, along with the southeastern and western regions, has experienced the most severe impacts, especially in recent years.

We asked farmers about their perceptions of insecurity, as these may significantly impact farm activities—farmers might avoid traveling to buy inputs, sell outputs, or even cultivate their land altogether. On average, twenty-two percent of the farmers indicated that they could not move around without serious concerns for security over the periods of the surveys while 29 percent of farmers felt 'insecure' or 'somewhat insecure' within their communities (Table 2). Farmers were also asked if fields were not cultivated in their community or if fields were burnt or destroyed or not harvested because of conflict in their area. At the national level, 8 and 4 percent, respectively, of the farmers indicated that this was the case in their area. Confiscation of land in their community was mentioned by 1 percent of the farmers. Farmers were also asked if they were afraid to store agricultural produce at their house. At the national level, 11 percent of the farmers indicated that they were indeed afraid to do so. In line with the ACLED data, reported insecurity issues by farmers are generally higher in the Dry Zone and in the Coastal agro-ecological zones.

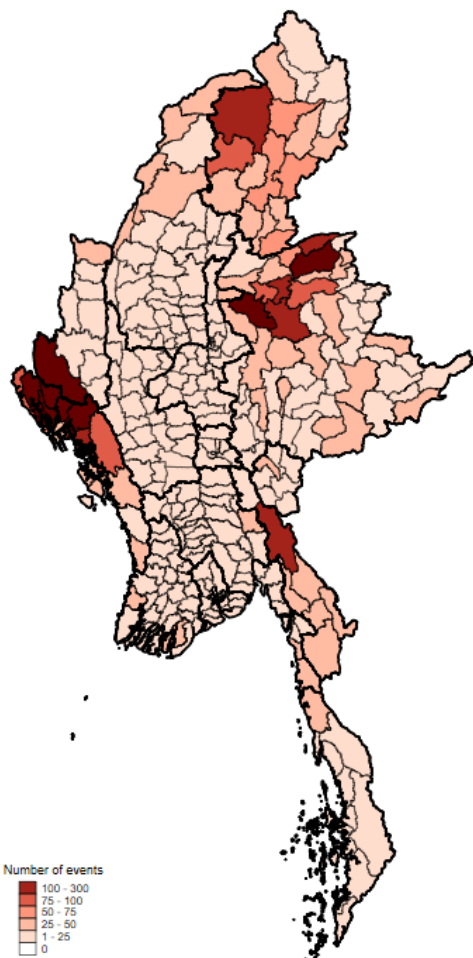
Figure 5. Number of violent events, 2018-2023



Source: Authors' calculations based on ACLED data

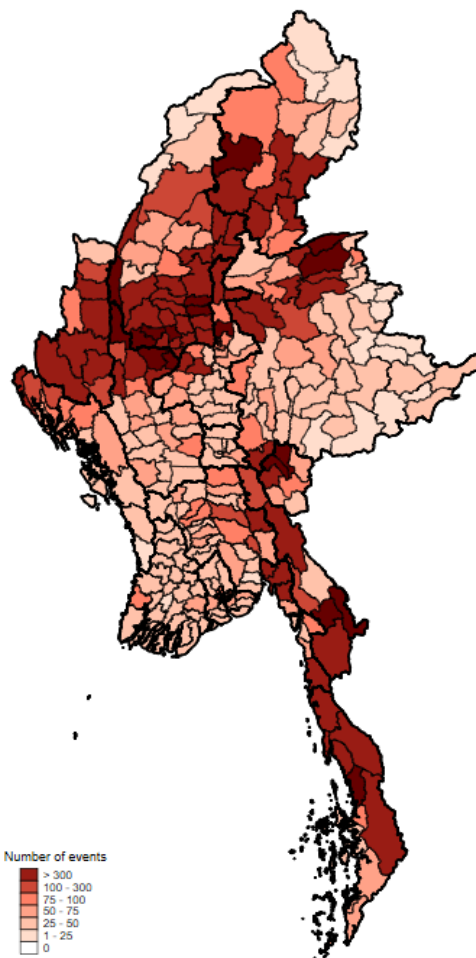
Figure 6. Number of violent events by township, 2018-20, and 2021-23

Number of conflict events during 2018-2020
Number of battles/violence/explosions recorded at township level



Source: ACLED

Number of conflict events during 2021-2023
Number of battles/violence/explosions recorded at township level



