The Compounded Impact of Climate Change and Armed Conflict on the Agri-food Sector in Northwest Syria

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List of Abbreviations

ACU	Assistance Coordination Unit
AEZ	Agro-Ecological Zone
CA-SYR	Crisis Analysis Syria
CFW	Cash for Work
FAO	Food and Agriculture Organization of the United Nations
FSL	Food Security and Livelihoods Cluster
GBV	Gender-Based Violence
GDP	Gross Domestic Product
HNO	Humanitarian Needs Overview
HOBOOB	General Establishment for Cereal Processing and Trade
IDP	Internally Displaced Person
IED	Improvised Explosive Device
IEP	Institute for Economics and Peace
IOM	International Organization for Migration
IMF	International Monetary Fund
iMMAP	Information Management and Mine Action Programs
INGO	International Non-Governmental Organization
IPCC	Intergovernmental Panel on Climate Change
KII	Key Informant Interview
NDMI	Normalized Difference Moisture Index
NDVI	Normalized Difference Vegetation Index
NGO	Non-Governmental Organization
NWS	Northwest Syria
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
SDF	Syrian Democratic Forces
SPEI	Standardized Precipitation Evapotranspiration Index
SPEG	Syrian Public Establishment for Grain
SME	Small and Medium-Sized Enterprise
TRY	Turkish Lira
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
USD	United States Dollar
UXO	Unexploded Ordnance
WFP	World Food Programme
WMO	World Meteorological Organization

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Executive Summary

Agriculture has long been both an economic backbone and cultural anchor of rural livelihoods and a cornerstone of food security in Syria. The past decade of armed conflict, compounded by accelerating climate change, has resulted in the collapse of the agri-food system and devastated the lives of those who depend on it. This study addresses a critical evidence gap by documenting how climate change and conflict interact as threat multipliers, setting off causal chains that explain the failure of Syria's major value chains, particularly wheat, olives, and livestock.

The value of this research is twofold, First, through extensive community engagement in Northwest Syria (NWS), it captures the lived experiences and priorities of farming and herding communities, voices that remain largely absent from existing humanitarian and development planning and funding models. Second, by tracing the evolution of Syria's agri-food challenges before, during, and after the armed conflict, the analysis shows that many vulnerabilities that preceded the armed conflict, such as poor natural resource management, fragile governance, and inequitable policies, have been intensified by both violence and climate pressures over this period. Recognizing these historical patterns of failure and resilience is essential to chart credible recovery pathways. At this moment in Syria's uncertain transition, generating evidence on how climate and conflict converge is indispensable for shaping meaningful interventions, ones that can rebuild a more inclusive, climate-resilient, and sustainable agri-food sector.

This participatory research shows how climate shocks including droughts, erratic rainfall, frosts, and pest outbreaks, directly undermine agricultural yields, livestock productivity, and the sustainability of natural resources. These stresses are then magnified by conflict factors: the destruction of irrigation and veterinary systems, restricted access to land, loss of skilled labour through displacement, and rising input costs driven by sanctions, border closures, and currency depreciation. Together, these compounded effects have devastated the sector. An estimated that 1.5 million olive trees were lost across Northwest Syria since 2011 (iMAAP, 2023); livestock herders report their herds are on average less than a third of their pre-conflict size; and the deficit in wheat production in 2025 was an estimated 2.73 million metric tons, enough to feed 16.25 million people (FAO, 2025). This has wide ranging consequences. Smaller herds and harvests reduce local supply; fractured markets limit distribution; and weakened purchasing power erodes household resilience, leaving communities more exposed to future shocks.

This crisis is also profoundly gendered. With the death, displacement, or migration of men, women shouldered a much greater share of agricultural and livestock work, managing land, herding, harvesting, and processing. However, this expanded role has not translated into empowerment as women remain excluded from markets, credit, and extension services, reinforcing wage gaps and structural inequality. For example, 72% of women in the olive sector report having assumed more responsibilities yet face a 20-50% wage gap with respect to their male counterparts and no representation in farmers' associations. This dual reality of greater responsibilities but fewer opportunities is one of the most striking outcomes of the compounded crisis.

1. Communities identify climate as an urgent and long-term threat, while donors and non-governmental organisations (NGOs) often focus on immediate humanitarian needs, farmers and herders repeatedly emphasised that droughts, shifting rainfall, and heatwaves pose the gravest risks to their survival. They also showed a range of responses, from water management to crop diversification, often anticipating solutions more readily than external actors.

2. Despite the compounded damage of armed conflict and climate shocks, pathways of resilience are emerging. Communities are not passive, and many are adapting practices, reorganising production, and relying on local networks. A striking example is the increased role of women in agricultural and livestock sectors. Although women face systemic exclusion from land, markets, credit, and decision-making, their assumption of greater responsibility in production and household survival positions them as critical agents of recovery. With targeted support in accessing finance, training, market access, and inclusion in governance structures, women can move from coping on the margins to leading resilience-building efforts.

These findings inform a set recommendations that that are sequenced to match the realities of compounding risks:

- **Short-term humanitarian priorities:** ensuring access to feed, seed, water, and vaccination support, to stabilize livelihoods.
- **Medium-term recovery:** restoring veterinary and extension systems, strengthening cooperatives, and supporting women-led agribusiness to rebuild productive capacity.
- **Long-term adaptation:** investing in renewable energy, certified seed systems, drought preparedness, and climate-smart agriculture to address structural vulnerability.

This report does not offer a full action plan but provides a grounded starting point. Rooted in local realities and community voices, it highlights how conflict and climate interact and identifies practical entry points for recovery and resilience in Syria's agri-food sector.

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Taken by Violet Media Team
Idleb Syria - OCT 2025

Chapter I: Introduction

With the growing recognition of climate change as a global threat multiplier, this paper investigates the intersecting impacts of climate change and protracted armed conflict on agricultural and livestock systems in NWS. Drawing on existing analysis of the Syrian context and beyond, and primary data collected in NWS, this paper examines how climate shocks and prolonged security challenges have jointly deepened food insecurity and disrupted livelihoods. This paper investigates three value chain case studies to build an understanding of how people from different backgrounds, roles, gender, and age differences are affected at multiple levels. Through this analysis, this study seeks to unpack the perceptions of those affected by climate risks and conflict legacies. It also explores the successes, failures and inefficiencies of previous interventions. This evidence will help identify existing opportunities and potential new interventions that can sustainably mitigate these compounded threats and build resilient communities in NWS.

A. Conflict, climate change, and compounding risks

The effects of climate change, including the global rise in temperatures, changing precipitation patterns, and increasingly frequent extreme weather events, pose critical threats to natural ecosystems and human security globally. The Intergovernmental Panel on Climate Change (IPCC) 2023 assessment report warns of catastrophic consequences if the threshold of a 1.5°C increase above pre-industrial levels is surpassed, making between 3.3 to 3.6 billion people highly vulnerable to increasing weather and climate extreme events globally (Calvin et al., 2023). Millions already face acute food and water insecurity, extreme heat events have increased mortality and morbidity worldwide, and global gross domestic product (GDP) is projected to decline by 10–23% by the end of the century, largely due to reduced agricultural yields, damage to infrastructure, and rising commodity prices (UN Climate Summit, 2023).

While climate threats put to the local communities around the world at different types of risks threating lives, income, or food insecurity, these climate impacts affect fragile states and vulnerable populations the hardest (Crawford et al., 2023). This is particularly true in conflict-affected areas where conflict and climate change are significant drivers of food insecurity (Food Security Information Network, 2024). According to the United Nations High Commissioner for Refugees (UNHCR), nearly half of all forcibly displaced people globally are facing the combined threats of climate change and conflict, with a quarter of all climate-induced displacements globally occurring in fragile and conflict settings (Aloui et al., 2024). These displacements are often triggered by recurrent drought cycles, water shortages, and shrinking access to arable land, which not only erodes livelihoods but also fuels tensions and competition over scarce natural resources (Ibid). Evidence shows a direct relationship between the increased severity of climate impacts and the intensification of violent conflict, through worsening food insecurity, economic decline, competition over scarce natural resources, and widespread displacement (Adaptation Fund, 2024). However, existing evidence indicates that climate-related security risks are highly context-dependent, with multiple pathways through which climate change can shape the onset and dynamics of armed conflict (Kim & Garcia, 2023). The Stockholm International Peace Research Institute identifies the following four key pathways through which climate change can increase the risk of violent conflict:

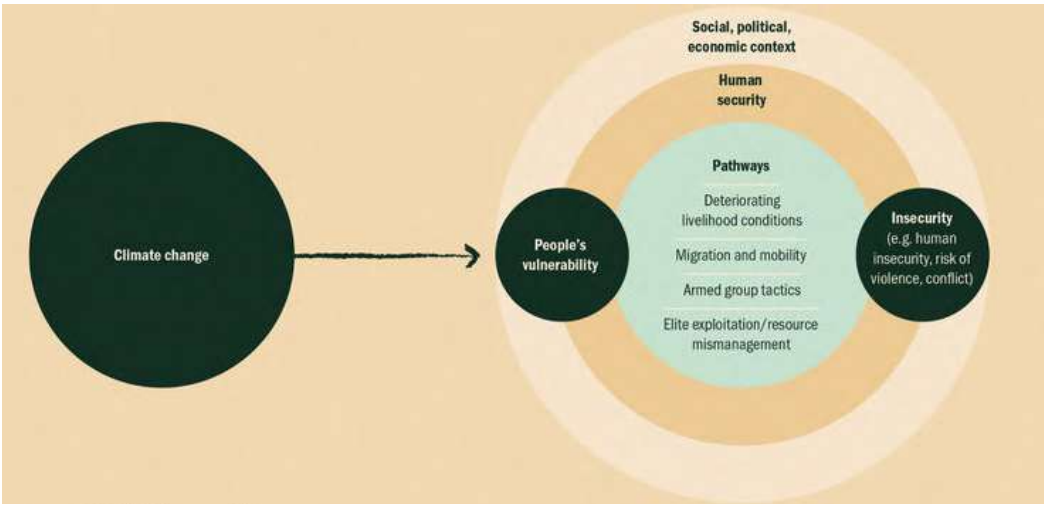
i. Livelihood deterioration: Climate shocks can negatively impact livelihoods, especially in sectors vulnerable to climate stressors, such as the agriculture and livestock sectors. This can lead to food insecurity, economic stress, and other potential ignitions of conflict.

ii. Migration and mobility: Climate stress can displace populations or disrupt traditional migration routes, which may provoke tensions or ignite disputes over land and resources in host communities.

iii. Armed group tactics: Climate change can shape armed groups' strategies and actions in several ways: (1) by prompting them to adopt coping mechanisms that enhance their access to food, (2) by exploiting the hardships caused by climate impacts to attract new recruits, and (3) by adjusting their tactics to take advantage of emerging opportunities created by environmental stress.

iv. Elite exploitation: Political and economic elites may manipulate climate vulnerabilities through land grabs or unfair resource distribution, which in turn fuels exiting grievances and risks escalating tensions.

The following diagram *(Figure 1 – Climate change and risk,(de Coning et al.,2022))* illustrates how climate change acts as a stressor that amplifies people's existing vulnerabilities, rather than directly causing insecurity. These vulnerabilities, embedded within broader political, economic, and social contexts, can escalate into insecurity or conflict, particularly where governance is weak and inequality entrenched.



As these pressures accumulate, they increase the risk of human insecurity and conflict. While the IPCC highlights the interconnected nature of conflict and climate change adaptation, emphasising the critical importance of concerted adaptation efforts, climate adaptation action is often undermined by conflict and fragility (Goodman & Baudu, 2023). Alongside exacerbating existing fragility, weakening social cohesion, and damaging livelihoods, conflict deflects governments and organisations' focus away from development, including climate adaptation, toward more immediate security and humanitarian concerns. Additionally, fragile and conflict-affected countries also receive considerably lower financial support for adaptation efforts, even compared to other low-income countries (Jones et al., 2024).

Consequently, those most at risk from climate change are often the least able to implement adaptation measures. As such, applying a threat multiplier lens in this study helps to explore the interconnected nature of conflict and climate threats in exacerbating insecurity and thus exposes the need for integrated, cross-sectoral responses that bridge humanitarian aid, climate adaptation, and economic recovery. Recognising climate change as a multiplier helps avoid siloed interventions and instead supports locally grounded, flexible strategies that address the interlinked drivers of fragility and strengthen resilience.

B. Climate and Conflict Intersection in the Middle East

According to the International Monetary Fund (IMF), the Middle East and Central Asia have experienced an average annual temperature rise more than double the global average (Duenwald et al., 2022). Climate induced extreme weather events in the Middle East, such as flash floods, cyclones, and landslides, have also become more frequent and severe over the past two decades, affecting over seven million people annually and causing an estimated USD 2 billion in direct material damage each year since 2000 (ibid). Climate change alone risks eroding rural livelihoods, accelerating migration from rural to urban areas, and deepening socio-political divides between migrants and host communities, but in many countries, climate induced risks are compounded by armed conflicts, leading to further deterioration (Rüttinger et al., 2015).

In 2024, the Institute for Economics & Peace ranked the Middle East and North Africa the least peaceful region in the world for the ninth consecutive year (IEP, 2024a), and within this region, countries face these compounded risks at different stages. Yemen and Palestine face active conflicts, Iraq is navigating a fragile recovery, while Egypt, Jordan, and Lebanon grapple with tensions between refugee and host communities (Global Peace Index, 2024). Despite differences between contexts, climate change is the common thread that intensifies vulnerabilities across contexts. Water scarcity, recurrent droughts, repeated displacement, economic fragility, and weakened agricultural systems jointly undermine human security, and women in particular bear a disproportionate burden, as will be unpacked later. For instance, armed groups such as ISIS have exploited agricultural collapse and strategically targeted and controlled water infrastructure, as seen in the Tigris and Euphrates Basin, to influence food production, manipulate irrigation flows, and, in some cases, flood cropland as a tactic of territorial control (Von Lossow, 2016).

These global and regional dynamics manifest distinctively in fragile states, where institutional capacity to adapt is weakest. Syria exemplifies this intersection: more than a decade of conflict has dismantled governance structures, eroded livelihoods, and left communities acutely exposed to and unable to adapt to the accelerating impacts of climate change. See Annex 1 for a timeline of major climate events mapped against conflict events between 2010-2024.

C. Climate and conflict intersection in Syria

Since 2011, the civil uprising in Syria has evolved into a protracted humanitarian crisis, with the number of people in need of humanitarian assistance rising from over 1 million in 2012 to an estimated 16.7 million by 2024 (UN, 2012). Beyond the immeasurable human suffering incurred by the conflict, the country has also faced extreme economic decline as Syria's GDP fell by 85% between 2010 and 2020, from $252 billion to $8.9 billion (IEP, 2024b). This was due to the destruction of infrastructure and productive capacity, displacement and loss of labour, external sanctions and isolation of the Syrian market as that severely restricted agricultural imports and financial transactions, with estimates suggesting that over 60% of fertilizer and pesticide imports were disrupted contributing to an average of 70% increase in input prices between 2018 and 2023 (FAO, 2024) topped up by the collapse of the Syrian pound. Alongside these nation-wide effects, areas outside of regime control like NWS experienced heavier bombardment, blockades and sieges, the absence of institutions in critical sectors like agriculture, and fragmented governance and taxation by armed groups, in addition to the cross-border dynamics with Türkiye and the UN security council resolutions politicization by Russia, China, and the US leading to an instability with both humanitarian and commercial supplies (UNDP, 2025a).

Rural populations in these areas were disproportionately affected due to the disruption of their livelihoods, with farming and herding directly targeted or disrupted, as will be unpacked later, while urban economies could at least rely on more diversified income sources like trade and services (ibid). This increased NWS' reliance on humanitarian aid and weakened communities' resilience. Long before the armed conflict, climate change had been threatening Syria's human and environmental security, creating significant instability and inequality. This was exacerbated by many poor governance decisions, such as unsustainable groundwater extraction policies and subsidies that encouraged water-intensive crops like cotton during prolonged droughts. This, alongside a historic lack of adaptation efforts, compounded vulnerabilities and left rural livelihoods in NWS exposed.

During the armed conflict, a deadly mixture of limited aid access[1] (Beals, 2023a), short term interventions to meet basic needs, damaged infrastructure, and worsening climate conditions represented by recurrent droughts, erratic rainfall, and heatwaves, cumulatively worsened food system fragility through widespread crop failures, degraded rangelands, and soaring expenses of inputs (Adaptation Fund, 2024). Historically a regional breadbasket and hub for agriculture trade, Syria's agriculture and livestock sector have been weakened to its core, as visible in declining food security, loss of livelihoods, and cultural heritage, shaking the social structures of rural communities (Al-Attar, 2024). These trends have intensified since the 2007–2009 drought and escalated further after 2011 with the conflict, with the Food and Agriculture Organisation (FAO) and World Food Programme (WFP) reporting a sharp decline in cultivated land and livestock herds over the past decade (FAO, 2017). Furthermore, efforts to adapt to these climate shocks proved extremely difficult due to the collapse of institutions, an absence of coordinated strategies, and the loss of climate adaptation knowledge due to significant brain drain of qualified professionals during the conflict (Adaptation Fund, 2024).

Despite the significance of the degradation of this sector on the economy, livelihoods, and cultural heritage of Syria, a comprehensive and multi-dimensional investigation of the effects of climate and conflict stressors on the sector is missing. This study seeks to fill this gap, attempting to not only assess the state of play of this sector after 14 years of conflict and increasing climate threats, but also explore the lived experiences and perceptions of its people. The scope and significance of this research also evolved in response to the change in context: the fall of the Assad regime in December 2024 fundamentally transformed the context and introduced both opportunities and challenges when looking into the future, and in turn shifted this paper's conclusions and recommendations.

The following section outlines the methodology used to assess the compounding impacts of conflict and climate on the sector up until December 2024, as well as opportunities and challenges for the future.

D. Methodology:

This research seeks to answer the following question: What are the different stakeholders' understanding of climate change-induced risks and armed conflict-induced shocks and stressors, their evolution over time, and their compounding impact on the agriculture sector in NWS?

To answer the research question, this study investigated:

- The impacts of the armed conflict on agriculture and livestock sectors in NWS.
- How the climate change-induced crisis has exacerbated challenges in agriculture and livestock sectors and how this has affected food security and livelihoods.
- How existing understandings of the context explain success, failures and inefficiencies in the approaches of donors and intervening organisations.
- What were the different lived experiences of agriculture and livestock actors amidst these compounded threats.
- What measures people tried themselves to mitigate some of these threats.
- What interventions, and opportunities exist within the context, to mitigate the impact of shocks and build resilience, and what are the necessary conditions for their implementation.