Source: ACLED

Source: Authors' calculations based on ACLED data

Table 2. Insecurity perceptions of farmers, 2022 – 2024

	Unit	National	Hills	Dry	Delta	Coastal
<u>Farmer can currently move around in the village tract/township without serious concerns for security:</u>						
Yes	%	78.1	78.1	73.8	85.4	71.8
No	%	21.7	21.8	25.9	14.5	27.7
Doesn't know/ Prefer not to say	%	0.2	0.1	0.3	0.1	0.6
<u>Perceived overall level of physical security in farmers' area:</u>						
Very insecure	%	8.7	9.6	10.3	4.0	14.5
Somewhat insecure	%	19.9	23.1	22.7	13.7	20.4
Secure	%	35.6	37.0	33.2	36.5	37.6
Very Secure	%	35.3	29.6	33.3	45.2	26.6
Prefer not to say	%	0.6	0.7	0.5	0.6	0.8
<u>Crops on fields burned, destroyed, or not harvested because of conflict in the community:</u>						
Yes	%	4.3	3.8	6.6	0.9	7.2
No	%	95.7	96.2	93.2	99.1	92.8
Doesn't know/ Prefer not to say	%	0.1	0.0	0.1	0.1	0.0
<u>Fields were not cultivated because of conflict in the community:</u>						
Yes	%	7.9	7.9	11.3	1.7	14.1
No	%	92.1	92.1	88.7	98.3	85.9
Doesn't know/ Prefer not to say	%	0.0	0.0	0.0	0.0	0.0
<u>Agricultural land has been confiscated in this community:</u>						
Yes	%	1.3	2.0	1.5	0.5	1.3
No	%	98.4	97.9	98.0	99.3	98.7
Doesn't know/ Prefer not to say	%	0.3	0.1	0.5	0.2	0.0
<u>The farmer is afraid of storing agricultural produce at his house because of the risk of confiscation/destruction</u>						
Yes	%	10.7	7.0	19.0	3.7	9.7
No	%	89.2	92.7	80.7	96.3	90.3
Doesn't know/ Prefer not to say	%	0.1	0.2	0.2	0.0	0.0
Number of Observations		25,318	5,626	9,978	7,499	2,215

Source: Authors' calculations based on the Myanmar Agricultural Performance Surveys

5. CLIMATE SHOCKS

5.1. Farming challenges and climate shocks

In our surveys over the last few years, farmers were asked to report their major challenges for crop production in the three months prior to the survey. Despite numerous conflict-related challenges

facing the country, weather-related issues were consistently ranked among the most pressing concerns for farmers (Table 3). Between 2021 and 2024, an average of 18 percent of farmers identified weather as a primary challenge. High input costs—often linked to sustained inflation during the conflict period (World Bank 2025)—were also frequently reported, though mentions declined over time, suggesting that the Ukraine–Russia war may have initially exacerbated the issue (fertilizer prices nearly doubled in 2022 compared to 2021). Pest and disease outbreaks were another persistent concern, cited by an average of 8 percent of farmers—more frequently than labor shortages, banking constraints, or limited access to inputs, all important issues linked to the conflict situation in the country (Boughton et al. 2024).

Table 3. Major reported challenges by farmers, 2021-2024, %

	2021	2022	2023	2024	Pooled
Number of Surveys	1	3	2	2	
No Difficulties	12.8	25.3	43.9	47.6	35.4
Unable to acquire enough inputs or mechanization	3.9	2.7	2.8	3.8	3.0
Higher prices of inputs or mechanization	33.5	29.1	13.4	8.6	19.9
High prices of fuel	3.5	5.1	2.0	2.8	3.6
Disruption to or access to banking services	2.3	2.9	3.1	1.7	2.6
I cannot reach my own farm	2.3	1.1	1.5	1.5	1.4
Water/irrigation supply problems	3.8	4.0	3.9	3.6	3.9
Weather problems	22.1	18.0	16.9	18.3	17.9
Pest and disease problems	11.5	8.5	7.3	6.8	7.9
Difficulties hiring workers	4.3	3.2	4.8	4.2	3.9
Other	0.0	0.2	0.2	1.3	0.5
Total	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculations based on the Myanmar Household Welfare Surveys⁶

We further inquired over the different rounds about the type of climate and disease shocks⁷ that had negatively affected crop production in the previous season. Twenty-nine percent reported that crop production had been affected by such negative shocks in the monsoon over the last three seasons, compared to 34 percent in the dry season (Table 4). Pests and diseases were the most mentioned shock as was reported by 13 percent of the farmers in the monsoon and by 15 percent in the dry season (Table 4). Irregular rain was mentioned by 11 and 12 percent of farmers in the monsoon and dry season respectively. Lack of water was reported more often than floods. Several farmers mention more than one shock, especially so in the monsoon. We also note significant spatial variability in the type of shocks that farmers were exposed to. In the Delta and Coastal agro-ecological zones, we see relatively more shocks related to pests and diseases, and floods while the Dry Zone faces more challenges related to the lack of water. Of the shock-affected farmers, 29 percent report being affected by more than one type of shock in the monsoon (33 percent in the dry season).

⁶ MAPS is a sub-sample of the Myanmar Household Welfare Survey (MHWS), which focused on measuring welfare and livelihoods. In the MHWS, approximately 12,000 to 13,000 households were interviewed across eight rounds between 2021 and 2024.

⁷ We include pests and diseases as new or more damaging pests, pathogens, and weeds are expected to increasingly challenge farmers because of climate change (Rosegrant et al., 2025).

Table 4. Combination of shocks, for those reporting negative effects of weather or disease shocks

		Monsoon					Dry Season				
		National	Hills	Dry	Delta	Coastal	National	Hills	Dry	Delta	Coastal
Crops negatively affected by any shock	% Yes	29.1	25.1	30.4	29.5	33.3	34.0	30.6	37.8	31.1	37.3
Lack of water	% Yes	6.8	4.3	10.4	5.0	5.3	7.5	5.1	12.6	3.2	9.0
Irregular rain	% Yes	11.4	10.1	12.7	11.1	10.8	12.0	13.9	13.1	10.2	9.1
Floods	% Yes	4.6	4.7	3.2	4.6	9.3	4.1	3.6	3.1	5.0	5.5
Extreme temperature	% Yes	0.5	0.5	0.4	0.5	0.9	1.6	1.8	1.9	1.0	2.5
Pest, disease, weeds	% Yes	13.4	11.8	11.3	16.4	16.5	14.5	11.5	13.1	16.7	19.8
Storms	% Yes	0.9	0.6	0.6	0.7	3.4	1.0	0.8	1.0	0.6	2.6
Combination of shocks, for shock-affected farmers:											
0 shocks in a season	% Yes	70.9	74.9	69.6	70.5	66.7	66.0	69.4	62.2	68.9	62.7
1 shock in a season	% Yes	21.6	18.9	23.1	22.1	21.8	27.8	25.0	31.5	25.7	27.4
2 shocks in a season	% Yes	6.6	5.6	6.7	6.1	9.8	5.7	5.0	5.8	5.1	9.2
3 shocks in a season	% Yes	0.8	0.5	0.5	1.1	1.6	0.4	0.5	0.5	0.2	0.2
4 or more shocks in a season	% Yes	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.5

Source: Authors' calculations based on the Myanmar Agricultural Performance Surveys

5.2. Farmers' perceptions on climate change

After assessing the incidence of shocks over the past three years, the 2024 survey also asked farmers how they perceived changes in these weather and disease shocks compared to earlier periods. These perceptions are important, as they might likely influence decisions around the adoption of appropriate CSA technologies. The results, presented in Table 5, suggest that farmers are aware of significant changes in weather patterns. A large majority agree with the proposition that the timing of the monsoon has shifted, with 83 percent stating it now starts either earlier or later than before. Similarly, 74 percent agree that growing periods have become shorter. Sixty-three percent agree that rainfall during the monsoon has become more irregular, and another 60 percent agree that there has been an increase in plant disease outbreaks. In contrast, opinions are mixed about less rain (54 percent agree), the frequency of droughts (49 percent agree) and floods (47 percent agree), and the impact of storms (52 percent agree). A majority of farmers (56 percent) disagree with the statement that higher temperatures reduce yields during the monsoon.⁸

We note strong regional differences in perceptions of climate change. Farmers in the Dry Zone report suffering more from a lack of rain in the monsoon (65 percent of farmers) as well as from an increased frequency of droughts (64 percent of farmers). In contrast, farmers in Coastal areas and in the Hills indicate that they suffer more from floods now than before (56 percent of farmers there report this to be the case). Fewer than one-third of farmers in the Dry Zone—the warmest agro-ecological zone in the country—agree that higher temperatures reduce crop yields.

For further quantitative analysis, we constructed a climate shock index by summing the number of times each farmer agreed with the nine statements. On average, farmers agreed with 5.2 out of 9 statements (Table 5).

Table 5. Perceptions on climate change during the monsoon over the years 2021-2023, compared to the period 2018-2020 (%)

	National	Hills	Dry	Delta	Coastal
"Rain is arriving later/earlier in the beginning of the monsoon"					
- Strongly Agree	48	45	54	50	38
- Agree	35	43	26	35	35
- Disagree	8	3	8	8	19
- Strongly Disagree	9	8	12	8	8
"The growing period is shorter during the monsoon"					
- Strongly Agree	44	40	51	46	30
- Agree	30	38	26	27	23
- Disagree	13	13	10	14	22
- Strongly Disagree	13	8	14	12	24
"There is less rain overall during the monsoon"					
- Strongly Agree	32	25	47	30	17
- Agree	21	27	18	22	16
- Disagree	18	19	10	19	36

⁸ While increased atmospheric CO2 might sometimes boost crop yields, most models predict a negative effect of climate change on yields (Rosegrant et al. 2025).