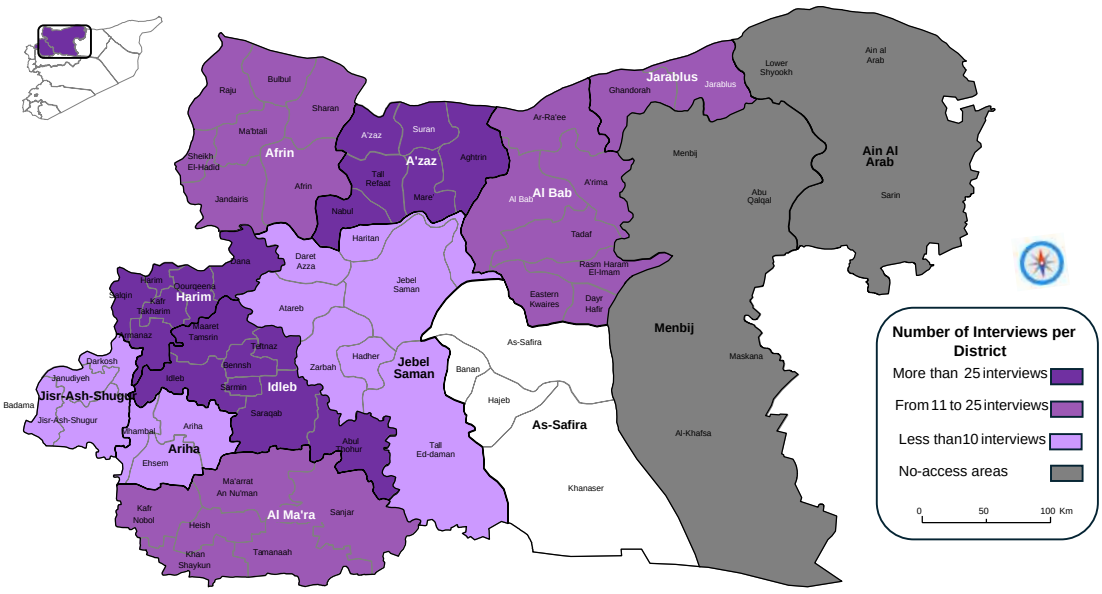
[1] This was due to the Syrian regime's control over major aid crossings between Türkiye and NWS and politicization at the UN security council which prohibited the overriding of this policy despite the urgent need for unrestricted humanitarian access (Beals, 2023b),

Uniquely, this research sought to investigate the intersecting and compounded effects of climate change and armed conflict, areas that had previously only been studied separately, if at all, in this context. Additionally, the research collected extensive primary data by employing a locally grounded participatory approach, centring the knowledge and agency of communities. In addition to employing local men and women to the community level data collection team, all data collection tools were co-developed with a team of local technical specialists to ensure relevance, nuance, and clarity, and refined throughout data collection through an adaptive learning process. Given that most recent studies on Syria were conducted based off projections, sparce existing data, and by research teams outside Syria, the data collected uniquely reflects communities' articulation and analysis of their lived realities, as well as allow them to identify priorities and develop context-specific plans of action. Additionally, recommendations and insights gathered during interviews were consolidated and validated to ensure they reflected local priorities with ensuring cultural sensitivities. Primary data was triangulated with literature and secondary sources to validate existing findings, substantiate and nuance existing knowledge, explore contradictions and gaps, and identify avenues for further study.

Due to the scarcity of existing data and methodological touchstones for such an investigation, an adaptive learning approach was taken to accommodate unforeseen factors, such as respondents' awareness as will be discussed later, as well as a rapidly changing context. This meant that tools were revised and developed iteratively, and, in this process, further insights emerged. Additionally, a conflict sensitive lens was applied throughout the research:

- Tool design and data collection: understanding conflict actors' dynamics (actors, power relations, divisions, grievances, alliances) and its effect on sampling, enumerator selection, and question design, as well as anticipating risks to respondents and researchers and ensuring do-no-harm safeguards.
- Data analysis: interrogating biases, dangers, and motivations of respondents and secondary data, especially in the recent post-conflict context of instability and unique potential to set new agendas.
- Reporting and dissemination: conducting consultations with experts and local communities to ensure findings are accurate and recommendations are relevant and feasible. Presenting diverse perspectives, not only those of the most powerful or accessible voices and ensuring that informants' insights are reported anonymously.

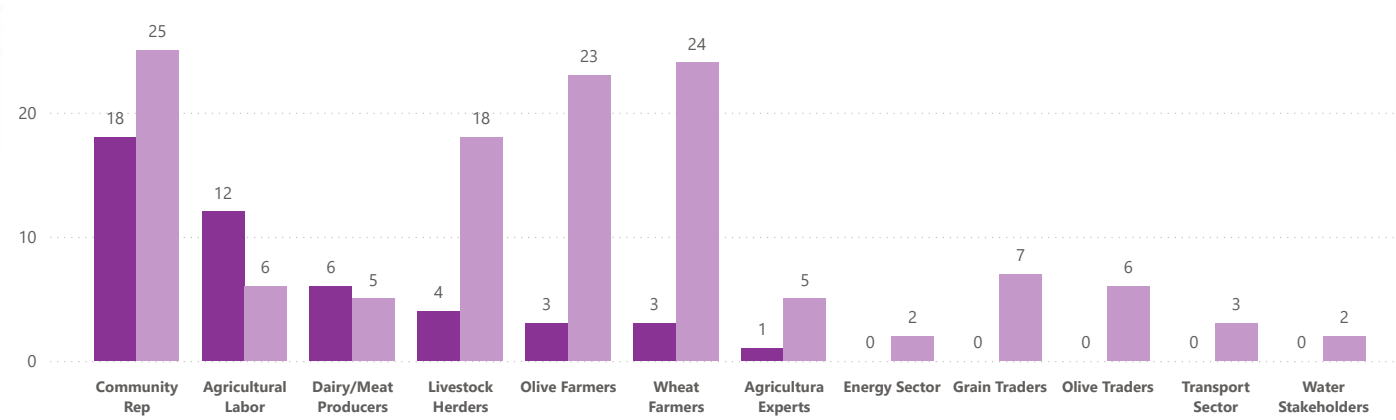
The next map *(Figure 2 – Interviews Mapping)* shows the covered districts in Aleppo and Idlib governorates. Guided by local agriculture and livestock specialists, districts were selected to capture the diversity of the sectors and surveys were distributed to reflect both the geographic coverage and the sectoral relevance.



Household Surveys (HHS):

Structured surveys were carried out using electronic data collection tools and allowed respondents to discuss the observed impact, capture adaptive practices and resilience mechanisms, and collect community-sourced recommendations. The survey tools were originally designed in English then translated into Arabic and enumerators received extensive training in the subject area to ensure their ability to clarify questions, as well as training on ethics and gender-sensitive engagement given the cultural barriers in NWS.

The following chart *(Figure 3 – Surveys breakdown)* reports the breakdown of the conduct surveys per background:



This diversity of survey respondents was another unique aspect of this study, as it aims to give a holistic, sector-wide local perspective. Survey design followed an adaptive learning approach to adjust to contextual factors revealed from the data collection process: for example initial tools assumed farmer awareness of climate terminology, and thus revised tools used experiential questions ('How has rainfall changed?') after discovering knowledge gaps. Surveys included both open and close ended questions with general questions to be compared between all respondents and questions specific to their value chain and profession to be compared between regions and identify variations between groups (gender, displacement status, etc). Once collected and cleaned, surveys between and within respondent background types were compared. A preliminary codebook was developed based on the research questions, literature review, and consultation with the expert panel, but as coding was performed iteratively, codes refined as analysis progressed, allowing systematic identification of recurring narratives and policy-relevant insights across surveys.

Key Information Interviews (KIIs)

Semi-structured KIIs were conducted in Arabic and English with technical experts, local stakeholders, and humanitarian professionals, to ensure technical and practitioner insights. At the local level, respondents included local authorities, community-based organizations, teachers, and mayors.[2] At the national and international level, they included cluster coordinators, NGO staff, academics, and agricultural specialists. The KII tool design was informed by initial findings of surveys and the topic guide sought to add in-depth insights into the agriculture and livestock sector from a comprehensive systems thinking, food security, and resilience perspective. KIIs are broken down into as per the following *(Table -1)* KII Mapping:

Category	Technical Speciality / Affiliation	Number of interviews
International NGOs	Cluster coordinators, TWG leads, food security & livelihoods managers, agricultural experts	6
Local NGOs	FSL managers, agricultural experts	4
Government	Agriculture directorate, Seeds multiplication, and grain establishment	4
Academics	Meteorologists, PhD students in agriculture/livestock/sustainability, conflict & resilience researchers	9

[2] These interviews were conducted in Arabic, but following the same topic guide as English interviews, and were translated to English to allow comparison with English interviews.

Secondary Data Collection and Analysis:

Secondary analysis covered peer-reviewed articles, policy papers, and practitioner reports were identified through targeted searches[3] on search engines such as ReliefWeb, UN OCHA databases, GoogleScholar, and Research Gate. This small set of cores, credible sources provided other set of references to follow, creating a "snowball" effect of accumulating sources. Global sources such as the IPCC informed climate baselines, while regional and international reports from FAO, WFP, IMF, IFRC, UN Women, CARE, Mercy Corps, World Vision, and others situated Syria's case within a broader context. National and subnational insights were drawn particularly from ACU and other sectoral datasets. This critical body of literature, including papers and reports from Syria, as well as comparable contexts,[4] served as a conceptual skeleton of key themes and identify gaps. Primary data from qualitative interviews and surveys then served to validate, problematise, or substantiate these findings, while also filling areas where evidence was lacking. This iterative cross-checking ensured a more comprehensive and contextually grounded analysis.

Limitations:

Syria has long faced structural challenges with data availability, even before the conflict national data systems were fragmented, inconsistently updated, and lacked transparency. Many official statistics under the Assad regime were classified as national security matters, making them inaccessible to researchers and the public. Since the onset of the armed conflict, the reliability and accessibility of data have deteriorated further, meaning that many existing reports rely on modelling rather than primary data.

Although Syria has capable researchers and institutions, the conflict has caused a significant loss of human capital due to displacement and the decline of research and academic institutions, further constraining the country's research capacity. In the humanitarian sector, although data collection has improved in recent years, much of the earlier information within cluster coordination systems, such as the Camp Coordination and Camp Management (CCCM) cluster, was not formally archived or standardised. This limited the ability to share raw data or provide informative displacement trackers documenting patterns and peaks. Moreover, many existing secondary sources rely on the same core datasets, often without new analysis or updated local insights. This reduces the depth and diversity of perspectives available.

This research was initiated before the fall of the Assad regime and therefore only focused on NWS, which was then Violet's only area of access. While NWS remains vital for agriculture, other key zones such as Northeast Syria (NES) and coastal governorates are also heavily affected by climate impacts and historically neglected in studies, they are not included within the scope of this research. Additionally, the timing of conducting surveys and KIIs coincided with a drought, meaning the experiences discussed were more immediate in respondents' daily lives. Many respondents were Internally Displaced Persons (IDPs) moving back home or from host communities experiencing demographic shifts, meaning perspectives on livelihood options and food security were in flux. More broadly, the easing of sanctions on Syria and the opening of borders meant that at the time of data collection, Syria was being flooded with imports, affecting food security and value chain prospects. Cumulatively, these factors mean that primary data provides an essential snapshot in Syria's transition phase, however follow-up research building on these findings is recommended for the coming year.

[3] Key words included: Climate change, Armed conflict, Drought, Rainfall, Temperature, Agriculture, Gender, Women, Youth, Labour, Olive, Wheat, Livestock, Fodder, Dairy, veterinary, landmines, Irrigation, Water, Seeds, Displacement, Land contamination, Airstrikes, Military, Market, Infrastructure, Currency, Fuel, Adaptation, Food Security.

[4] For example, Iraq served as a comparative touchstone given its agri-food sector having been shaped by the legacy of conflict, displacement, and weakened state institutions, followed by the challenges of post-conflict reconstruction. It also faces acute climate stressors such as drought, desertification, and water scarcity.

The primary data collection also faced significant operational limitations as access to different locations in NWS was often hindered by damaged infrastructure, roadblocks, and checkpoints between districts. As seen in *Figure 2*, areas highlighted in grey were completely inaccessible due to security concerns for field staff. Even in areas considered safe, navigating these obstacles required extensive coordination, including approvals from local authorities and management of operational risks. These challenges were compounded by political and military shifts after Syria's liberation, as local authorities were still adapting to newly defined geographic boundaries and restructured responsibilities. In some areas, farmers refused to participate in surveys unless assistance was provided in return, reflecting the transactional expectations created by years of aid dependency and the socio-economic vulnerability of rural households. Furthermore, the data collection team encountered low participation from women, reflecting broader gendered barriers in rural economic life and the gaps in women's voices in data and decision-making. However, anticipating these challenges, the team engaged community representatives to refer female participants to be interviewed by female field enumerators. Additionally, interviews with both male and female participants directly addressed women's barriers and opportunities.

Such challenges are to be expected when working in fragile and conflict-affected contexts. This study should therefore be considered a first step in a longer research process. The methodology and tools developed here can be adapted and scaled to other regions in Syria, supporting a more holistic and nationally representative understanding of how climate change and conflict intersect with agri-food systems. Additionally, the findings from this research carry significance beyond the Syrian context, offering insights into how intertwined climate and conflict dynamics shape agri-food systems and livelihoods in other fragile and crisis-affected settings. This research contributes to a wider investigation into how integrated, locally grounded approaches can build resilience in the face of compounded risks, particularly in regions like NWS where overlapping crises leave little institutional capacity for adaptation.

The following chapter explores the contextual background and analysis of Syria, covering the evolution of the humanitarian situation, the state and history of the agri-food sector, and the country's ecological makeup. It also examines the impacts of climate change on agriculture and livestock, the effects of conflict, and the compounded impacts of both. The chapter concludes with an initial assessment comparing secondary data with primary findings, which will be examined in greater detail in the subsequent technical analysis.


Taken by Violet Media Team
Idleb Syria - OCT 2025

Chapter II: Contextual Analysis

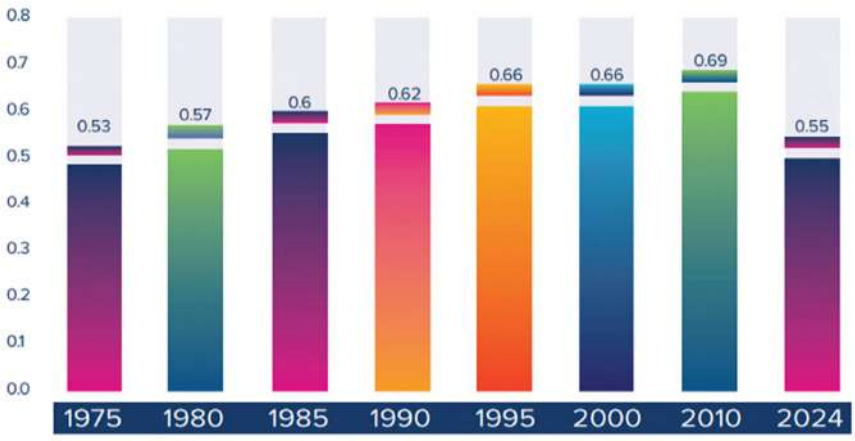
Section 1: Background:

Between 1975 and 2010, Syria experienced steady economic growth and improving human development despite significant governance challenges. Unemployment declined to just over 8%, albeit with higher rates among women and youth, and the economy expanded annually by nearly 5%, reaching a GDP of 61 billion USD by 2010 (UNDP, 2025). However, shortcomings in terms of poor regulatory quality, political instability, and limited accountability, created tensions that eventually erupted into civil unrest and later conflict. Syria's poor regulatory quality allowed patronage networks to flourish, favouring regime-linked enterprises while burdening small businesses and discouraging fair competition.

Political instability stemming from underlying social tensions, including regional disparities, rural neglect, and rising unemployment, were largely unaddressed by the state's centralised system and patronage networks and corruption also excluded citizens from meaningful participation and demanding accountability, deepening inequality and mistrust.

Together, these factors contributed to a deterioration in the Human Development Index (HDI) *(Figure 4 – HDI 1975 - 2024)* to levels seen in 1975 (ibid).

Prior to the conflict, agriculture was a main source of local livelihoods through cultivating crops such as wheat, barely, olives, and cotton, as well as the livestock sector including cows, sheep, and goats. Both pillars provided food security and income for both men and women.



Abbreviations: HDI = Human Development Index.
Source: UNDP, Human Development Reports, Data Centre. https://hdr.undp.org/data-center/specific-country-data#/countries/SYR.

Market-based interactions and land ownership were dominated by men, while women held more home-based jobs or engaged in certain services, such as olive harvesting or feeding livestock. However, women's role was often confined to the production phase, with structural barriers, including limited access to credit, land ownership, and decision-making power preventing them from full involvement in the wider agricultural cycle and its economic outputs (Gharibah, 2024).

By 2011, agriculture accounted for roughly 19% of Syria's GDP and employed about one-quarter of the workforce, with wheat accounting for around 35% of agricultural GDP, olives 22%, and livestock and dairy products approximately 28%, reflecting the sector's central role in both food security and rural incomes (FAO, 2017). Prior to the armed conflict, the sector faced challenges including land tenure insecurity, heavy reliance on subsidies, outdated farming practices, and limited access to modern technology and training (ACU, 2024). This is largely due to limited governance efficacy and a corrupt and unstable system lacking strategic planning and adaptation to climate change (ACU, 2024).