- Strongly Disagree	28	29	25	30	32
"I suffer more from droughts during the monsoon"					
- Strongly Agree	31	22	46	26	20
- Agree	19	24	17	14	13
- Disagree	20	25	9	27	26
- Strongly Disagree	31	29	27	33	42
"I suffer more from floods during the monsoon"					
- Strongly Agree	28	30	25	28	30
- Agree	19	26	11	20	26
- Disagree	15	18	14	17	9
- Strongly Disagree	37	26	50	35	34
"Rain is more irregular during the monsoon"					
- Strongly Agree	41	39	49	36	32
- Agree	22	25	17	23	26
- Disagree	11	12	10	14	9
- Strongly Disagree	26	24	25	26	33
"Crops suffer more from storms during the monsoon"					
- Strongly Agree	33	31	37	29	28
- Agree	20	24	14	27	15
- Disagree	13	15	13	13	10
- Strongly Disagree	34	30	35	31	47
"I suffer more from plant diseases during the monsoon"					
- Strongly Agree	34	34	39	30	32
- Agree	25	29	22	25	26
- Disagree	12	15	11	14	7
- Strongly Disagree	28	23	29	31	35
"The higher temperatures reduce yields during the monsoon"					
- Strongly Agree	24	28	16	26	31
- Agree	20	24	12	21	26
- Disagree	12	11	14	13	10
- Strongly Disagree	44	37	57	40	34
Climate Shock Index	5.2	5.5	5.2	5.1	4.6

Source: Authors' calculations based on the Myanmar Agricultural Performance Surveys

6. CLIMATE SHOCKS, CONFLICT AND THE ADOPTION OF CSA TECHNOLOGIES

Because of the multiple shocks in recent years, it is expected that farmers will adapt their use of agricultural technologies.⁹ In this section, we assess the reported adoption of various CSA technologies. We asked farmers about a range of practices typically considered part of the CSA technology package (e.g., Rukundo et al., 2024; Shaffril et al., 2024). These technologies are categorized into five domains: agricultural diversification, water and soil management, pest and disease control, risk management, and post-farm management. Descriptive results are presented in Table 6.

We observe a trend of increasing diversification over time. A minority of farmers reported cultivating short-duration and early maturing rice varieties (30 percent) as well as climate-resilient varieties (41 percent). There has also been a notable shift toward direct seeding as a substitute for traditional transplanting methods. Direct seeding is considered more climate-friendly due to its potential to significantly reduce methane emissions (Chaudhary et al., 2022). In terms of water management, 19 percent of farmers supplement irrigation using private pumps, while over one-third report having access to effective drainage systems. The use of organic fertilizers is widespread, with more than two-thirds of farmers applying them—typically in conjunction with chemical fertilizers. However, only 18 percent of farmers report using green manure. The application of effective microorganisms remains limited, and less than one-third of farmers retain crop residues in the soil. Tillage practices remain intensive, with farmers tilling the soil an average of 2.6 times before planting.¹⁰

Adoption of biological pest management is low, reported by only 22 percent of farmers. Similarly, uptake of crop insurance is minimal, with just 3 percent of farmers enrolled. A majority of farmers (60 percent) rely on modern weather forecasting tools, with adoption particularly high in the Delta region (73 percent). Mechanized harvesting and processing are increasingly recognized as climate-smart practices due to their potential to substantially reduce post-harvest losses (Castelein et al., 2022). Mechanization has expanded rapidly across Myanmar in the past decade (Belton et al., 2021), although its adoption remains uneven. The use of modern grain dryers, for instance, is still relatively limited (Table 6).

While there is a general upward trend in the adoption of most CSA technologies over time, the increases are however, relatively modest. Among the 13 CSA technologies examined, the average number adopted increased from 3.5 to 4 in the past three years compared to the previous three-year period. The largest gains are observed in the adoption of direct seeding (a 7-percentage-point increase) and organic fertilizer (an 8-percentage-point increase).¹¹ The highest adoption of CSA technologies is observed in the Delta agro-ecological zone—the most commercial agro-ecological zone in the country (Minten et al. 2024)—while the Hills and Coastal zones show the lowest levels of adoption.

We examine next the factors associated with changes and heterogeneity in the adoption of CSA technologies, using the panel data component of the survey and applying the Poisson panel regression framework described in the Appendix. We aggregate the technologies described in Table

⁹ Previous research has shown a large increase in the adoption of labor-saving agricultural technologies over time in Myanmar, but less so for farmers in conflict-affected areas (Minten et al., 2025).

¹⁰ Low-tillage agriculture is promoted as a CSA technology as it increased the ability of soil to store carbon while simultaneously enriching the soil (Paustion et al., 1995).

¹¹ It is possible that these changes may not be directly driven by climate or conflict shocks. Instead, they are likely associated with shifts in factor markets—specifically, sharp increases in the prices of chemical fertilizers – linked to the Ukraine-Russia war –and a tightening of labor markets following the coup, driven by significant internal and international migration (Minten et al., 2025).

6 in the 5 above-mentioned categories.¹² Conflict-affected farmers do not exhibit any significant changes in CSA adoption compared to more secure ones, suggesting that conflict has not influenced adoption rates (Table 7). Reported climate shocks by farmers are linked to higher adoption rates, as evidenced by the significant coefficient. We observe significant positive effects on the adoption of diversification strategies and CSA water management technologies from this shock index. However, effects are overall small. A one-unit increase in the shock index is associated with a 0.04 increase in the number of CSA technologies adopted, *ceteris paribus*.