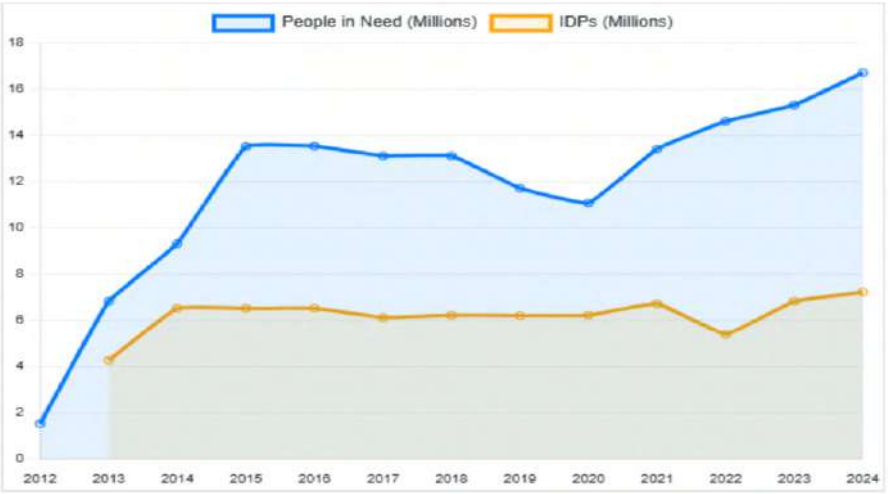
The outbreak of the armed conflict profoundly disrupted Syria's rural stability, causing infrastructure destruction, widespread displacement, and the collapse of governance, which severely undermined agricultural support and market functions in NWS (ibid). Extension services, once vital for providing technical support, largely disappeared, while farmers faced shrinking access to land. Livestock herds also declined dramatically due to displacement, loss of pasturelands, and the breakdown of supply chains.

i. Humanitarian Needs Overview and the Evolving Crisis

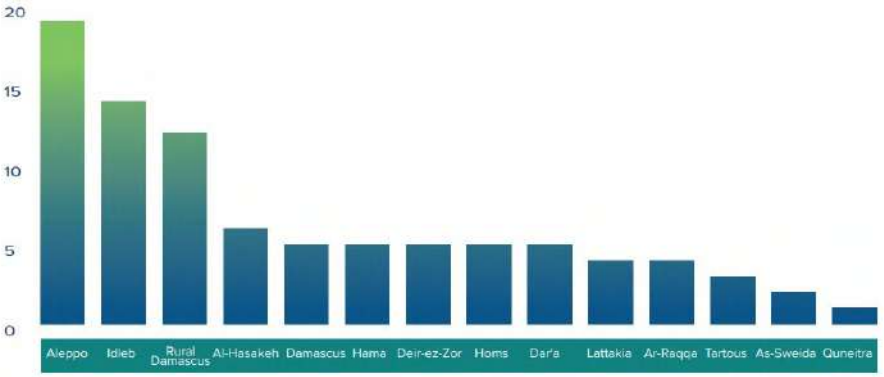
The Syrian crisis is among the most complex emergencies in the world, marked by mass displacement and the involvement of an array of state and non-state actors. (Center for Preventive Action, 2025). NWS, the focus of this study, hosts one of the highest concentrations of IDPs and is heavily reliant on humanitarian aid. Following the regime's retreat from Idleb and Northern Aleppo after extensive bombardment, the area became a destination for opposition factions and displaced communities from across the country. Over time, the scale and nature of needs have become chronic, driven by protracted conflict, fragmented governance, economic collapse, and the effects of international sanctions.

To understand the trajectory of humanitarian needs, this section presents an analysis of the Humanitarian Needs Overview (HNO) reports released by the UN OCHA, with inputs from various coordination clusters and technical working groups, these reports cover the period from 2012 to 2024 highlighting the deterioration of the situation[1] over time.

In December 2024, an estimated 16.7 million people across Syria were in need for humanitarian assistance, the highest figure since the beginning of the conflict. Of this total number, 7.2 million are IDPs, with approximately 4.4 million residing in NWS, meaning at least two-thirds of the population were IDPs. *Figure 5 – HNO Analysis illustrates* the sharp rise in both the total population in need and the number of IDPs between 2012 and 2024[2] reaching a total of 12.4 million either food insecure or at risk of being food insecure.



This became a widespread national emergency affecting NWS particularly due to loss of food production, disruption to supply chains, and erosion of household coping mechanisms. Similarly, the HNO per governorate on the left *(Figure 6 – HNO Per governorate in 2024),* underlines the correlation between displacement and need severity as Aleppo and Idleb governorates hosting the most IDPs were ranked highest in need.



Source: United Nations Office for the Coordination of Humanitarian Affairs (OCHA) (2024), Syrian Arab Republic: 2024, Humanitarian Needs Overview. February. https://www.unocha.org/publications/report/syrian-arab-republic/syrian-arab-republic-2024-humanitarian-needs-overview-february-2024-enar.

This deteriorating situation affected vulnerable groups hardest, with nearly 5 million women and 3.4 million girls requiring assistance in 2024. Additionally, according to protection actors, those with experience of displacement have an increased vulnerability to exploitation, trafficking, and various forms of Gender Based Violence (GBV) due to overcrowding, insecurity, and limited privacy in camps and informal settlements. Dependence on humanitarian aid, which is widespread among IDP families, and the disruption of protective social networks can also create power imbalances and reduce access to support and reporting mechanisms, further exposing survivors to exploitation and abuse.

[1] Reports can be found here: https://data.humdata.org/dataset/syrian-arab-republic-humanitarian-needs
[2] Due to limited data availability, IDP figures for 2012 are not included as recoding and tracking displacement was not

7.5 million children required urgent assistance, and 97% of young people received under the recommended food intake, raising risks of malnutrition and long-term developmental harm (World Vision, 2024).

Nearly 2.4 million are out of school and exposed to an increased risk of child labour, and for girls' early marriage, as survival strategies for families facing displacement, violence, and poverty (ibid). Around 6 million Syrians live with permanent disabilities, many resulting from conflict related injuries or medical neglect. Limited access to education, employment, and social support further constrains their ability to access basic necessities such as safe water (INTERDSOS, 2025). Youth face bleak employment prospects, with unemployment rising from 20% in 2010 to 46% in 2021, reaching 60% among young women (Common Country Analysis: 2024 Update, 2025) . Without educational or professional opportunities, many youths have resorted to negative coping strategies, including high risk jobs, risky migration, and recruitment into the armed conflict. Many have also turned to the informal sector accepting low-paying, insecure jobs that lack any form of social protection and undermine their long-term resilience, increasing protection risks, and limiting their role in Syria's recovery.

ii. Main Crops and Types of Livestock:

Syria sits within the Fertile Crescent and thus has a long history of crop cultivation and livestock domestication, which has deeply shaped the agricultural landscape and livelihoods of the region's inhabitants. By the time Syria became a republic in 1946, agriculture was the backbone of its economy, contributing the largest share to GDP until the late 1990s (FAO, 2017). Although this share decreased to 19% by 2011 from 27% in 2001 from agriculture and related processing continued to be significant, with double the economic contribution compared to the manufacturing sector (ibid). Prior to the conflict, Syria was largely a net importer of staple foods such as rice, maize, barley, soybeans, fish, and poultry, while maintaining a net export status in olives, fruits, and vegetables sourced from different parts of Syria. NWS, comprised of agriculturally rich governorates in Aleppo and Idleb, was known for cultivating a variety of significant crops (Verner & Breisinger, 2013):

- Cereals: wheat and barley form the staple cereals cultivated predominantly under rainfed conditions in Agro-ecological zones 1 and 2, which encompass large parts of NWS (see *(Figure 7)* - Agro-ecological zones).
- Olives: olive cultivation is a hallmark of NWS agriculture; olive groves not only contribute to local diets and income but are also major export commodities and part of the local culture.
- Vegetables: Summer crops (potatoes, cucumber, tomatoes...etc.) are more intensive water dependent are grown primarily in irrigated areas.
- Legumes: Legumes like lentils and chickpeas also play a significant role in crop rotation and household food security in NWS.

Primary data from the interviewed farmers across Aleppo and Idleb governorates confirmed their cultivation of wheat, barley, and olives, but they also reported being forced to diversify crops and reduce the investment volume due to climate-induced hazards such as prolonged drought and temperature instability. Diversification included lentils, chickpeas, and sometimes black seed, while beans, potatoes, and squash have been used to supplement or replace cereals. Olive farmers also mentioned that since olives have lost their value in the market due to the loss of access to wider national and international markets, they were forced to cultivate other crops through intercropping among olive trees.

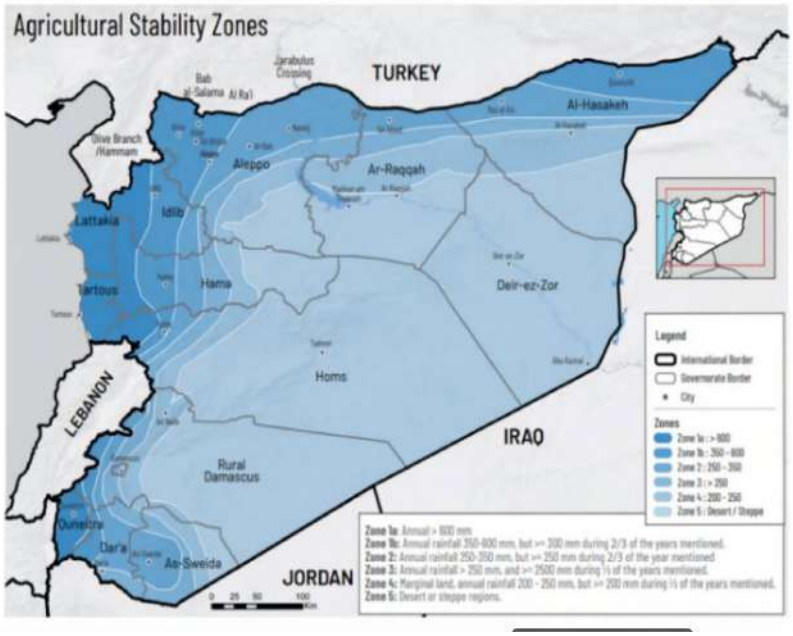
Livestock has traditionally been a cornerstone of the agricultural economy in NWS, contributing nearly 6% of Syria's GDP before the crisis (FAO, 2017). Sheep production was a dominant subsector accounting for 3% of GDP, with the Awassi breed representing over 90% of flocks and supplying 75% of national meat and 32% of raw milk and dairy products (ibid). Livestock production in NWS was largely based on seasonal grazing across semi-arid Badia pastures, sustaining traditional sheep herding practices. Other livestock species in the region include goats, cattle, and buffalo, although in smaller numbers. Water buffalo in particular have historically provided an important livelihood source for some of the most vulnerable communities' , generating up to 75% of family income in some cases, although their herds have shrunk drastically due to conflict and displacement. Interviewed livestock herders confirmed sheep, particularly the Awassi breed, as their most important livestock due to its resilience and multiple uses, while goats were valued in harsher, drier areas.

Cattle and water buffalo were also noted, though herd sizes have sharply declined because of rising feed costs, reduced grazing land, and limited extension services.
Despite these challenges, livestock remains the most vital productive asset for herders, sustaining their survival and recovery throughout the prolonged crisis.

iii. Climatic Zones of Syria

Syria's agricultural livelihoods are shaped by its Agro-ecological diversity in terms of agricultural activities, adaptation mechanisms, and vulnerabilities toward climate change. This places Agro-ecological zones (AEZs) at the core of any climate or agriculture analysis. The country is traditionally divided into five climatic zones based on rainfall probability, geomorphological features, and historic land use patterns, which form the classification designations for agricultural planning and land management. These AEZs are also referred to as Agricultural Settlement Zones.

(Figure 7 - Agro-Ecological Zones of Syria, IFPRI):



NWS falls predominantly within the more agriculturally viable Zones 1 to 3, making it both a food production hub and a region acutely sensitive to shifts in climate patterns, rainfall reliability, and water availability. Understanding these zones is essential for assessing Syria's exposure to climatic stress and its implications for food security and resilience (P. Al-Riffai et al., 2012).

As per the below *table 1,* zones 1 and 2 are the heart of Syria's rainfed cereal and fruit production and are also key areas for livestock due to their relative water availability and vegetation cover.

In contrast, Zone 5 (the Badia), comprising more than half of Syria's land area, is arid and primarily supports livestock grazing. Irrigation plays a critical role in Zones 1–3 where rainfall is seasonal or variable. Irrigated land in Syria has expanded from 670,134 hectares in 1989 to 1,238,300 hectares in 2009 out of the 6.5 million hectares of total arable area, while reliance on non-irrigated land continues to depend on annual rainfall.[3]

The demand for irrigation thus intensifies in years of below-average rainfall, placing pressure on both groundwater and surface reserves. Syria's seven major water basins [4] support 21 main rivers, 12 of which are transboundary, shared with neighbouring countries like Lebanon, Jordan, Iraq, and Turkey. However, according to primary data, many rivers became seasonal or diminished due to both overuse, reduced precipitation, or lack of commitments from neighbouring countries to previous agreements which undermines the required resources for adaptative practices. Syria also has eight major lakes and over 140 rain-harvesting surface dams used for domestic and agricultural purposes, including the "Al-Tabqa dam and Tishreen Dam" on the Euphrates River which remains the largest water body in the country. Despite these reserves, aging infrastructure and limited technical capacity have caused an estimated 25% water loss in municipal systems, and with limited maintenance due the armed conflict, water losses have significantly increased (Al-Riffai et al., 2012). While NWS experiences increasingly erratic precipitation and groundwater depletion due to climate change, degradation of water governance through lack of commitments to water agreement with neighbours and reduced state management capacity has degraded water security. On top of this, disruptive to water infrastructure caused by the direct targeting of water stations by airstrikes has made water systems even more unreliable as the report will be present further later.

[3] https://www.fao.org/aquastat/en/geospatial-information/global-maps-irrigated-areas/irrigation-by-country/country/SYR
[4] Syria is divided into seven major water basins: Barada & Awaj, Al-Yarmouk, Orontes, Dajleh & Khabour, Euphrates & Aleppo, Desert, and

Table 1 - Agro-Ecological Zones of Syria:

#	Zone	Rainfall (mm)	Land Share (%)	Area (million ha)	Key Agricultural Characteristics
1	Zone 1 / ASZ1	>350 mm	14.50%	2.7	Highly suitable for rainfed agriculture; two cropping seasons possible; wheat, legumes, summer crops.
2	Zone 2 / ASZ2	250–350 mm	13.30%	2.5	Wheat, barley, pulses; rainfed cereal production; crop rotation practices.
3	Zone 3 / ASZ3	250–300 mm	7.10%	1.3	Barley and legumes; 1–2 cropping years out of 3; fallow rotation common.
4	Zone 4 / ASZ4	200–250 mm	9.90%	1.8	Marginal zone; mainly barley; used for grazing and some crop rotation.
5	Zone 5 / ASZ5	<200 mm	54.70%	8.3	Badia; unsuitable for rainfed cultivation; used as grazing lands.

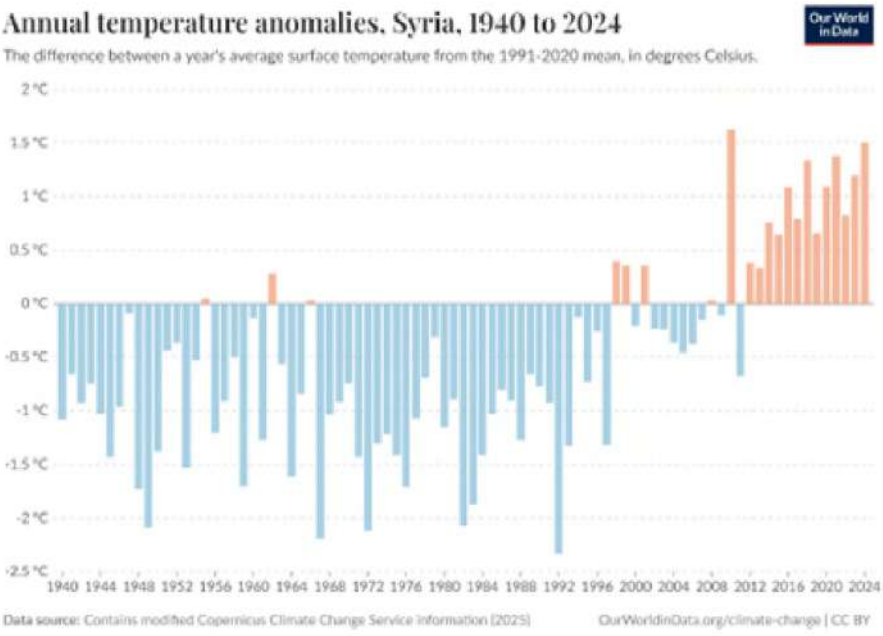
Section 2: Climate Crisis Impact:

While conflict remains the primary driver of displacement in Syria, climate-related stressors including droughts, flash floods, and heatwaves have caused many waves of internal displacement prior to the conflict. For example, the drought between 2006 – 2010 caused loss of livelihoods and forced families from rural areas to move in search of more viable conditions in urban communities. During the conflict, the increasing frequency and intensity of extreme weather events also complicated humanitarian operations: for example, flash floods restricted access to affected areas and limited the effectiveness of recovery and rehabilitation projects. This was especially damaging to initiatives focused on water systems, which are highly sensitive to rainfall patterns and temperature fluctuations. In some cases, changing climatic conditions have directly contributed to project delays or even failure, straining the limited capacity of humanitarian and development actors to meet growing needs. This convergence of environmental vulnerability and institutional strain caused by fragmented governance underscores the urgency of understanding Syria's climate history for designing anticipatory action at any level or scale. The following sub-sections will briefly outline key climate induced extreme weather events that have impacted people and food systems in NWS:

i. Climate-Related Extreme Weather Events

1. Temperature Instability

Reviewed reports have clearly shown the notable rise in both average and extreme temperatures over the past two decades. Mean annual temperatures in Syria have increased by around 1.2–1.5°C since 2000, roughly 0.6°C above the global average, with projections suggesting a further 2–4°C rise by mid-century if current trends continue (World Bank, 2020). Heatwaves are becoming more frequent, longer in duration, and more intense, posing a direct threat to human health, agricultural productivity, and livestock systems. For a longer scope and *Figure 8 – Annual temperature Anomalies, Syria 1940 – 2024*



sourced from our world in data datasets, it is recorded that the temperature mean is rising, and according to the world weather attribution study, drought cycles will be shorter with an increased severity and frequency.

These temperature extremes intersect with and compound the impacts of declining rainfall and drought, particularly in Syria's agriculturally productive zones (1–3). High temperatures during critical growing periods, especially during flowering and grain filling, can cause significant losses in staple crops: wheat yields may decline by up to 27% per 2°C rise (Lobell et al., 2011), and applying this to where around 70% of the wheat crop relies on rainfall, agricultural production was 80% lower in 2022 than it was in 2020 (Tandon, 2023). While barley losses are estimated at 10–15% under heat stress events (FAO, 2021). Heat stress also reduces seed germination, increases evapotranspiration, and weakens plants, making them more susceptible to pests and diseases. For livestock, extreme heat reduces feed intake, slows growth, causes fertility problems, and increases mortality. Rising temperatures also influence the life cycles and geographic distribution of insects, further increasing risks for crops and herds. Heatwaves already classified among the deadliest of extreme weather events, are especially dangerous in armed conflict settings where displaced people, who make up the core source of agricultural labour force, live in tents that trap heat and access to water shrinks (World Weather Attribution, 2024). Similarly, cold waves and spring frost events are also becoming more unpredictable. Farmers reported that late frosts are causing damage to blooming fruit trees and vegetables, and sudden cold snaps can devastate cereal crops like wheat. While the overall frequency of frost events may be declining due to global warming, their later occurrence after early warm spells has become a growing risk, shortening the growing season and raising uncertainty for farmers (World Bank, 2020). Cumulatively, temperature instability has undermined agricultural reliability in NWS, with reduced yields, degraded livestock health, and growing production risks. These effects have indirect consequences for food availability and market stability, with displaced and low-income households most exposed to rising costs and declining access to food.

2. Declining Rainfall and Drought:

Drought has been a persistent and increasingly severe feature of Syria's climate *(see box 1),* driven by climate change and compounded by unsustainable and irresponsible water management practices.

Box (1): Drought ***(Source: FAO, WMO, UNCCD)***

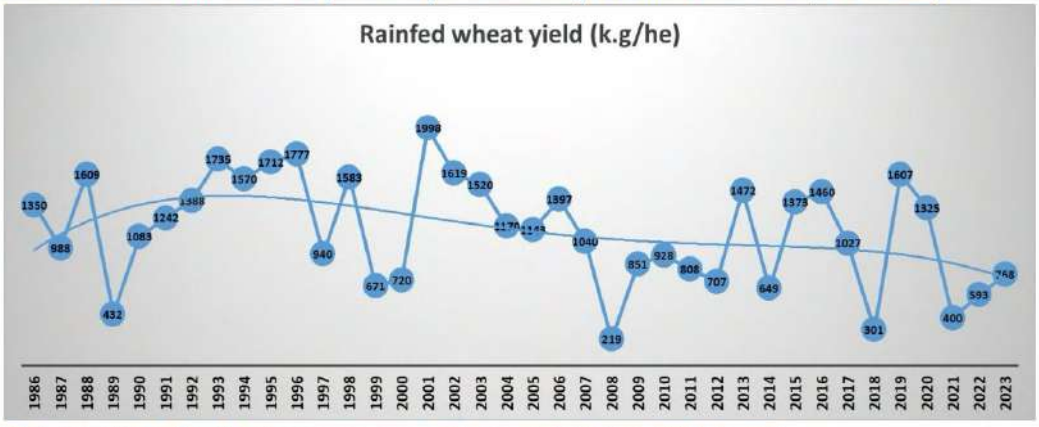
Drought is commonly defined as a prolonged period of deficient precipitation that results in water shortages, affecting ecosystems, agriculture, and livelihoods. It is not just a single, uniform phenomenon—droughts come in several forms:

- **Meteorological Drought:** Occurs when rainfall is significantly below average for an extended period.
- **Agricultural Drought:** Happens when soil moisture is insufficient for crops to grow, often lagging meteorological drought.
- **Hydrological Drought:** Refers to reduced water levels in surface and groundwater systems such as rivers, lakes, and aquifers.
- **Socioeconomic Drought:** Arises when water shortages begin to affect the supply and demand of goods and services.

Understanding these types is essential for monitoring drought severity and planning appropriate interventions. In Syria, drought impacts often span multiple categories, compounding stress on rural communities and national systems

Between 1961 and 2009, Syria experienced drought conditions for nearly a quarter-century, starting in the 1970s when drought was especially severe and lasted a full decade, impacting more than 60% of agriculture lands in four of Syria's five agroecological zones (UNDRR, 2011). Another national drought occurring between 1998 – 2001 caused widespread crop failure and livestock mortality (ibid).

Evolution of the rain-fed wheat produced yield according to rainfall anomalies (1986 – 2023)



LTA of yield = 1136 k.g/he (first ten season average= 1311, second= 1314, third= 944, forth= 935)

Zones 2, 3, and 4 remained particularly vulnerable especially for strategic crops such as wheat and barley.

FAO reporting observed that out of 41 rainy seasons observed between 1986 and 2023, 32 seasons recorded below-average rainfall as shown in the *Figure 9 – Rainfed wheat 1986 - 2023, (FAO, 2025):*

In the 2024-2025 season, national rainfall decreased 32% on average since the previous year and 27% from the long-term average (CA-SYR, 2025). Syria's Normalized Difference Vegetation Index (NDVI) dropped by up to 32% and the Normalized Difference Moisture Index (NDMI) by up to 70%, with Idleb and Lattakia seeing their vegetation indicators fall to the lowest levels recorded in years. Mercy Corps described the situation as ***"not just a seasonal dry spell, but a multi sectoral crisis rooted in sustained environmental and hydrological degradation"*** **(Environment and Climate in the Middle East, 2025).** The persistent dryness triggers cascading effects:

The persistent dryness triggers cascading effects:

- Substantial reductions in agricultural yields or total crop failure, particularly for rainfed staples such as wheat, barley, and legumes.
- Severe stress on the livestock sector, as grazing lands and water sources diminish. The Euphrates and the Orontes, two of Syria's largest rivers are recording significantly lower inflows compared to historical norms, and baseflow contributing groundwater to streams and rivers has decreased to the lowest point recorded in the last decade.
- Economic security and rural areas, with small-scale farmers and herders losing income, increasing food insecurity, and driving internal displacement.

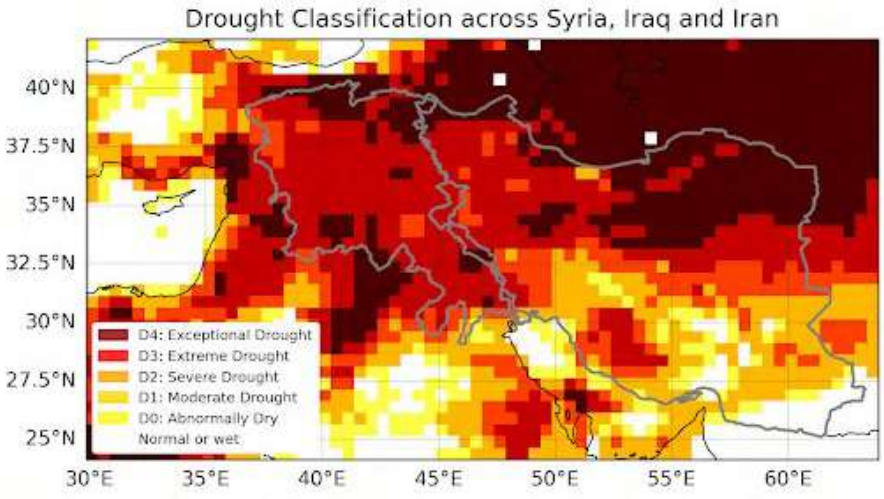


Figure 10 – Drought Classification, (Otto, 2023) charts an agricultural drought between July 2020 and June 2023, captured using the Standardised Precipitation Evapotranspiration Index (SPEI), which measures drought severity based on the balance between precipitation and potential evapotranspiration. Negative SPEI values indicate water deficits, with values below –2.0 classified as 'extreme drought'.

This index provides a robust assessment of agricultural and hydrological stress, complementing rainfall-based indicators, and Figure 10 shows exceptionally extreme drought conditions in NWS. Beyond rainfall deficits, interviews with experts reported that decades of unsustainable water management through over-extraction of groundwater, proliferation of illegal wells, and inefficient irrigation have depleted water resources, degraded water quality, and caused rising salinity threatening soil health. These challenges extend beyond water scarcity for livestock, with herders reporting degraded pastures, feed shortages, declining animal health and reproductivity stress due to rising temperatures.

3. Flash Floods

In addition to drought, Syria is facing an increased frequency and intensity of flash flood events hitting unprepared communities, especially IDPs camps in NWS. Drier long-term climatic conditions have hardened soil quality and reduced natural absorption capacity, meaning that sudden, extreme rainfall can rapidly overwhelm drainage systems. This effect is amplified in conflict-affected areas, where conflict-related degradation of infrastructure, deforestation, and unregulated urban expansion have sharply reduced the land's natural ability to absorb and channel water, leaving settlements highly exposed. In January 2019, heavy rainfall in Idlib and Aleppo displaced more than 80,000 people and destroyed large quantities of food stocks (IOM, 2019). Floods in January 2021 struck 196 IDP sites in the same governorates affecting 67,600 people (OCHA, 2021), and in March 2023, rainstorms damaged 2,233 tents across 57 IDP sites, affecting more than 83,000 people (ACU, 2023). Beyond causing considerable human suffering, floods damaged more than 194,000 acres of farmland, destroying crops and contributing to livestock deaths.

In some cases, floodwaters have contaminated arable land with crude oil and debris, disproportionately affecting smallholder farmers who rely on a single growing season and had limited access to recovery support (MEACAM, 2025). Although precise flood damage figures for NWS remain limited and understudied compared to drought, floods are nevertheless a recurring climate extreme in the region, causing yield losses and damaging hectares of arable land.

Looking forward, projections suggest that the frequency and severity of flood events in Syria will increase due to ongoing climate variability, land degradation, and inadequate infrastructure (ibid). Without targeted investment in watershed protection, soil restoration, sustainable land management, and early warning systems, both humanitarian and economic losses will continue to escalate, particularly for low-income farming communities and displaced households in NWS.

ii. Stakeholder Perceptions of Climate Risks:

How do farmers, livestock herders, and policymakers understand and respond to climate-induced extreme weather events?

Primary data from farmers, herders, and other local actors—expanded on in the next chapter mirror the secondary data, all respondents across olive, wheat, and livestock sectors reported experiencing climate-related changes in the past 15 years. Yet the primary data goes further, offering a grounded sense of how these shifts are lived and understood in local contexts. Farmers and herders spoke not only of environmental changes, but of their impacts on daily decision-making and their employment of both erosive and adaptive coping strategies, while traders and suppliers highlighted how these pressures are already reshaping markets, prices, and storage practices. The primary data overwhelmingly reflects that climate risks are not understood as abstract or anticipated future phenomena, but as a new climate reality that already deeply impact all levels, from production to trade and consumption. However, despite understanding these threats, farmers and herders report facing multiple challenges to adaptation, with a lack of finance and resources consistently listed as the top challenge by 70% of farmers. This is followed by lack of access to quality inputs and technology cited by 50% of respondents, and a lack of knowledge and information gaps mentioned by 40%.

Organisational actors, including NGO and INGO staff and community representatives, reported that steps were being taken to build resilience, such as introducing drought-tolerant crops or training on climate preparedness. They also acknowledged major gaps in outreach, resources, and capacity, especially in rural or insecure areas. Community leaders connected climatic pressures to food insecurity, migration, and aid dependency, underscoring the social and economic dimensions of environmental stress. Taken together, these insights not only validate the evidence from secondary sources but also provide a more nuanced and locally grounded picture of how climate change interacts with livelihoods and market systems. These themes will be explored in greater depth through the case studies that follow.

Section 3: Armed Conflict Impact:

At the start of this research, the Syrian conflict had entered its 15th year, marking a grim milestone since the regime first challenged in March 2011 and later was overthrown in December 2024 (Lawless, 2024). This protracted armed conflict has deeply disrupted the foundations of rural life, particularly in agriculturally dependent regions like NWS. Critical agricultural infrastructure, including irrigation systems, grain silos, and food storage facilities, have been systematically targeted or damaged as collateral effects (FAO, 2023), while land seizures, intentional crop burning, and the widespread presence of Unexploded Ordinances (UXOs) have further undermined food access stability, and livelihoods (STJ, 2018).

The volume of casualties, permanent injuries and disabilities, and irreversible damage make the Syrian conflict a uniquely brutal and complex, with an estimated death toll surpassing 620,000 out of a total population of 22 million before the conflict (The New York Times, 2024).

i. Overview of Armed Actors and environmental/agricultural impact

Throughout the conflict, military operations by various armed groups have left deep environmental and agricultural scars across rural areas, especially in NWS due to it lying outside of regime control and hosting the largest population of IDPs. Each phase of territorial control introduced different patterns of destruction, often tied to distinct strategies of governance, warfare, and resource extraction. While this research will focus on the Syrian regime as the principal destructive force, , it is important to highlight other armed actors who also contributed to the pressure induced by the armed conflict. The following summary provides an overview of how armed actors in the conflict inflicted direct and indirect damage on agriculture and the environment (European Union Agency for Asylum, 2023):

- **Syrian regime forces and allied partners (including Russia and Iran-backed militias):** Military campaigns have repeatedly targeted or damaged agricultural infrastructure from irrigation systems and water pumping stations, causing losses estimated at $3.2 billion (FAO, 2017a). Silos, mills and storage facilities have also been the subject of collateral damage and in some cases as part of deliberate strategies (ibid). Aerial bombardment and sieges have destroyed irrigation canals, water installations, and processing facilities; control of water infrastructure and seizure of land have restricted farmer access; and allied ground operations (including the use of proxy militias such as Liwa Fatemiyoun, Hezbollah, and Harakat al-Nujaba) have prevented repair and investment.

- **Islamic State of Iraq and Syria (ISIS) 2014 - 2017:** During its rule until early 2017, ISIS pursued an extractive and destructive approach that depleted local resources and damaged the environment (UN News, 2016). The group deliberately set fire to oil infrastructure and supported makeshift refining operations, releasing toxic smoke and contaminating land and water. It also created unmanaged waste and hazardous dumping sites, left improvised explosive devices (IEDs) and landmines in farmland that rendered fields unsafe for years, and cut or destroyed trees (including olive trees) for fuel or tactical purposes, and these actions caused both acute health risks and long-term soil and groundwater contamination, causing many farmers to abandon their land (Conflict and Environment Observatory, 2016).

- **Syrian Democratic Forces (SDF) / YPG 2015 - Present:** In areas under the SDF control, farmland was repurposed for bases, checkpoints, underground tunnels, and fortifications. Movement restrictions reduced available agricultural labour and access to fields near frontlines and farmers faced structural barriers such as compulsory conscription of youth and informal taxation. These dynamics discouraged investment, reduced local production, and contributed to food insecurity (Human Rights Watch, 2019). The SDF received direct military support from the United States and NATO allies, particularly through airstrikes targeting ISIS infrastructure, including oil facilities, which caused both immediate destruction and longer-term environmental risks (Conflict and Environment Observatory, 2016). The group also practiced open burning of informal waste and discharged sewage onto fields, which polluted soil and water resources and constrained farm recovery.

- **Turkish military and Turkish-backed armed groups 2016 - 2024:** Military operations and cross-border campaigns (e.g., Olive Branch, Euphrates Shield, Peace Spring) have included widespread air and artillery strikes, deliberate burning of fields, and the destruction of olive groves especially in the city of Afrin (Afrinpost-English, 2024), damaging livelihoods and leading to large displacements. Wells, irrigation canals, and roads have also been destroyed, while depopulation in villages has caused land abandonment and fractured supply chains (Amnesty International, 2018).

- **Opposition Armed Groups/Rebel factions 2011 - 2024:** Various armed opposition groups, including the Free Syrian Army (FSA), Ahrar al-Sham, Hay'at Tahrir al-Sham (HTS), and others, have contributed to environmental and agricultural damage, particularly during the early and mid-stages of the conflict. Fighting in areas controlled by opposition groups has led to the destruction of agricultural land and critical food infrastructure, including the seizure of grain silos and the targeting of irrigation canals and water pumping stations, which were either damaged in fighting or left to decay due to a lack of maintenance and access (Carnegie endowment for international peace, 2015).

- Other local and foreign militias (2012 – 2024): Groups such as Iran-backed militia formations, local pro-regime militias, and other non-state actors have contributed to checkpoints, informal taxation of agricultural produce, and competition over scarce natural resources (European Union Agency for Asylum, 2023). These activities increase transaction costs, fragment markets, and discourage producers from investing in long-term recovery (ibid).
- Israeli military operations (2011–present): Although not a ground actor in most parts of Syria, Israeli forces have conducted regular airstrikes and targeted operations across Syrian territory, officially justified as countering Iranian or Hezbollah presence. These strikes, including in southern Syria and occasionally further inland, have damaged infrastructure and contributed to environmental degradation through the destruction of fuel depots, military sites, and occasionally civilian areas. While their impact on agriculture was less direct compared to other actors, localized destruction and instability further disrupted rural

ii. Displacement:

Over course of the conflict, Syria witnessed the largest displacement crises in history since World War II, with more than 6 million Syrians displaced within the country, and another 6 million fleeing abroad, primarily to neighbouring countries such as Turkey, Lebanon, and Jordan, together amounting to over half of the country's pre-conflict population being forcibly uprooted (UNHCR, 2025). About half the internally displaced population continue to reside within their home governorates, though even today many cannot return to their original homes, as they have been destroyed, looted, or occupied (UNDP, 2025c).

The massive scale of displacement in Syria is not only a humanitarian crisis but also a driver of deeper structural vulnerabilities. Even months after the defeat of the regime, many displaced Syrians continue to live in substandard shelters without the security of tenure. A lack of infrastructure, jobs, and basic services continues to undermine efforts at long-term recovery. For these families, displacement is not temporary, but an ongoing state of vulnerability marked by loss of shelter, livelihoods, and community networks. Although the security conditions have improved in NWS, facilitating a dignified return and reintegration of displaced people would require significant financial resources and long-term planning which must be accounted for in Syria's post-war recovery and reconstruction agenda and budget (UNDP, 2025c).

Nowhere is the displacement crisis more concentrated than in NWS, where out of the total population of 5.1 million, nearly 3.4 million are IDPs, and over 1.95 million people live in more than 1,500 formal and informal camps (OCHA, 2024a). This represents the largest concentration of camp-based IDPs in the country Displacement can be broadly categorized in three overlapping waves:

- **Conflict Escalation Period (2011–2015):** Displacement surged as fighting spread. By 2013, UNHCR and other agencies reported over 4 million IDPs, many from rural farming communities causing initial losses including abandoned farms, disrupted sowing seasons, and crop losses as farmers fled (UNHCR, 2025).
- **Systematic Concentration Phase (2016–2019):** Large campaigns, sieges, and escalating conflict caused forced relocations, e.g. the Idlib offensive displaced close to 940,000 people in 2019. Host communities and displaced people alike placed pressure on farmland and grazing lands, often reducing yields due to overuse and disrupted access to inputs (UNHCR, 2025).
- **Compound Crisis Phase (2020–2024):** Conflict hot spots combined with climate shocks such as severe droughts, erratic rainfall, and the earthquake of 2023 drove new displacements. The FAO reported that agriculture was severely affected by both conflict and climate change during this period, specifically wheat crop production, which in 2021 dropped to approximately 1 million tons, the lowest in decades (Al-Attar, 2024b). Displaced farmers often lost orchards, grazing land, and access to water. In some cases, camps were established on agricultural lands , reducing available farmland. Environmental stress from soil degradation, vegetation loss and water stress has accompanied these shifts.