We also see that there is notable heterogeneity in CSA adoption rates. Adoption rates by smallholders are significantly lower than those of medium and large farms, particularly in diversification, crop management, and post-farm management. More remote farmers within the township – those further away from the local town – show fewer changes in the number of CSA technologies adopted. Regional differences in CSA adoption paths are also significant. Farmers in the Delta exhibit significantly higher adoption rate changes compared to those in other regions, as shown by the significant negative coefficients for other agro-ecological zones. This regional disparity is especially pronounced in water, crop, and post-farm management, where farmers in the Delta are increasing CSA adoption rates more rapidly than their counterparts elsewhere in the country.

¹² The number of tillings and the use of crop residues were not considered in these dependent variables.

Table 6. Reported changes in the adoption of climate-smart agricultural (CSA) technologies, over the periods 2018-2020 and 2021-2023

Farmer Responses	Unit	National		Hills		Dry		Delta		Coastal	
		2018 - 2020	2021 - 2023	2018 - 2020	2021 - 2023	2018 - 2020	2021 - 2023	2018 - 2020	2021 - 2023	2018 - 2020	2021 - 2023
<u>Diversification</u>											
I plant short-term (early-maturing) varieties	%	26.5	30.1	19.1	21.1	29.5	35.4	43.9	44.7	14.9	19.6
I plant climate-resistant (heat- or flood-resistant) varieties	%	38.9	41.2	28.4	29.5	40.1	42.6	53.4	54.9	43.5	49.9
I do direct seeding instead of transplanting	%	51.3	58.7	48.2	55.6	53.8	63.4	57.6	61.4	44.4	50.6
<i>Index</i>	0-3	1.2	1.3	1.0	1.1	1.2	1.4	1.5	1.6	1.0	1.2
<u>Water Management</u>											
I irrigate extra with pumps and do not rely only on rain	%	15.0	19.4	14.7	16.9	14.5	20.7	21.8	24.0	7.9	16.7
I have good drainage system on my farm	%	29.4	35.1	23.9	30.2	23.8	29.5	47.3	51.2	34.9	41.0
<i>Index</i>	0-2	0.4	0.5	0.4	0.5	0.4	0.5	0.7	0.8	0.4	0.6
<u>Sustainable Soil Management</u>											
I use organic fertilizer (compost, manure)	%	61.8	69.9	59.5	68.5	76.3	85.7	43.1	44.1	54.0	66.00
I use green manure	%	17.0	17.7	19.9	20.5	19.3	19.0	9.4	11.6	13.5	15.2
I use effective micro-organisms (EM)	%	9.6	13.3	12.7	14.7	7.1	10.0	9.1	14.1	9.1	17.6
Use of Crop Residue after Harvest (Mostly)											
- Left in field, burned	%	30.1	31.7	32.8	33.5	20.6	21.9	46.4	50.0	27.1	29.3
- Left in field, retained in soil	%	39.1	37.5	42.5	41.9	35.4	33.4	32.4	28.7	48.9	48.6
- Removed, fed to livestock	%	24.4	24.5	17.2	17.2	37.3	37.8	18.1	17.8	17.5	17.0
- Removed, sold	%	2.9	3.0	5.2	5.2	2.3	2.4	1.6	1.6	0.2	0.7
- Removed, fuel or cooking	%	0.5	0.5	0.8	0.8	0.5	0.5	0.1	0.1	0.5	0.5
- Removed, other	%	3.0	2.8	1.5	1.5	4.0	4.1	1.6	1.8	5.9	3.8

Number of Tillings	Mean	2.5	2.6	1.7	1.7	3.3	3.6	2.9	3.0	2.1	2.1
<i>Index</i>	0-3	0.9	1.0	0.9	1.0	1.0	1.1	0.6	0.7	0.8	1.0
<u>Crop Pest – Disease Management</u>											
I use biological pest management	%	19.3	22.7	19.2	19.6	18.5	23.6	25.4	34.0	13.6	13.7
I use crop insurance	%	2.7	3.3	3.6	4.4	2.0	2.2	2.8	3.1	2.0	3.4
I rely on modern weather forecasting	%	55.2	60.5	48.2	51.4	55.9	62.7	67.4	73.1	54.9	61.3
<i>Index</i>	0-3	0.8	0.9	0.7	0.8	0.8	0.9	1.0	1.1	0.7	0.8
<u>Harvest and Post-farm Management</u>											
I use combine harvesters	%	23.6	29.2	17.9	19.9	14.6	20.2	49.4	60.7	28.3	35.2
My crops are dried using modern driers	%	2.9	3.3	3.4	4.2	1.3	1.4	4.5	4.6	4.0	4.0
<i>Index</i>	0-2	0.3	0.3	0.2	0.2	0.2	0.2	0.5	0.7	0.3	0.4
<i>Index all</i>	0-13	3.5	4.0	3.2	3.6	3.6	4.2	4.3	4.8	3.3	3.9

Source: Authors' calculations based on the Myanmar Agricultural Performance Surveys