While armed clashes may no longer occur at the same scale, the legacy of the Syrian armed conflict will endure for decades, embedded in the physical destruction of communities and the repeated displacement of millions. Even before civilians were forcibly displaced by different artillery shelling and bombardment targeting, many were driven from their homes by the slow destruction of rural life.

Attacks on farmland, irrigation networks, and agricultural infrastructure intensified throughout the conflict, stripping families not only of shelter but also their means to subsistence, as shown Figure 12. This shows a high concentration of attacks on agricultural infrastructure in NWS and reveals how the Syrian regime deliberately targeted agriculture and other sources of livelihood (Insecurity Insight, 2023a). This aimed to fully collapse rural economies through burned crops, stolen equipment, inaccessible pastures, and disrupted water supplies. Additionally, this tactic was designed to push entire communities to leave their villages and give up any chance to cultivate their lands.

Interviews with farmers and herders confirm that conflict-induced displacement directly undermined agricultural labour availability. A wheat farmer from Al-Bab explained:
"A large proportion of workers and working women have fled their village or have migrated outside the country, and this forced us to employ displaced people who have no experience in agriculture and harvesting."

Similarly, a community representative from Ma'arat al-Numan noted:
"As a result of repeated displacement and repeated targeting of land, availability of agricultural labour has decreased significantly, as the majority left especially youth, some of whom were martyred and some of whom were displaced."

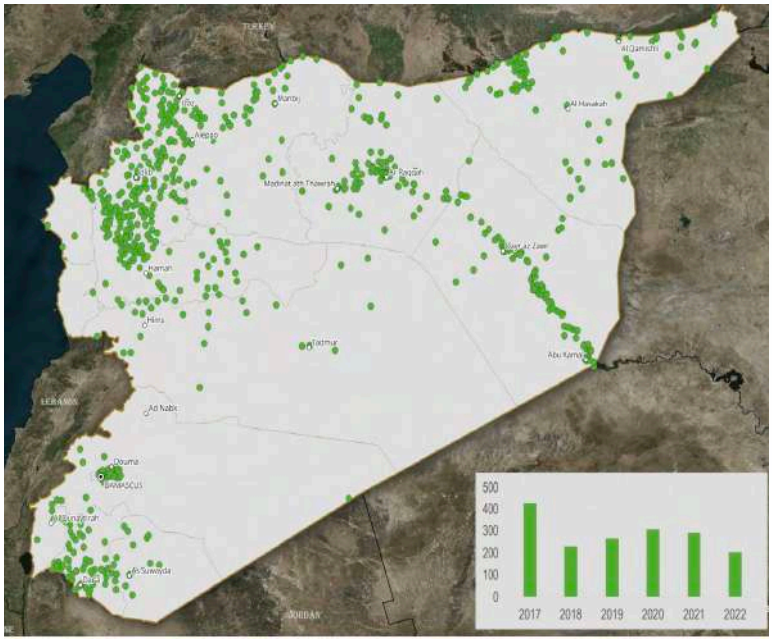
These testimonies echo broader evidence of agricultural degradation from the FAO (FAO, 2017), which documented labour shortages across rural Syria, leading to rising labour costs, delayed harvests, and reduced yields (FAO, 2017).

Beyond human displacement, the establishment of camps on agricultural lands has generated severe environmental pressures. Rapid settlement growth has often replaced cultivated fields, reducing productive land area. Poorly managed camp waste streams have contaminated nearby soils and water bodies, while deforestation around camps-driven by logging for shelter construction and heating has accelerated land degradation. According to the OCHA, deforestation in displacement-hosting areas like Idlib and northern Aleppo has been particularly acute, stripping olive groves and orchards within walking distance of large camps (OCHA, 2021).

These conditions exacerbate communities' vulnerability to climate-induced shocks such as drought, flash floods, and wildfires by weakening natural buffers like vegetation cover and soil fertility. This dynamic can be observed in Kah village near the Turkish border, where satellite imagery *(Figure 11, Ag-land & Displacement 2011 - 2024)* shows how agricultural land once dominated by olive groves was overtaken by camp structures, with a visible reduction in vegetation over time. Furthermore, satellite-derived analyses estimate that between 2011 and 2021, NWS lost around 45,320 hectares of tree cover, some of which correlates with expansion of IDP settlements and logging around camps for firewood and construction (PAX, 2023).

iii. Armed Conflict & Agriculture

1. Targeting Ag & Livelihoods



Mapped data of airstrikes on agricultural areas between 2017 and 2022 *(Figure 12 – Regime attacks 2017 - 2022)* shows a concentrated pattern of attacks in the country's most productive zones, particularly in NWS.

Out of the 79 verified airstrikes impacting farmland, nearly 90% were attributed to Syrian and Russian military forces, and over three-quarters occurred in Aleppo, Hama, and Idlib governorates, as clearly visualized in the same map (Insecurity Insight, 2023). The highlighted airstrikes in the report flagged that some of the land remains unusable due to lingering physical threats and soil contamination.

This aligns with the 198 documented incidents of deliberately burned farmland or crops during the months of May and June each year targeting the wheat harvest season. These attacks were mainly attributed to the Syrian regime and Russian forces concentrated in NWS (Insecurity Insight, 2023). Turkish military led operations seeking to upgrade borders and establish observation points, and operations by the US-led international coalition also contributed to this destruction (ibid). Regardless of the actor or intent, the outcome of reduced crop and income yields in addition to displaced farmers, remained consistent.

Primary data from farmers and livestock herders revealed that impacts varied sharply across groups. Smallholder farmers lost orchards and wells and lacked the savings to reinvest. Landless labourers and IDPs who depended on daily wages reported that employment opportunities collapsed when farms were abandoned or access was blocked, leaving them with no alternative source of income. Women-headed households faced compounded barriers: in several interviews, women explained they could not safely travel to markets or fields and could not access informal networks distributing aid or agricultural inputs. Host communities described tensions with IDPs over scarce labour opportunities and access to farmland, which added another layer of fragility to rural livelihoods. A female community representative from Aleppo reported the following observation:

Taken by Violet Media Team
Idleb Syria - OCT 2025

"Working in agriculture is not normal with constant bombardment, cutting trees, destruction of the irrigation pipes, targeting warehouses, and never safe transportation."

Additionally, ongoing clashes, checkpoints, and fear of violence have severely restricted farmers' and herders' access to land, preventing timely harvesting and maintenance. An olive farmer from Afrin described difficulty accessing his land which forced him to accept safety risks and has delayed his harvest for the past few years. Additionally, labourers reported being concerned to work on the ground due to sudden clashes between different armed factions. A livestock herder from Al-Bab shared a similar concern:

"Unsafe roads, roadblocks, and landmine causing the destruction of pastures and limiting access for grazing, and in some areas nearby the front lines it is impossible to get close and leave with your herd alive."

Several grain traders and farmers explained that bombardments and checkpoints forced them to abandon traditional transport routes. A grain trader from al-Bab said:

"It was too many things to worry about, the fear of bombing threatening family, workers, and facilities, or market instability and lack of price control due to changing governments ruling the region which might lead to full economic loss."

Similarly, farmers in Idlib explained that road closures increased the cost of transporting seeds and fertilizers, in some cases doubling input prices. This evidence illustrates that the collapse of transportation and markets was not abstract but directly documented through field testimonies.

2. Land Contamination:

While many types of destruction are visible, a hidden threat was the contamination of soil and water by chemical residues or UXOs. These were planted among large areas of farmland and posed long-term safety risks to both farmers, livestock herders, and other actors involved in agriculture production. Children collecting firewood and playing in fields, herders grazing animals, and returning IDPs ploughing abandoned lands faced disproportionate danger from UXOs according to interviewed women farmers, who explained how UXOs prevented them from agricultural activities. The impact of landmines in Syria is considered by experts as the greatest impact of UXOs anywhere in the world (MAG, 2025).

While most airstrikes occurred before 2020, the number of UXO detonations on agricultural land has increased since 2019, indicating that many unexploded items remain buried in soil, especially in Idlib and Hama governorates (Insecurity Insight, 2023a). These UXOs prevent ploughing, irrigation, and harvesting, and contributed to chronic land abandonment, especially near previous frontlines or contested zones (ibid). Their presence also inhibits the use of machinery and increases input costs for farmers who must shift to manual techniques (ibid).

A few months after the fall of the Syrian regime, it was estimated that at least 1 million munitions were used in Syria over the course of the armed conflict with a minimum failure rate between 10% to 30% (representing 100,000 to 300,00 explosive items across different areas posing daily risks to the population). Between December 2024 and March 2025, 116 children were killed or injured by UXOs (Humanity & Inclusion, 2025). This high number is due to widespread desperation to return home after years of being expelled to camps. Mines Advisory Group (MAG) programs in NWS have reported high number of casualties and injuries to farmers and workers when ploughing their fields. One farmer speaking from his hospital bed in Idlib said:

"We were about to rest for lunch, and someone said we will do two more lines; we have no choice because we must cultivate land to survive. We must work and we must grow food."

Interviews with farmers and livestock herders highlighted how UXOs in NWS have reduced agricultural activities in many areas and exacerbated displacement as farmers abandoned their lands or shifted to non-agricultural activities. One herder gave the following account:

"Mines have destroyed and killed many herds and herders, which changes the type of livestock herding from a staple and calm job to a very dangerous and stressful work."

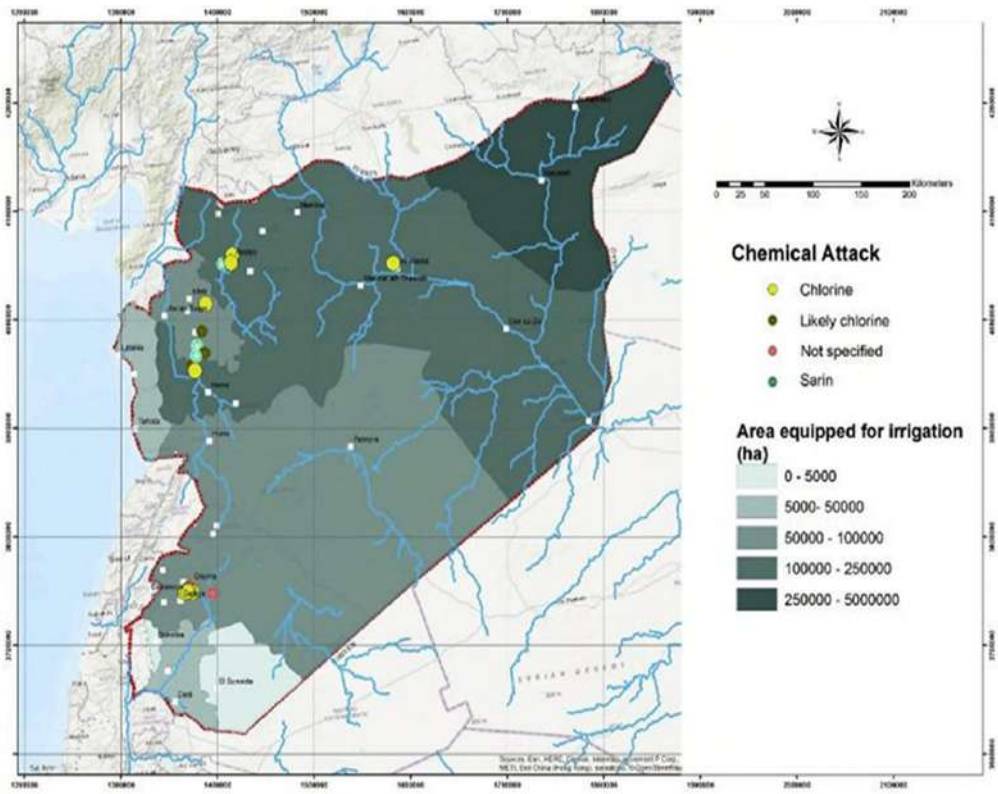
Farmers and herders strongly emphasised that demining and land clearance must be a top priority for any recovery plans before even speaking about climate-resilient farming. Across KIIs, technical experts and NGO staff also consistently flagged the seriousness of the threat posed by UXOs . Despite the many mine clearance fatalities at the time of writing, some returning farmers have themselves accepted the risk of clearing landmines with no experience or capacity to assess the dangers.

3. Water:

The destruction of canals, pumping stations, and storage tanks severely limited irrigation, especially in areas dependent on gravity-fed systems and uninterrupted canal and reservoir networks. Once canals were damaged by shelling or left without maintenance, entire downstream farming communities lost water access. An interviewed water management professional reported ***"a full collapse of irrigation canals, water tanks, and water stations due to targeting."*** This observation was echoed by FAO's 2017 assessment, which estimated $3.2 billion in irrigation infrastructure losses, affecting more than 60% of farmers reliant on irrigated production (FAO, 2017a) . Additionally, due to the gap of governance, many communities and HHs drilled wells to access groundwater with no prior assessment or permission. According to a community representative in Idleb:

"Randomly drilling wells led to a decrease in the water level and due to the limited capacity and quality, high pollution risks are threating all of us."

Water sources have also been subjected to long-term contamination by the Syrian regime due the use of chemical weapons *(Figure 13 – Chemical attacks, (Baba et al., 2021))*. Reports from Organisation for the Prohibition of Chemical Weapons (OPCW) has identified the residues of different agents used, leaving groundwater vulnerable to contamination (ibid). Furthermore, contamination might occur due to other reasons such as poor waste management, weak sewage systems in camp areas during flash floods, UXOs, and other warfare-related pollutants. This affects groundwater, springs, rivers, and irrigated soil Consequently, these impacts not only affect local communities, soil and plant health, but also exposes regional and global communities to these threats.



Section 4: The Intersection of Conflict and Climate: A Dual Threat to Food Security in NWS

The intersection of climate stress and armed conflict in NWS has created overlapping and reinforcing pressures on already overstretched communities, leading to a high frequency and volume of displacement, while environmental degradation continuously erodes their means of recovery. The armed conflict caused severe disruptions to governance systems, leaving entire sectors without coordination or adequate investment, especially those linked to agriculture and food security.

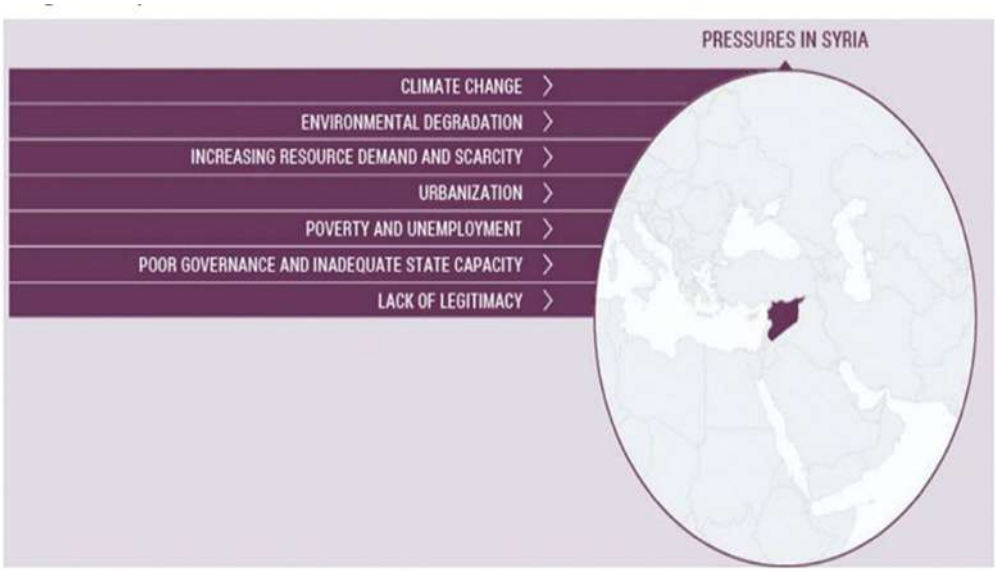
This institutional vacuum multiplies the impact of climate events due to the complete lack of preparedness and early warning tools. For example, in the absence of sustainable irrigation maintenance, even short dry spells have resulted in crop failures, and without flood protection, moderate rainfall has triggered devastating floods in IDP camps. This illustrates the role of conflict as a risk multiplier in NWS, where insecurity and governance collapse amplify climate risks far beyond their standalone effects (Rüttinger et al., 2015). At the household level the research categorizes these dynamics at two levels:

- The income effect: droughts, displacement, and restricted land access reduce agricultural earnings and daily wage opportunities.
- The price effect: the cost of food, water, and fuel skyrockets, further eroding purchasing power.

Households have responded with a variety of coping strategies, some of which are erosive and others adaptive but insufficient.

These include adjusting diets and diversifying small-scale income. Together, these strategies reflect both the ingenuity and the limits of communities under compounded conflict–climate stress. These household-level strategies do not exist in isolation as they are embedded within broader structural pressures, as highlighted by the New Climate for Peace framework, which shows how Syria's fragility emerged from the convergence of multiple stressors layered over weak governance and a lack of legitimacy.

Figure 14 – Pressures in Syria shows how interconnecting stressors shaped the environment for the 2011 uprising and magnify household level vulnerabilities (Rüttinger et al., 2015). The 2006–2011 drought, which forced widespread rural displacement, intersected with these pressures to erode resilience and deepen public discontent.



This illustrates how climate shocks act as threat multipliers, magnifying governance failures and socio-economic fragilities, and accelerating the pathway from environmental stress to political instability and conflict (ibid).

i. Food Security & Livelihoods:

Before the armed conflict, Syria maintained a degree of food sovereignty, even serving as a regional wheat exporter (FAO, 2011). By 2022, the country had become a net importer of food, heavily reliant on humanitarian assistance and unable to stabilize its food economy. While recurrent droughts and irregular rainfall have shortened growing seasons and depleted water resources, conflict has destroyed grain silos, irrigation channels, and public bakeries leading to the collapse of food systems and livelihoods.