Table 7. Associates of changes in climate-smart agricultural (CSA) technologies (Marginal effects Poisson regressions)

Variables	Unit	(1) Diversification	(2) Waste Management	(3) Soil Management	(4) Crop Management	(5) Post-farm Management	(6) Combined
Period 2	0/1	-0.270 (0.170)	0.190* (0.108)	-0.448** (0.178)	0.019 (0.132)	0.321*** (0.081)	-0.005 (0.365)
Number of violent events	log(Num. + 1)	0.013 (0.024)	0.010 (0.015)	0.019 (0.028)	0.000 (0.024)	0.001 (0.015)	0.040 (0.052)
Period 2 * climate shock index	0/1	0.027** (0.012)	0.020** (0.007)	0.001 (0.008)	-0.002 (0.007)	-0.003 (0.006)	0.042* (0.024)
Period 2 * large farm	0/1	0.421*** (0.074)	-0.001 (0.063)	0.132** (0.059)	0.193*** (0.048)	0.122*** (0.045)	0.880*** (0.157)
Period 2 * medium farm	0/1	0.137 (0.085)	0.076 (0.054)	0.084 (0.058)	0.116** (0.048)	0.140*** (0.045)	0.569*** (0.171)
Period 2 * remoteness city 50K people	0/1	-0.045 (0.078)	0.075 (0.048)	-0.078 (0.070)	-0.131*** (0.045)	0.033 (0.043)	-0.162 (0.162)
Period 2 * remoteness border	0/1	0.043 (0.075)	-0.142** (0.061)	0.168*** (0.062)	0.089 (0.066)	-0.149*** (0.052)	0.024 (0.172)
Period 2 * remoteness center township	0/1	-0.086 (0.058)	-0.111** (0.047)	-0.067 (0.054)	-0.048 (0.041)	-0.114*** (0.037)	-0.419*** (0.123)
Period 2 * rural	0/1	0.238** (0.117)	0.030 (0.069)	0.068 (0.087)	0.152** (0.068)	0.043 (0.052)	0.506** (0.227)
Period 2 * Dry Zone	0/1	-0.099 (0.093)	-0.295*** (0.067)	0.424*** (0.109)	-0.162*** (0.052)	-0.395*** (0.055)	-0.608*** (0.197)
Period 2 * Hills	0/1	-0.499*** (0.109)	-0.258*** (0.074)	0.369*** (0.130)	-0.193** (0.082)	-0.385*** (0.066)	-1.058*** (0.253)
Period 2 * Coastal	0/1	-0.074 (0.099)	-0.325*** (0.083)	0.248* (0.128)	-0.191** (0.092)	-0.200*** (0.053)	-0.651*** (0.248)
Observations		2,052	2,052	2,052	2,052	2,052	2,052
Pseudo R2		0.01420	0.0166	0.0090	0.0078	0.0448	0.0146

Source: Authors' calculations based on the Myanmar Agricultural Performance Survey.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

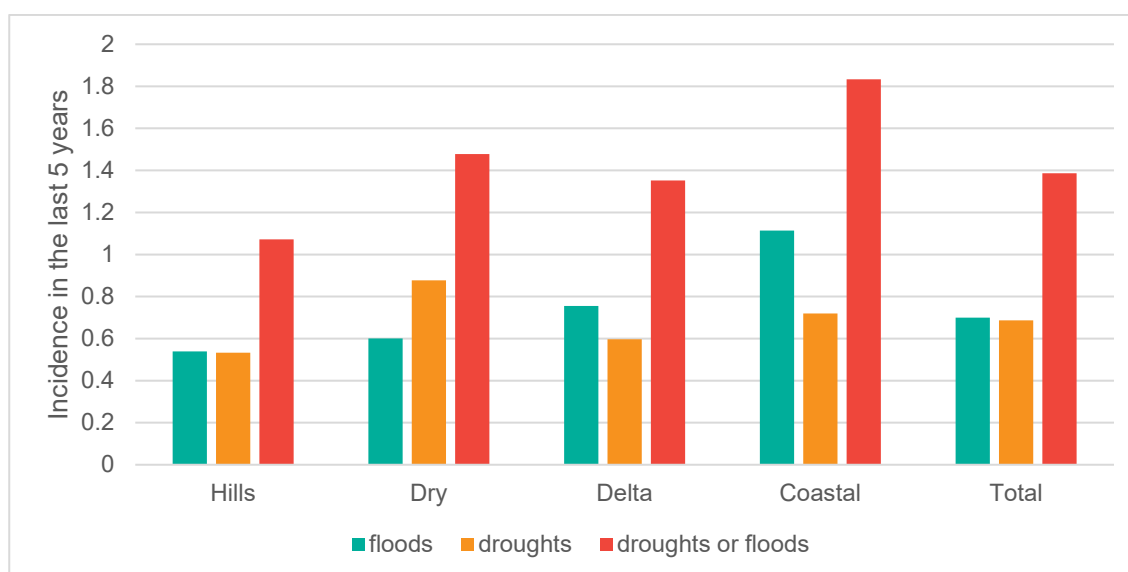
7. CLIMATE SHOCKS, CONFLICT, AND AGRICULTURAL LAND VALUATION

Hedonic land valuation is regarded as a reliable method for assigning value to amenities that are not directly traded in markets, such as weather-related and conflict risks (Mendelsohn and Olmstead, 2009). This approach enables us to assess how these factors are reflected in the value of agricultural land resources in Myanmar. Similar methods have been used to evaluate the impacts of climate change and conflict in other settings (e.g., Bernstein et al., 2019; Mendelsohn and Olmstead, 2009; Lynch and Rasmussen, 2001).

For this analysis, we focus on farmers' largest rice plot as we collected detailed information on this plot in our 2024 survey. Descriptive statistics on this plot are presented in Table 8. We use data from two survey rounds covering 2,303 plots, resulting in a total of 4,606 observations. The median value of agricultural land is 5 million Kyat per acre—approximately 2,400 USD, at the official exchange rate. Most rice plots are in lowland areas and are not artificially irrigated (e.g., via dams or water pumps). Two-thirds of the plots can be cultivated twice per year. We also include agro-ecological zones as an indicator of the land's agricultural suitability. To measure conflict, we use the total number of violent events recorded by ACLED in each township during the survey years, as well as in preceding years.

We asked farmers how often their plot had been affected by hydroclimatic extremes—a flood or drought—over the past five years, using this as our measure of climate risk. National and agro-ecological zone averages are presented in Figure 7. Overall, the data reveal a high level of climate risk for rice farmers in Myanmar. On average, a plot was affected 1.4 times by a flood or drought over a five-year period. At the national level, floods and droughts were equally common, each affecting plots an average of 0.7 times. Figure 7 also highlights significant spatial variation in climate risks: floods were more frequently reported in the Delta and Coastal agro-ecological zone, while droughts were more common in the Dry Zone. The Coastal agro-ecological zone shows the highest overall climatic risk, whereas the Hills experienced the lowest.

Figure 7. Annual incidence of floods and droughts on rice plots of farmers



Source: Authors' calculations based on the Myanmar Agricultural Performance Survey.

We adopt a stepwise regression approach, beginning with a parsimonious specification that includes only the two primary variables of interest: conflict exposure and climate risk. We then extend

the model to incorporate a broader set of controls, including plot-level characteristics and location-specific variables.¹³ Across both specifications, we find that exposure to climatic risks is significantly associated with lower reported land values (Table 8). Specifically, each additional drought experienced over a five-year period is associated with a 13 percent reduction in land value in the simple model, and an 8 percent reduction in the more fully specified model. In contrast, the association between flood incidence and land value is weaker, with reported values declining by approximately 4 percent in both specifications—substantially less than the effect observed for droughts. It has been shown that losses due to droughts are usually larger than those caused by floods in other settings, possibly explaining this higher association here as well (Elagib et al., 2023).

We observe a significant increase in reported land values over the two survey years, averaging 21 percent (Table 8), reflecting the high inflationary environment in the country during this period (World Bank, 2025). While contemporaneous increases in insecurity are not significantly associated with changes in land values, we find that lagged exposure to violent events is negatively correlated with current land values. Specifically, a doubling of the number of violent events during the three years preceding the 2021 coup (i.e., 2018–2020) is associated with a 9 percent reduction in land value, *ceteris paribus*. Similarly, a doubling of violent incidents in the year immediately prior to the survey is associated with a statistically significant 1 percent decline. These results suggest that the effects of conflict on agricultural land markets may materialize gradually, as conflict risks are only internalized over time in these land markets.

Reported agricultural land values are generally aligned with theoretical expectations across a range of other indicators. Land that is less steep, has higher soil quality, or is formally certified has significantly higher values. Plots that can be cultivated multiple times per year are also more valued: land suitable for double and triple cropping is associated with 25 and 48 percent higher values, respectively, compared to single-crop land. Higher population pressure in townships is associated with higher land values. As predicted by the von Thünen model (von Thünen, 1966), location plays an important role in land valuation. Land situated farther from the farm, the township center, and international borders is valued significantly less. Increased distances to cities of at least 50,000 people are associated with lower values as well, but the coefficient is not significant at conventional statistical levels.

¹³ For both specifications, we run a Mundlak test – reported at the bottom of the table – which assesses if time-averaged regressors are jointly significant. The H_0 is rejected, suggesting that regressors are correlated with the individual effects, and that the CRE model with the time averages included is appropriate.