For smallholder farmers and pastoralists, the risk of food insecurity has become chronic, pushing many households to sell assets , migrate, or turn to child labour to survive. Crop monitoring in NWS confirmed that wheat and barley yields fell in the 2023/24 season, while farmers faced severe challenges from high input costs, fuel shortages, and climate stress. This impacted market actors in different ways (iMMAP, 2023):

- Smallholder vs. larger farmers: Smallholders were hit hardest by input price inflation, as they lacked capital reserves to buy seeds, fertilizers, or fuel at inflated rates. Larger farmers, though also affected by insecurity, often had better storage capacity and some market leverage, enabling partial continuity of production.
- IDPs vs. host communities: IDPs lost direct access to land, relying instead on daily labour, informal markets, or aid, while host communities saw land pressure increase as more than 1500 camps expanded onto farmland, further shrinking cultivation areas for the host communities (OCHA, 2024).
- Women and youth: Women-headed households reported sharper declines in dietary diversity and fewer income opportunities compared to male-headed ones. 92% of female-headed households in camps struggle or are unable to meet basic needs (OHCHR, 2023). Youth displacement and forced migration reduced the availability of skilled agricultural labour, while those who remained often faced exploitative or insecure conditions.

Livestock herding, once a vital component of rural livelihoods, has also declined steeply. Herders increasingly cited both fodder price inflation and physical scarcity of pasture and water as reasons for herd reduction or abandonment (iMMAP, 2023). For smallholder herders, herd losses meant the disappearance of critical household assets such as milk, meat, and manure, while larger commercial herders could sometimes maintain partial herds but faced declining profitability. During the armed conflict, this sector experienced severe structural damage, as reflected in the widespread decrease in food consumption for average HHs in NWS, regardless of their background, location, residence, or financial capacity. This intersectionality of armed conflict and climate change induced shocks has left rural households with depleted means of resilience and greater dependence on humanitarian aid. In surveys examining coping strategies to cover food needs during stress periods , 98% of respondents rely on aid for income and food, 95% of respondents depend on low priced food, 84% mentioned that it is normal to skip a meal at least once a week to allow food for other family members. Additionally, 79% mentioned that borrowing money from family and friends helps cover their needs, while 51% mentioned that they needed to sell a land, house, or other productive assets to cover their needs.

ii. How Conflict and Climate Amplify Existing Vulnerabilities

Armed conflict and climate change act as mutually reinforcing threat multipliers in NWS, driving households deeper into poverty and food insecurity. The collapse of governance and basic services magnifies the impact of climate extremes: when irrigation canals are destroyed, farmers must rely on erratic rainfall; when drainage systems are left unrepaired, even minor floods can inundate camps and farmland. Displacement further compounds exposure, as millions settle on marginal lands such as floodplains, deforested hillsides, or drought-prone farmland where climate hazards are more destructive and recovery options are minimal (UN OCHA, 2024) , and this leads to systematic vulnerabilities such as:

- Infrastructure collapse: Conflict has destroyed irrigation systems, storage facilities, and roads, which leaves agriculture highly exposed to climate shocks. For example, in areas where irrigation channels were bombed or abandoned, droughts directly translate into failed harvests.
- Displacement to marginal lands: Families uprooted by violence often settle in flood-prone valleys or degraded rangelands. Flash floods in these areas have repeatedly damaged IDP camps, while prolonged droughts have left displaced farmers unable to cultivate new plots (ibid).

It is important to emphasise that hazards have different impact on communities and market actors according to their vulnerability, and it is important to disaggregate these impacts:

- Smallholders vs. landless labourers: Smallholder farmers face repeated crop losses due to input shortages and climatic shocks, while landless labourers suffer from reduced wage opportunities as agricultural employment contracts.
- Women and youth: Climate shocks have compounded gendered labour burdens. Women walk longer distances to fetch water and firewood as rainfall declines, reducing time for paid work and increasing dependency. Youth face heightened unemployment, with some forced into precarious informal labour or early marriage as coping mechanisms (OHCHR, 2023).
- IDPs vs. host communities: Displaced populations report lower access to land and water, often competing with host farmers for dwindling resources. This dynamic has sharpened local tensions in rural communities (OCHA, 2024).

In NWS, conflict and climate shocks are inseparable as each intensifies the other's effects, eroding resilience at household and system levels. For displaced and rural households alike, this dual burden has created layered vulnerability, chronic poverty, environmental degradation, and social inequality. Women in particular embody this paradox as they are both essential to sustaining food systems and among the least supported, excluded from decision-making and formal recovery planning. Without systemic investment in governance, gender equity, and climate-resilient infrastructure, even small climatic shocks will continue to spiral into humanitarian crises.

Gender Lens

While climate change in Syria acts as a threat multiplier for communities by compounding existing vulnerabilities created by over a decade of conflict, this is further complicated by gender-based inequalities. Female-headed households in Syria are twice as likely as those headed by men to report a complete inability to meet basic needs. This is especially true in displacement settings, where 92% of female-headed households in camps report struggling or being completely unable to meet basic needs (OHCHR, 2023).

Women working in the agricultural sector face responsibilities, both to work and family, that are severely affected by climate and conflict instability. As rainfall decreases and irrigation systems collapse, they spend more hours fetching water and firewood and suffer lost incomes from diminishing harvests (UN, 2025). Additionally, women's access to productive resources in NWS, including land, agricultural tools, and credit, are severely restricted by discriminatory inheritance laws, patriarchal customs, and legal barriers (Gharibah, 2024).This is exacerbated in displacement contexts where women's access to land documentation and community networks are often severed (ibid). These vulnerabilities and inequalities are made worse in conflict settings where women's access to land, financial services, education, and decision-making power is threatened (UN Women, 2025). Traditionally, gendered divisions of labour place the responsibility for collecting food, water, and fuel on women, tasks that become increasingly difficult as environmental conditions worsen (UN, 2015). According to the World Food Programme (WFP), 38% of women-headed households in conflict zones face moderate to severe food insecurity, compared to 20% of male-headed households (WFP, 2022). Displacement caused by conflict or climate drivers threaten even further women's access to land documentation, further undermining their rights and ability to rebuild livelihoods (UNHCR, 2022). Displacement can also raise protection concerns, including heightened exposure to GBV in camps or in trying to access essential resources in insecure areas (ibid).

Primary data collected from agricultural communities in NWS reinforces and deepens this picture of vulnerability. Over two-thirds of women in both olive (67%) and wheat (79%) sectors reported that their workloads had increased due to climate-related and conflict-driven pressures, while 80% of women in the olive sector and 62% in the wheat sector reported lost income opportunities. On top of this, soaring input costs (up 200-300%) and wage disparities has seen women's income fall 50% during drought years, hindering services access.

Women also reported facing greater mobility and safety issues than men, encountering risks of harassment and assault at armed checkpoints and in IDP camps set up on olive groves. Conflict-related risks such as shelling and mines make travel to services unsafe, reducing women's engagement by 40% in high-risk areas. Across the studied value chains, women tend to be sidelined at all stages after production, with limited market information as they cannot adequately negotiate prices due to limited access. Some interviewees cited wholesalers lying to women and taking 50-60% profit. In the livestock sector , despite women dominating routine husbandry (milking, feed mixing, cheese/ yogurt production), they rarely control sales channels or input purchase reports. Furthermore, they are paid 10 to 50% less than men for the same work, except in short-term NGO projects. Additionally, all this work is on top of existing unpaid household-based responsibility.

To adapt to different challenges, women report employing both erosive coping strategies and adaptive strategies. With even higher pressures to make ends meet given their lower wages and restriction to primary production activities, women were often forced to take on extra work, often informally without wage or labour protections. They were also under increased pressure to sell productive assets and limit consumption of costlier goods. Additionally, climactic shifts have forced women to shift their working schedules to avoid heat waves and existing responsibilities like fetching water, which has become more time consuming and precarious. Despite these difficulties, women have been forced to adapt in ways that if properly supported, could be long-lasting strategies. This includes maximizing home-based businesses and working on diversifying their income through agriculture, food processing, sewing, or any other opportunity to generate income. However, these structural support systems have been largely unsupportive of women and formal coordination bodies like farmers' associations are completely absent of women.

This is largely due to greater family responsibilities which has undermined their access to networks and reduced their capacity to advocate for their needs (Gharibah, 2024). Together, this exclusion has hindered women's contribution to shaping agricultural policy and regulation (ibid).Although women do receive support from NGOs, with one academic interviewee stating:

"NGOs in the NWS were the lifeline to sustain the agriculture sector, especially when it comes to women."

NGO interventions only reached 20% of women according to surveyed respondents and of these interventions, the focus was largely on protection and livelihood rather than increasing market access , promoting genuine inclusion in decision-making, or strengthening knowledge about new technologies. Only 15% of extension guides are female-focused, further marginalising women. Additionally, while they do exist in Syria, no surveyed women reported involvement in structured female co-operatives. When asked why, 10 respondents cited mobility and security restrictions, followed by eight mentions of inhibitive customs and traditions, with six respondents citing their commitment to household responsibilities. With limited participation in agricultural cooperatives or decision-making bodies, women are largely excluded from shaping basic recovery strategies. This decreases the effectiveness of any interventions significantly, since women make up many producers, processors, and consumers. This is a systemic issue, reflected in the complete absence of any gender and age breakdown in the Syrian National Adaptation Plan (NAP). This emphasises the importance of implementing efforts at all levels.

Having established the historical and contextual foundations, we now turn to primary evidence from farmers, herders, and market actors who navigate these compounded realities daily. Each case study will examine how conflict and climate change have affected production, explored the resulting economic consequences, and identified the challenges and opportunities that have emerged as a result.

Chapter III: Evidence & Primary Data – Technical Analysis

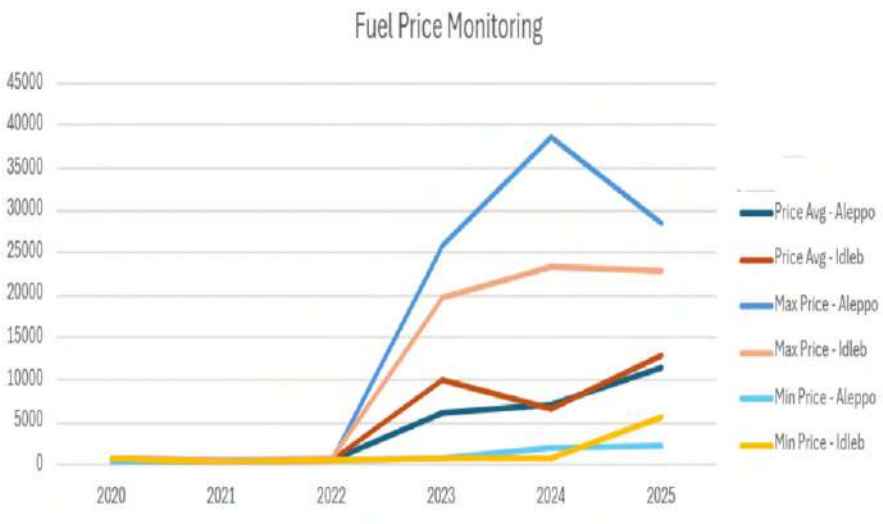
Section 1: Agriculture & Market dynamics

Primary data was collected from 53 farmers and 22 livestock herders, 56 market actors, and 43 community representatives in Idleb and Aleppo governorates. This was complemented by secondary sources produced by reliable actors such as FAO, WFP, iMMAP, and the ACU to disaggregate the impacts of the compounding pressures of recurrent droughts, rising fuel costs, damaged infrastructure, and fragmented market systems on the smallest possible unit of analysis such as HH or individual. During the studied period, the research shows that low rainfall continues to be a defining stressor *(Figure 15 – iMMAP Rainfall Tracker, (iMMAP, 2023).* In the 2021–2022 season, 69% of farmers surveyed by iMMAP reported below-average rainfall, up from 46% in the previous season (iMMAP, 2022).

For rainfed wheat producers, particularly smallholders and displaced households without access to irrigation, this resulted in shortened growing seasons and widespread crop failures. In contrast, larger farmers with access to borehole irrigation systems were less affected, though rising costs for diesel-powered pumps made irrigation unaffordable for many. Reduced precipitation combined with higher irrigation costs has therefore created a two-tiered impact. Subsistence and IDP farmers dependent on rain-fed systems face food insecurity, while larger producers report declining profit margins.

Access to affordable diesel fuel was consistently identified in interviews as the most critical input challenge. Farmers reported that diesel prices rose by over 1,694% between January 2020 and December 2024 due to disrupted supply chains, Turkish border restrictions, and international fuel price volatility. This matches WFP VAM records for Aleppo and Idleb governorates between 2020 – 2025 *(Figure 16 – Fuel Price Monitoring).*

This instability undermined agricultural cultivation due to the reliance on fuel for irrigation, transportation, and processing. Road closures, militia checkpoints, and shifting frontlines have cut NWS producers and consumers off from the national market, and sustained airstrikes (23 documented incidents between 2019 and 2022) on marketplaces, food convoys, and livestock fairs have further undermined trader confidence causing a local market collapse (Insecurity Insight, 2023).



Prior to 2011, government subsidies stabilized fodder prices through guaranteed procurement of barley and maize (ACU, 2024). The sudden removal of these subsidies, combined with drought conditions and conflict-related pasture loss, led to significant price volatility and herders were forced out of traditional grazing lands (ibid). Additionally, the overconcentration of livestock in NWS has accelerated pasture degradation and raised feed costs, particularly as communal rangelands now provide only 38% of ruminant feed, and herders relied on expensive feed supplementation, often without proper nutritional knowledge (ibid). This has led to health issues such as chronic acidosis in dairy cattle and lowered productivity and profits. Despite these challenges, local markets remain the primary outlet for livestock and agriculture sectors, with some export to Türkiye, regime-controlled areas, and Iraq (ibid). These exports and the large imports were traded in foreign currencies. Wheat, barley, and animal feed, were largely purchased in US dollars and outputs sold in Turkish lira , reflecting both currency instability and cross-border trade norms. Farmers continuously faced rising input prices driven by global market volatility, monopolistic control by large traders, and exchange-rate fluctuations, all which strain production margins and limit reinvestment.

For livestock, the collapse of veterinary services has left herds vulnerable to disease without access to vaccination or treatment, compounding the pressures of feed scarcity and high input costs. In the absence of state governance and support systems, NGOs became the primary providers of humanitarian survival mechanisms, including livelihoods and agricultural assistance. However, most humanitarian NGOs' mandates were heavily shaped by donors' or by INGOs' agendas rather than community-defined priorities. Respondents consistently described their interventions as indispensable but insufficient, pointing to both their life-saving role and structural limitations. Despite these criticisms, there was consensus among all respondents that their presence was essential and necessary during the compounded crisis of armed conflict and climate-induced hazards. In the agriculture sector specifically, 45% of interviewed farmers stressed that NGOs helped them continue agricultural activities, although 31% reported that support was insufficient and poorly aligned with local priorities of fuel and irrigation. A recurring concern raised by respondents (2 olive farmer, 1 wheat farmers, and 2 community representatives) related to the quality and targeting of NGO assistance, indicating that assistance often lacked quality assurance and focused on the delivery of goods rather than their suitability.

Interviewees reported having received expired or rotten food parcels, sick seedlings, or poorly stored seeds that later caused diseases. These testimonies, though limited in number, were consistent across interviews and triangulated by KIIs, suggesting a wider pattern rather than isolated cases. In relation to beneficiary-selection processes, they were frequently not clear, leaving many HHs uncertain why some households were included while others not, leading interviewees to suspect nepotism or favouritism at the field level. These failures have concrete consequences such as eroding trust in humanitarian actors and have fuelled inter-community tensions between IDPs and host communities or between households where gender prioritisation was applied. When tackling this aspect with the KIIs, two main operational drivers emerged:

1) Supply-chain constraints, where rapid responses and restrictive donor procurement rules often force agencies to source available stock without adequate quality checks and limited locally led procurement, especially for seeds and seedlings.

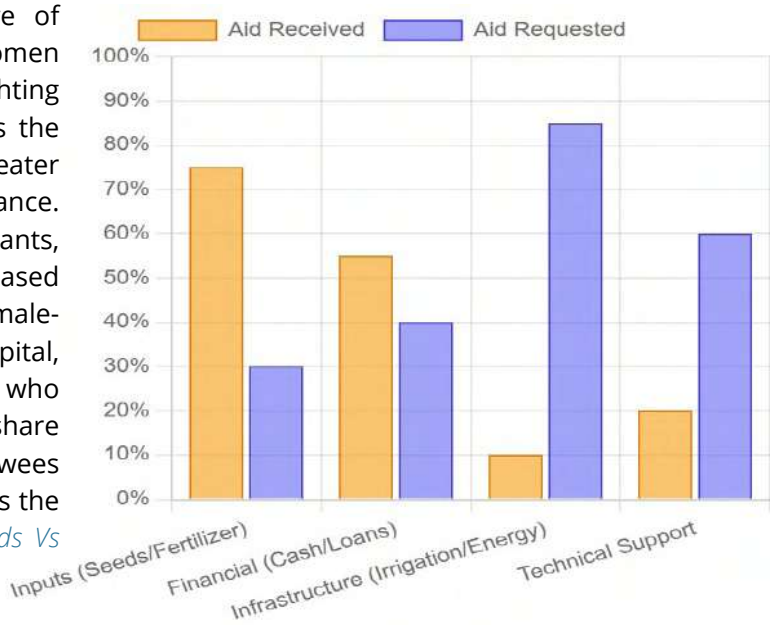
2) Unstable supply chain capacity within the context of cross-border programs between Türkiye and NWS which limited storage, cold-chain, and monitoring among some local partners.

These findings were echoed and expanded upon in KIIs, with coordination bodies and senior NGO staff confirming these dynamics. They also agreed that donor agendas largely drove the response, especially in the early years of the conflict, with limited space for local actors to shape strategy. Only after Syrian technical experts were engaged in later years, more strategic crops and priorities emerged, however local NGOs remained constrained by their dependence on international funding.