Table 8. Hedonic price regressions of agricultural land – results correlated random effect regressions

Variables	Unit	Mean	Median	St.Dev	Unit	(1)	(2)
Agricultural land price (100,000 MMK per acres)	Number	69.58	50.00	75.99			
<u>Climate variables</u>							
Flood risk (number of times in last 5 years)	Number	0.68	0.00	1.08	log(Num.+1)	-0.041** (0.017)	-0.040** (0.016)
Drought risk (number of droughts in last 5 years)	Number	0.70	0.00	1.07	log(Num.+1)	-0.130*** (0.018)	-0.082*** (0.017)
<u>Conflict</u>							
Number of violent conflicts in township	Number	32.69	10.00	47.14	log(Num.+1)	-0.001 (0.006)	-0.001 (0.006)
Number of violent conflicts in township (lag 1 year)	Number	28.41	11.00	41.57	log(Num.+1)	-0.013* (0.007)	-0.014* (0.007)
Number of violent conflicts in township before coup (2018 – 2020)	Number	4.15	0.00	21.13	log(Num.+1)	-0.141*** (0.028)	-0.086*** (0.026)
<u>Characteristics plot (default = lowland plot)</u>							
Upland steeply sloped	0/1	0.006			0/1		-0.596** (0.285)
Upland slightly sloped	0/1	0.018			0/1		0.118 (0.147)
Upland flat	0/1	0.046			0/1		-0.043 (0.086)
Deepwater	0/1	0.015			0/1		0.019 (0.135)
Irrigated	0/1	0.402			0/1		-0.026 (0.029)
Perceived soil quality (fair/poor versus good)	0/1	0.719			0/1		-0.112*** (0.037)
Land certificate	0/1	0.901			0/1		0.198*** (0.062)
<u>Number of times farmer can cultivate over the year (default==1)</u>							
2 times	0/1				0/1		0.274*** (0.047)

3 times	0/1				0/1	0.509*** (0.062)	
Remoteness							
Travel time plot to farm (minutes)	Number	19.4	15.0	16.3	0/1	-0.152*** (0.035)	
Travel time farm to center township (minutes)	Number	50.5	30.0	81.7	0/1	-0.110*** (0.034)	
Travel time farm to city of 50,000 people (minutes)	Number	168.3	137.9	117.3		-0.053 (0.041)	
Travel time farm to international border (minutes)	Number	426.1	426.2	151.6	0/1	-0.113** (0.047)	
Population density (people per 2KM)	Number	140.1	140.1	1501.0	log(number)	0.179*** (0.035)	
Agri-ecological zones (default = Delta)							
Hills	0/1	0.162			0/1	0.343*** (0.066)	0.521*** (0.079)
Dry	0/1	0.386			0/1	0.473*** (0.047)	0.466*** (0.059)
Coastal	0/1	0.065			0/1	0.023 (0.091)	0.152 (0.096)
Year = 2023	0/1	0.500			0/1	0.206*** (0.007)	0.206*** (0.007)
Constant					0/1	3.490*** (0.079)	2.430*** (0.218)
Time-averages included						Yes	Yes
Observations						4,431	4,421
Number of groups						2,329	2,324
R-squared						0.158	0.249
Mundlak test – prob > chi2=0						0.0000	0.0000

Source: Authors' calculations based on the Myanmar Agricultural Performance Surveys
Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

8. CONCLUSION

Increasing conflict and climate change are two major global challenges with profound implications for agricultural performance and, consequently, food security. This study presents evidence from Myanmar, a country acutely affected by both phenomena. In 2024, Myanmar ranked second on the Global Conflict Index, with widespread impacts of conflict on rural livelihoods. Our data show that almost one-quarter of farmers reported fear of traveling due to security concerns, directly affecting agricultural activities. Concurrently, Myanmar is highly vulnerable to climate change, ranking fourth globally on the Climate Risk Index in terms of exposure to extreme weather events (Adil et al., 2025). Since 1980, the country has experienced a 1°C increase in average temperature and a 5 percent decline in annual precipitation.

Using unique, large-scale, and recent farm-level data, we find widespread awareness among farmers of climate change impacts, with many respondents reporting noticeable changes in weather patterns over the past six years. Farmers consistently report growing weather unpredictability and a rise in pest outbreaks. Importantly, these perceptions and experiences vary significantly across agro-ecological zones. Despite this awareness, adoption rates of climate-smart agricultural (CSA) practices changed little, particularly among smallholders and remote households. Our analysis also reveals strong correlations between climate-related risks and agricultural land valuation, suggesting more severe impacts in those areas affected by these increased risks. We also find that conflicts lead to lower land values, but with a lagged effect. Myanmar is characterized by a diverse range of agro-ecological zones. These zones experience different patterns of weather-related changes: increasing drought frequency is more commonly reported in the drier regions, while heightened flood incidences are more prevalent in wetter zones.

Our findings indicate that agriculture in areas affected by conflict and climate change faces significant constraints, with several important implications. First, the promotion of appropriate agricultural technologies in conflict- and climate risk-affected areas requires targeted attention, given the heightened vulnerability of livelihoods in these contexts. Second, the substantial heterogeneity in perceived climate risks across agro-ecological zones underscores the need for differentiated strategies in the promotion of climate-smart agriculture (CSA) and agricultural extension services. Third, particular focus should be placed on remote households and smallholders, who exhibit markedly lower capacity for coping and adaptation, and are therefore more exposed to adverse impacts.

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