10 KIIs also warned that repeated cycles of emergency aid risked shifting communities from self-reliance to aid-dependence, especially as negative coping strategies depleted household savings and reduced farmers' willingness to invest in their own recovery. This frustration stemmed from NGOs' inability to match the scale, consistency, and coordination of the former state system, which was centralized, nationally integrated, and widely accepted by communities. NGOs could only implement village-level projects targeting the most vulnerable, with short funding cycles and limited coverage. 24 out of 53 farmers (45%) interviewed across the wheat and olive value chains indicated that seeds and fertilizers were the most common input support, which despite their utility did not always match farmers' seed preferences. 35% of interviewed olive farmers were mostly satisfied with the labour support through Cash-for-Work (CFW) provided for harvesting and pruning, which offset shortages caused by displacement. However, 62% of respondents agreed that less investment was put toward technical trainings, extension services, and infrastructure rehabilitation. This was attributed by NGO staff and experts to the prioritisation of emergency relief over long-term investment in infrastructure due to political constraints. . Overall, farmers agreed that any NGO input reduced a financial burden they would otherwise face, increasing their profit margin and enabling them to cultivate the next season at the same or a larger scale. Although this represents a lifeline for many in the agriculture sector, which couldn't function without NGO support, these interventions are not sustainable. Two KIIs reported a similar finding from a forthcoming joint agricultural internal study conducted by their agencies: ***"75% of farmers asked whether they would continue with production without NGO support said they would not continue."***

CFW schemes, while not a sustainable solution for youth employment, reduced labour costs for farmers and allowed young workers to earn fair wages to cover household needs. Many participants described CFW as both a survival mechanism and a learning opportunity that sometimes led to longer-term jobs. Farmers valued CFW because it offset rising labour costs, enabling them to sustain cultivation despite shrinking margins. Especially for female participants who noted that CFW projects provided their first entry point into a protected equal paid agricultural work with the provided NGOs protection against the wage discrimination in the market that was confirmed by 100% of the interviewed female agricultural labours estimating the wages to be lower by a range of 20% to 50% than men for a similar task.

Female participants were especially appreciative of NGOs deliberate efforts to create entry points for women into market-based activities, repeatedly highlighting small and medium enterprise (SME) programs as the most effective intervention, which enable greater market participation and reduced barriers to finance. Specifically, SME schemes offered small cash grants, subsidized in-kind inputs and facilitated group-based savings mechanisms. This helped women bypass male-controlled trader networks and access start-up capital, reducing dependence on male intermediaries who traditionally dominated distribution channels and share the profit margin. The research asked interviewees about their priority needs reported to NGOs versus the assistance received *(Figure 17 – Humanitarian Needs Vs Assistance Provided).*



This revealed a systematic gap between community-reported needs and final programming. Farmers consistently prioritized fuel, water, and veterinary support, but instead received seeds, fertilizers, or food parcels. Interviewed market actors (bakeries, olive mills, grain mills) noted that humanitarian interventions, though limited, boosted access and purchasing power through subsidies and rehabilitation, helping to stave off the collapse of local food supply chains.

In regard to climate adaptation , NGOs were the only actors making deliberate efforts, though constrained by limited resources, competing priorities, and short-term project designs. These efforts included the distribution of drought-tolerant seeds, and piloting solar-powered irrigation systems. Beneficiaries were primarily small-scale rainfed wheat and olive farmers, who faced the highest exposure to drought and erratic rainfall. Frustration was widespread regarding the limited number of sustainable livelihoods programs as respondents highlighted that the emergency response was mainly limited to food. This imbalance was driven by donor emphasis on emergency relief, and implementation of more technical programs was deprioritised due to the highly complex political and legal environment.

Unlike most conflict affected settings, considering the instability of humanitarian assistance delivery corridors being tied to the UN Security Council cross-border mandates, overlapping local authorities, international sanctions on the Syrian regime, and strict donor anti-diversion and anti-terrorism compliance rules. Together, this created an unprecedented governance vacuum as there were no functioning national agricultural institutions to regulate markets or inputs. NGOs were constrained from investing in long-term systems such as veterinary networks or irrigation rehabilitation, and in this vacuum, an unregulated input market emerged. Interviewees described how low-quality or unauthorized seeds, pesticides, and vaccines were widely traded across the Turkish border without quality checks.

To summarise, NGOs prevented outright collapse of livelihoods and food systems, but their interventions were limited to short project cycles, basic quality control, and insufficient community engagement. As a senior humanitarian specialist concluded: ***"The biggest disease we face is short-term thinking."***

To further understand this context, the impact on different groups and coping mechanisms, three value chains, wheat, olive, and livestock, were chosen as case studies. This is due to their critical role in sustaining food security and income in NWS, vulnerability to climate change and conflict induced threats, various degrees of female participation, and cultural importance in rural life. These value chains illustrate not only the systemic constraints in the agricultural sector but also its enduring capacity for resilience and recovery.

Section 2: Agri-food sector in NWS:

To capture the complexity of how conflict and climate interact in NWS, this research adopted a value chain case study approach rather than treating agriculture as a single sector, value chains allow researchers to trace how shocks ripple through production, processing, and marketing stages, and how different actors experience these impacts.

Case Study 1: Wheat Value Chain

This section summarizes findings from interviews with different actors and stakeholders in the wheat value chain, including farmers, grain traders, Ag-inputs suppliers, agronomists, ag-pharmacists, silos, bakeries, mills, labourers, water committees, local authorities, and community representatives.

- Production

Before the armed conflict, wheat was not only Syria's most strategic crop but also the backbone of national food security. Bread and other wheat-based foods dominate the Syrian diet, making domestic production critical for community resilience (Sharma & Sharma, 2025). The government-maintained control over inputs and marketing: seeds, fertilizers, and irrigation were regulated through public institutions, while the General Establishment for Cereal Processing and Trade (HOBOOB) acted as the sole buyer, stabilizing farmer incomes and distributing wheat to over 140 collection centres nationwide (Ahmed, 2016). This centralization ensured relatively stable prices, infrastructure investment, and a guaranteed market, shielding farmers from international volatility. However, wheat cultivation is largely dependent on rainfall, with only some farmers using complementary irrigation, placing it at high risk of climate-induced shocks such as drought and rainfall variability.

The 2024–2025 agricultural season provides a stark illustration of this vulnerability, according to the FAO, winter rainfall was over 69% below the long-term average, leading to near-complete crop failure in many areas. The resulting production deficit was estimated to be 2.73 million metric tons, enough to feed 16.25 million people, driving food insecurity to alarming levels (FAO, 2025b). this led to the abandonment of nearly all rainfed wheat cultivation in AEZs 2 and 3, where rainfall averages 250–350 mm and 200–250 mm, respectively (Jaafar et al., 2015).

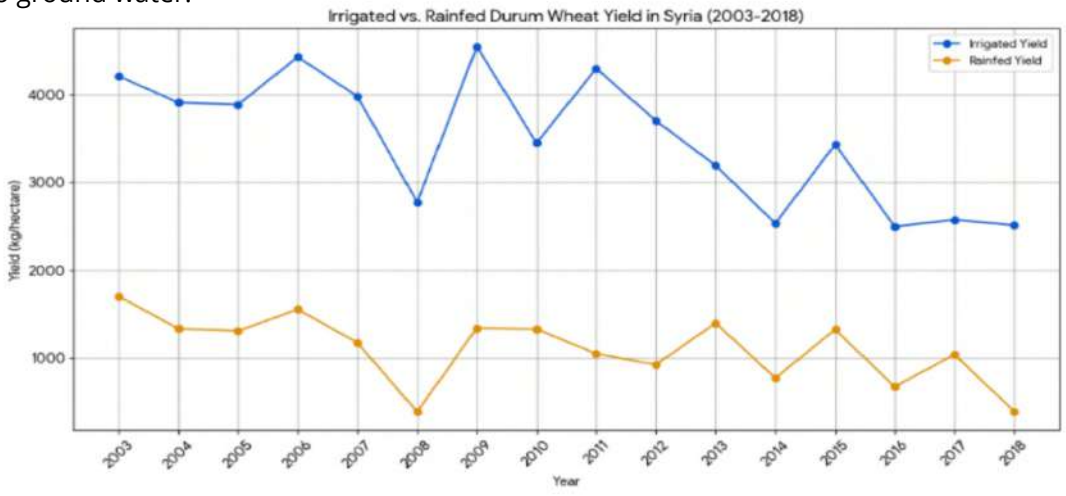
By contrast, Zone 1, which typically receives over 350 mm annually, maintained limited irrigated production but still recorded an estimated 25–30% decline in cultivated area due to groundwater depletion and high irrigation costs. Overlaying drought data with conflict intensity further reveals that the hardest-hit AEZs correspond directly to conflict-affected governorates such as Aleppo, Hama, and Idlib, where displacement, damaged irrigation infrastructure, and input shortages compounded the rainfall deficit. This intersection of climatic and conflict pressures created a "threat multiplier" dynamic—where environmental stress magnified the governance vacuum and institutional breakdown in the wheat value chain.

Table 3 - Durum wheat production 2002 – 2020, (Ministry of Agriculture, 2020):

Durum Wheat Production in Syria between 2002–2020, presented by the Syrian Ag-Statistical group, shows how wheat production and cultivated areas between 2003 and 2020 consistently varied. There is a notable drop in rainfed yields during major drought years such as 2008, shown in red. While irrigation provided significantly higher and more stable yields throughout this period, overall production saw a sharp and sustained decline after 2010 due to the compounding factors of conflict, drought, input shortages, market instability, and currency depreciation. Despite some recovery in 2019 and 2020 that could be associated with rainfall improvements, production levels remained below the historical amounts before 2011.

Year	Irrigated + Rainfed Area (ha)		Rainfed Area (ha)	
	Production (tons)	Area (ha)	Production (tons)	Area (ha)
2002	2,319,671	831,931	620,279	430,488
2003	2,456,136	843,708	742,794	436,985
2004	2,225,281	848,655	565,216	424,284
2005	2,067,029	800,776	528,860	405,210
2006	2,230,390	760,785	614,706	396,156
2007	1,816,397	703,984	410,818	350,970
2008	947,848	602,713	115,708	302,581
2009	1,581,834	541,202	367,295	274,241
2010	1,307,144	550,958	371,276	279,758
2011	2,043,813	718,113	334,960	320,668
2012	1,833,347	748,758	311,155	337,761
2012	1,611,144	690,591	461,218	330,405
2013	952,964	577,634	221,915	288,925
2014	1,460,343	641,530	463,821	351,228
2015	1,141,514	754,806	273,227	407,296
2016	1,154,581	673,697	390,405	376,775
2017	754,684	613,600	143,545	370,415
2018	1,763,802	721,165	623,883	363,645
2019	1,672,849	744,123	490,571	374,689

Looking at durum wheat production in KG per hectare on the national level, *Figure 18 – wheat production 2003 - 2018),* the trend highlights the clear vulnerability of rainfed wheat to drought and instability. Irrigated wheat, though higher in yield , still fluctuated due to conflict and water stress resulting from decreased rainfall contribution to ground water.



After 2012, central government collection systems broke down in opposition-held areas, and local traders filled the vacuum by importing seeds and flour from Türkiye or regime-held regions, often at high cost and low quality. Since the General Organization for Seed Multiplication (GOSM) in the opposition-controlled areas had limited capacity to meet the demand for seeds compared to before the conflict, local farmers were forced to opt for private seed traders whose seed quality was a major concern. As a result, 34% of farmers indicated that they used seeds from their own production or preferred to wait for NGO distribution.

Interviewed wheat farmers reported that privately traded seeds have limited disease resistance, are often infected with pests and diseases, and have poor purity due to mixing with other seeds (durum and soft wheat seeds, or wheat and barley together). In addition, the country of origin is not always Syria, meaning seeds are often unsuited to the domestic climate.

Speaking to wheat farmers on their preference between durum and soft, 85% reported preferring durum wheat, citing its resilience to water shortage and higher survival rates, requiring fewer fertilizers and pesticides compared to soft wheat varieties. This shows a clear shift in practices due to climate change and armed conflict induced pressures. Farmers also highlighted that durum is essential for producing burghul (bulgur), a staple food that can be stored for long periods, making it particularly valuable for food security under conflict and climate stress. However, decisions are not made purely on preference, as farmers emphasized that choosing between durum and soft wheat is determined by external factors such as rainfall forecasts, expected market demand, and household risk appetite. While soft wheat offers higher market demand for bread production, it requires more water and inputs, which many farmers cannot secure consistently. In practice, cultivation choices are informed by community-level information sharing where farmers frequently reported 'reading the market' together by discussing rainfall, neighbouring crops, and recent harvest outcomes, reviewed collectively with family, peers, and community.

Interviewed farmers recalled that before the armed conflict, access to fertilizers was relatively stable through the General Establishment of Fertilizers, even for those with limited purchasing power due to subsidized credit from the Agricultural Bank. However, the armed conflict led to record-low fertilizer supply and a surge in prices for imports. This was primarily due to the closure of domestic fertilizer plants during the conflict, increased transport costs, and sanctions disrupting access to international suppliers which affected the quality of different crops such as wheat (Mehchi, 2022). Furthermore, the depreciation of the Syrian pound and sanctions against the regime severely affected supply chains of agricultural inputs. According to the FAO, fertilizer imports declined by more than 50% compared to pre-2011 averages, while prices for urea and phosphate fertilizers rose more than fivefold between 2011 and 2018 (FAO, 2022). All of the interviewed agricultural pharmacies indicated that the quality of imported fertilisers had deteriorated, reporting that they were expired, adulterated, or diluted. This reduced their effectiveness and damaged crops, which despite being communicated by farmers with local councils, and NGOs seeking a solution but there was no action taken.

Many farmers indicated that markets offer expired or low-quality products including fertilizers and pesticides at lower prices, yet many farmers are forced to use them due to their limited purchasing power or not being informed on their negative impacts. To mitigate such issues, farmers are demanding stronger markets and border controls, in addition to better access to information on technical inputs and climate resilient programs. Without this , farmers will continue being exposed to different risks for each agricultural cycle, facing debt, crop failure, and lack of income, which risks forcing farmers to shift away from strategic crops, reduce the cultivated areas, or abandon agricultural activities. Farmers in NWS raised serious concerns in relation to pests and insects, and the low quality and the skyrocketing prices of pesticides. More than 70% of interviewed wheat farmers reported massive losses due to pests and diseases, and that they are facing these challenges with low quality inputs and limited diagnostic capacity in the absence of extension services. This is especially true for emerging pests and diseases in NWS, which all interviewed farmers attributed to prolonged droughts and erratic rainfall. In response, some farmers considered that wheat was no longer a feasible crop during the conflict due to the low incentives.

What emerges from these testimonies is not only the challenge of pest and disease pressures in NWS, but also the collapse of the governance system. Armed conflict dismantled formal extension and regulatory bodies, while climate change compounded the crisis by increasing the frequency of droughts and extreme weather, creating higher demand for inputs at precisely the time when supply systems were weakest. Together, conflict and climate shocks created a governance vacuum, where unregulated local markets and informal traders dominated input supply. Labour, while less central in wheat production compared to other crops, was not immune. It was mentioned in all interviews with actors in the wheat value chain that labour availability fluctuated due to displacement and migration. Seasonal workers were harder to find during drought years, when reduced cultivation meant fewer jobs and wages, disproportionately affecting landless labourers who rely on seasonality for income.

- Economic impact

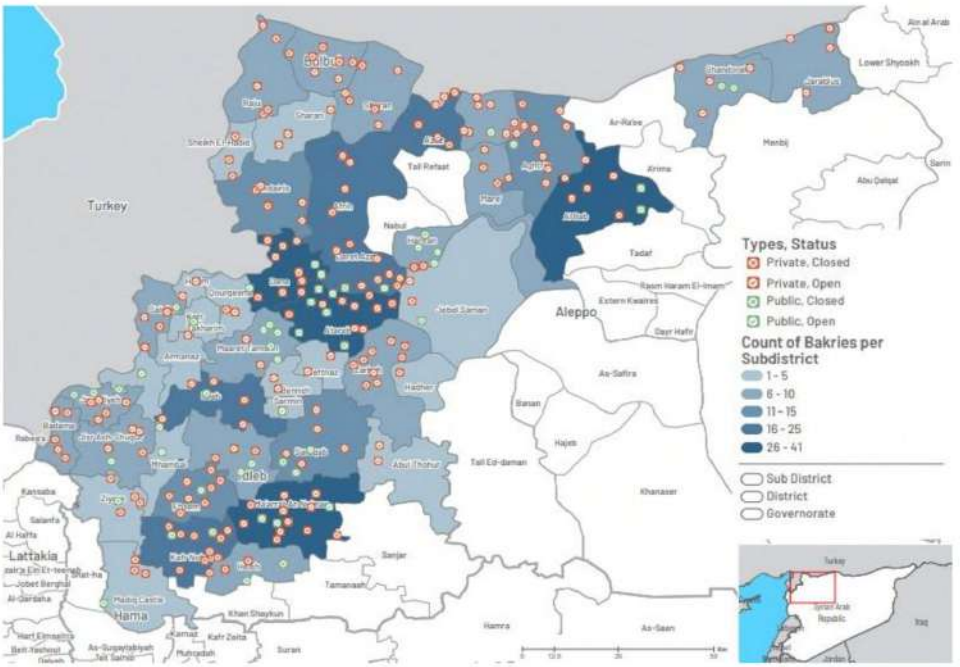
Wheat farmers reported that the wheat farming could no longer provide a stable source of income due to the collapse of price control and market manipulation by traders, especially those controlling wheat imports through Türkiye, including Ukrainian and Russian suppliers. This has left farmers exposed to the global market without any protection by their national government, leaving them unable to cover even basic costs of production when markets are flooded with cheaper wheat or flour.

Over 70% of wheat farmers reported many incidents of selling at prices allowing no profit. During drought periods, small farmers preferred to grant access to local livestock herders to graze in their land at a low price instead of incurring harvesting expenses and financial losses. This practice occurred mainly during drought periods, when rainfed harvests were so poor that selling the crop was unviable. This difficult market environment is exacerbated by the lack of safety, destroyed roads, armed checkpoints imposing fees or informal 'taxes', and many wildfire incidents, both accidental and those resulted from deliberate shelling causing economic losses and production instability. While farmers call for a return of the structured and controlled system similar to that of the pre-2011 regime, it is important to note that such centralised control was also criticised by local actors for stifling competition and farmer autonomy. Under the fragmented governance in NWS during the armed conflict, establishing even basic price stabilisation mechanisms wasn't possible due to variable military and political control, and limited institutional capacity, coordination and exposure to a fluctuating market. Competition between Turkish grain traders in North of Aleppo, Syrian regime, SDF, and others led to a race to purchase the largest amount at the lowest price possible, often with the use of political pressure.

Pre-2011, wheat was primarily stored in government-supported silos and large warehouses, which allowed for bulk preservation and relatively stable quality. This infrastructure has largely collapsed due to bombing, leading to smaller scale storage. Interviewed grain traders shared that they relied on private warehouses, while farmers rely on low-cost adaptations such as storing wheat in ventilated rooms, underground pits, or plastic sacks within their homes. These methods are short-term and highly vulnerable to humidity, pests, and heat. In 2019, iMMAP screened all silos in NWS and found only two in the Jarablus and Idleb sub-districts were reported as functional out of more than 15 silos in NWS (iMMAP, 2022). Grain traders described moving from storing thousands of tons in large silos to holding only a few hundred tons in small warehouses or dozens of tons in household storage, to reduce exposure to bombing (ibid). Rising temperatures and heatwaves were also mentioned as influencing storage, exacerbating post-harvest losses followed by humidity and insects. According to grain traders, quality control is mostly done manually by farmers and traders themselves, since no functioning public authority provides standardized inspection. As indicated by interviewed electricity providers, capacity was limited to provide power to such machinery due to destruction of the government grid and limited rehabilitation efforts because of ongoing conflict.

These examples highlight how conflict and climate act as threat multipliers where armed conflict destroyed centralized storage, forcing risky small-scale alternatives, while rising temperatures and humidity from climate stress further undermined grain quality. Interviews with mill owners reported damage to mills caused by bombardment, clashes nearby , and looting incidents requiring farmers to deliver their harvest to alternative mills with further transportation expenses. Storage emerged as one of the most fragile points in the wheat value chain, with a clear decline in capacity and reliability since the conflict began. This is because they represented easy targets for airstrikes and were deliberately destroyed in areas outside regime control due to the severe impact on residents and direct threat to food (Insecurity Insight, 2023).

In 2019, iMMAP and the Food Security and Livelihoods (FSL) cluster published a map of bakeries' functionality *(Figure 19 – Bakeries functionality 2019),* showing a significant disruption in bakery operations, including widespread closures, erratic bread supply, and inconsistent pricing mechanisms. It is important to note that what were considered public bakeries during the armed conflict were not under the control of the regular Syrian Public Establishment for Grain (SPEG) as the was the case prior to 2011.



Instead, bakeries were reporting to different armed groups and local authorities, which had consequences on bread prices, availability, and quality, often leading to sharp inflation and unequal access across neighbouring villages.

Ownership of bakeries and wheat-related infrastructure also frequently shifted during the conflict from public control to armed groups and private individuals, creating constant instability in management and accountability. Such fluctuations disrupted production planning, discouraged investment in equipment and staff, and undermined trust in market stability. Combined with climate-related shocks that further reduced wheat availability, these governance vacuums left communities facing unreliable access to bread, one of the most critical components of household food security. This illustrates how conflict-induced institutional instability and climate stressors together amplify vulnerability, with ownership changes acting as a multiplier of existing fragility in the wheat value chain.

Prior to the armed conflict in Syria, agricultural value chain actors' access to credit was ensured by the government and through national and local financial institutions. This encouraged farmers to use agriculture inputs secured on credits such as seeds, fertilisers, pesticides and fuel. Tractors and machinery were made accessible through instalment plans, and these financing methods were described by one wheat farmer as making ***"wheat cultivation a very stable and guaranteed deal before the conflict."***

During the armed conflict, there was no substitute for essential financial support and aid systems, leaving farmers in rural community without safety nets and infrastructure. Humanitarian aid filled some of the gaps with inputs provisions and other programs covering needs partially, but with exclusive focus on the small farmers. Some respondents mentioned the presence of informal, high-interest loans offered by local traders that could not be covered by wheat crop profits and risked deepening poverty rather than alleviating it. While wheat farming is generally male dominated, women's role in the wheat value chain is significant as they carry out sowing, weeding, packaging, storage, and processing wheat into bulgur or freekeh. No surveyed woman reported owning land or being identified as a wheat farmer, which underscores limited land ownership among female community members. Surveys estimate that women perform about 70% of essential tasks, however despite this contribution, women are paid 20–50% less than men for comparable work. As a local wheat farmer explained:

"Women handle seed cultivation, harvesting, and processing; their roles increased due to male migration, but wages are lower due to the nature of work."

This combination of limited land ownership and wage disparity constrains women's economic agency and reduces access to credit, cooperative membership, and bargaining power in markets.

- Challenges and opportunities:

In summary, wheat value chain actors described challenges such as chronic water shortages, declining yields, limited access to quality seeds and fertilizers, and frequent disruptions to planting and harvest cycles due to insecurity. Climate shocks such as droughts, frosts, and humidity-related crop diseases further undermine production. Meanwhile, outdated farming practices and weak access to milling and storage facilities also reduce efficiency and value addition. Social barriers restrict women's participation in marketing and decision-making, and youth disengagement from agriculture has created labour gaps. These challenges can be grouped by urgency. In the short term, farmers emphasised the need for affordable inputs (seeds, fertilizers, pesticides) and reliable access to water and fuel, whether through fuel subsidies or solar-powered irrigation. In the medium term, investment in certified seed systems, pest management, and rehabilitation of small-scale milling and storage would help stabilize production. In the longer term, climate-resilient strategies such as conservation agriculture, crop diversification, and community-based cooperatives are needed to sustain productivity and reduce conflict over resources.

Adaptation efforts were observed in farmers who are adopting drought-resistant wheat varieties, participating in experiments with improved soil management, and benefiting from NGO support. Farmers are shifting to alternative crops or investing in solar-powered irrigation to reduce fuel reliance. Yet, farmers repeatedly stressed that opportunities for resilience cannot be realised without structural changes at the political and institutional level. They linked their major challenges not only to climate variability but also to sanctions, trade restrictions, and the absence of central governance. A specific opportunity lies in recognising women's central yet undervalued roles in post-harvest processing and small-scale marketing. Rather than investing primarily in large male-dominated cooperatives, support could focus on women-led wheat processing SMEs that improve household food security and create income opportunities.

Similarly, targeted programs for youth could link digital extension services, agribusiness incubation, and contract farming to reduce disengagement from agriculture. A stable recovery plan, the lifting or easing of sanctions on agricultural inputs, and secure movement of people and goods across borders were described by interviewees as preconditions for meaningful recovery. Climate change further compounds these challenges, making investments in certified seed systems, renewable energy for irrigation, and cooperative strengthening even more urgent. These dynamics underscore opportunities for climate-resilient programming and scaling up climate smart agricultural practices. These practices include expanding certified seed systems, investing in renewable energy for irrigation, strengthening cooperatives, and recognising of the existing role of women and youth to evolve the wheat value chain into a sustainable and resilient system.

What is the compounded impact of climate change and armed conflict on wheat value chain?

Primary data from farmers, traders, and community representatives highlights how conflict and climate change do not act in isolation but reinforce each other in predictable causal chains. For example, drought reduces rainfall and groundwater recharge, pushing farmers to shift to irrigation; conflict-driven fuel price spikes then make irrigation unaffordable, forcing land abandonment. Similarly, armed conflict induced sanctions and currency depreciation inflate input costs, forcing farmers to rely on low-quality imported seeds with poor yields and disease outbreaks, altogether discouraging further investment.

Climate-induced droughts, erratic rainfall, frosts, and crop diseases reduce yields and strain water resources. In turn, conflict magnifies these stresses by restricting land access, damaging irrigation and storage infrastructure, and displacing agricultural labour. Border closures, sanctions, and currency depreciation further inflate the cost of inputs, leaving farmers dependent on poor-quality alternatives that depress productivity. The combined effect is widespread production decline, market fragmentation, and reliance on low-quality imports for bread production. This dual pressure deepens socio-economic vulnerabilities, such is the case for many women who face heavier workloads during climate shocks, while conflict limits their mobility and access to fair wages, entrenching gender inequality. Youth are also affected by reduced access to formal education, and disillusionment with agriculture push many to migrate or shift to other income sources, often in risky sectors. Interview data shows that even when households attempt adaptation strategies such as drought-resistant seeds or solar-powered irrigation, these efforts often fail due to insecurity, lack of credit, and aid dependency.

In short, climate change erodes the natural foundations of wheat production, while conflict strips away the systems needed to cope. Together, they create a vicious cycle that dismantles the wheat value chain in NWS, destabilizes markets, and drives households deeper into food insecurity. This analysis demonstrates that neither climate shocks nor conflict alone would have caused this collapse; it is their interaction, confirmed by farmer testimonies and KII insights, that explains the scale and persistence of wheat production decline in NWS.

Case study 2: Livestock Value chain

This section summarizes findings from interviews with different actors and stakeholders in the livestock value chain focusing on sheep, goat, and cows (livestock herders, veterinarians, feed supplier, labourers, dairy processors, slaughterhouse, butchers, transportation, local authorities, and community representatives).

- Production

Before the armed conflict, the livestock sector was one of Syria's strongest pillars of rural livelihoods and food security, representing nearly 40% of agricultural GDP and employing more than 20% of the rural workforce (FAO, 2017). Nationally, the country ranked first worldwide in Awassi sheep production, with approximately 20 million sheep, as well as 3 million goats, and 1.5 million cattle (MoA, 2010). Strong state institutions provided organized veterinary care, subsidized feed, breeding programs, and export systems leading Syria to self-sufficiency in meat and dairy production, with a surplus capacity for export (ibid). Years of conflict and climate stress dismantled this foundation: from 2011 to 2018 national herd numbers declined by more than half in directly affected areas with displacement, feed shortages, and loss of pasture (Braam, 2022). Many herders in NWS were forced to sell livestock at reduced prices or abandon production altogether (ibid). This was confirmed according to 82% of herders who reported their herd sizes had fallen from pre-war averages of 50–100 animals to only 10–30 animals today. This contraction was driven by a combination of feed and water scarcity, disease outbreaks, and the loss of grazing land due to displacement and insecurity. More than three-quarters of interviewed herders reported at least a 50% reduction in pasture availability, while over 80% face severe water shortages as traditional sources have dried up or become unsafe.

The collapse of veterinary services has intensified animal health challenges, and diseases such as Foot-and-Mouth Disease (FMD), Peste des Petits Ruminants (PPR), and pasteurellosis spread widely as vaccination campaigns became sporadic or ceased altogether (Braam, 2022). All veterinarians interviewed in NWS confirmed the prevalence of these diseases and reported an almost tenfold increase in medicine and vaccine prices. In several localities, FMD incidence rose compared to pre-conflict levels, while PPR re-emerged with localized mortality exceeding 30% among small ruminants. Likewise, Pasteurella and parasitic diseases have tripled in frequency since 2018, according to 67% of interviewed veterinarians. The weakened immunity of livestock caused by heatwaves and drought, coupled with poor shelter and overpopulation in displacement areas, has made outbreaks nearly impossible to contain. Mortality rates are now estimated between 20% and 40%, compared to below 10% before the conflict (Braam, 2022). These shocks have hit herders hardest, eroding income and assets.

Primary data show that 70% of herders experienced income losses exceeding 50% compared to pre-conflict levels. Feed prices have increased by more than 500% since 2011, while the prices of animals and animal products have not kept pace. One herder attested that ***"The price of feed has increased more than fivefold, but the price of animals has not risen at the same rate."*** To cope, 82% of herders reported selling female animals or young stock, an erosive coping mechanism that undermines long-term recovery and herd regeneration. Others have shifted from cattle to goats due to their lower feed and water requirements. Goats have proven more resilient to harsh conditions, while cattle requiring substantial inputs were the most frequently abandoned.

Dairy processors and slaughterhouses mirror the collapse in production capacity, as before 2011, dairy processing and cold storage were widely distributed and supported by formal infrastructure. Today, more than 60% of processing units in NWS are non-functional with remaining facilities operating at only 20–30% of capacity (UN OCHA, 2024b). Processors reported a 70% decline in milk supply and a shorter milking period due to feed and water shortages. Rising costs of packaging, energy, and fuel have further eroded margins, and the lack of cold chain facilities forces processors to sell locally with limited profit. Some respondents expressed fears about declining milk quality and the potential misuse of antibiotics, raising public health concerns.

Formal wholesale markets that once connected rural producers to urban consumers have largely disappeared, replaced by fragmented and hyper-local networks dominated by middlemen. Nearly 82% of interviewed herders reported paying informal taxes ranging from $40 to $120 per truck at checkpoints. These transaction costs, combined with insecurity, have stripped producers of bargaining power. ***"The traders control the selling prices, and we have no influence or power to negotiate"*** said a female livestock producer in Aleppo countryside. Middlemen are reported to capture an estimated 30–50% of final sale value. Transporting livestock is also fraught with risk, as all herders reported that they fear theft, shelling, or kidnapping during movement, pushing them to sell locally at discounted prices to mitigate security risks. Consumers, in turn, are caught between declining purchasing power and falling product quality. Butchers noted that many households have reduced or stopped meat consumption, shifting to cheaper inputs as a coping strategy including bones.

Women have emerged as the backbone of the remaining livestock economy. With male household members killed, displaced, or engaged in other livelihoods, women have assumed expanded roles in animal care, milking, and dairy processing. While women traditionally managed feeding and processing tasks, they now oversee daily herd management and animal health decisions. Despite this transformation, over 90% of interviewed women remain excluded from market access, veterinary training, and formal support programs, which continue to be restricted to male community leaders. This contradiction, where women carry the heaviest workload but retain the least decision-making power limits household resilience and the potential for sectoral recovery.

- Economic impact

Economically, the livestock sector exemplifies a system under compounded stress, where conflict, climate, and market failures have combined to dismantle the foundations of rural production and income. Soaring prices of feed, veterinary medicine, and water that is paired with the destruction of processing units and cold-chain infrastructure which have dramatically eroded profitability across the value chain. Herders are often forced to sell female animals at distressed prices to cover immediate expenses, thereby reducing their future productive capacity. Meanwhile, the purchasing power of consumers has collapsed, further depressing demand for meat and dairy. ***"Climate change has led to poor rainfall and degradation of natural pastures, making milk production weak"*** a dairy processor said, summarizing a crisis that extends from producers to end consumers. Primary data shows a catastrophic decline in income for pastoralists and livestock herders, with 70% reporting their monthly earnings had fallen by more than half compared to pre-conflict levels.

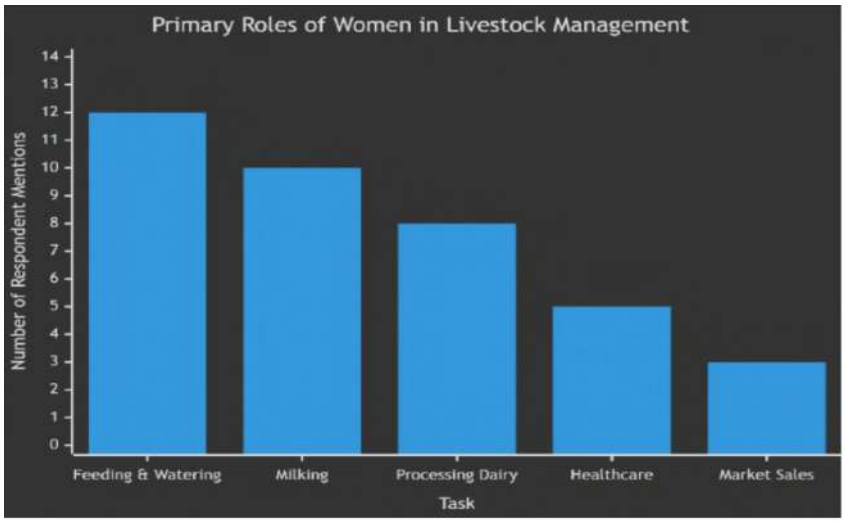
Nearly all interviewees described worsening conditions since 2018 due to the combined effects of drought and price shocks. This is reflected by reported feed cost increases of over 500% since 2011, according to FAO and iMMAP data, while feed supply itself has decreased by roughly 40% due to import disruptions and degraded pastures. In contrast, animal prices have not risen accordingly , squeezing profit margins and increasing debt: ***"The price of feed has increased more than 500%, but the price of animals has not risen at the same rate"*** one herder explained.

Processors and slaughterhouses operate under conditions of scarcity and insecurity. With feed shortages reducing milk yields and drought shortening the milking season, dairy production has declined both in quantity and quality. Processors report that milk's fat content has dropped due to inadequate grazing and heat stress on animals, while bacterial contamination risks have increased because of the absence of cold-chain facilities and uncontrolled antibiotic use by untrained herders. Average milk output per animal is now estimated at less than 50% of pre-conflict levels. One butcher echoed these dynamics, saying: ***"I receive more customers for bones rather than for meat."*** Meat quality has also deteriorated as animals are often undernourished or diseased, with herders forced to sell sick animals at lower prices.

These erosive coping mechanisms such as selling female animals, slaughtering diseased stock, and reducing herd size undermine the sector's recovery potential by depleting its reproductive and productive assets. Many herders sold their stock simply to meet food needs, driving themselves into irreversible poverty and debt. Households have responded by increasing self-production of dairy products to cut costs, but this has simultaneously reduced demand for formal dairy producers who face high input and energy expenses. The result is a cycle of asset depletion, income erosion, and shrinking market participation.

Women have emerged as the de facto backbone of livestock management in the NWS, taking on expanded responsibilities as men migrate, join other income activities, or are lost to conflict. Interviews revealed that women's roles traditionally focused on feeding, watering, milking, and dairy processing have broadened to include herd management, animal health monitoring, and even market interactions. Yet, despite these added burdens, women remain excluded from veterinary extension, training, and financial decision-making, as most programs are still channelled through male intermediaries. o Greater female participation in the sector is not reflected in policy and programme decision making. This reduces household resilience and entrenches gender inequities. Women work longer hours, balancing domestic and productive labour under increasing hardship, with little access to tools, finance, or recognition.

Figure 20 shows women's reported roles in the livestock sector, yet despite the high workload, they remain largely invisible in program design and service delivery. Critically, recovery is not simply about restocking animals, but requires an integrated approach that stabilizes inputs, rebuilds health systems, and establishes fair, sustainable market linkages to restore livestock as a viable livelihood.



- Challenges and opportunities:

Livestock and dairy value chain actors described multiple challenges. The unaffordability and scarcity of feed and green fodder caused by degraded pastures, drought, and soaring costs was consistently highlighted among the most urgent needs. The collapse of veterinary services has left animals exposed to preventable diseases where only vaccination campaigns have taken place. Producers also struggle with poor market access due to insecurity, damaged infrastructure, and reliance on exploitative middlemen. Milk collectors, processors, and retailers face low and inconsistent supply, inadequate cold-chain, high transport and fuel costs, and limited access to finance. Rising production costs paired with low selling prices undermine profitability across the chain, while consumers face shortages and unaffordable prices for dairy and meat products despite a clear preference for local goods. Women livestock keepers play an essential role in feeding, milking, and processing, but face cultural barriers to participate in marketing and decision-making, while the overall sector suffers from the erosion of institutional and technical support.

At the same time, opportunities exist short-term humanitarian interventions such as subsidized feed, vaccines, and improved access to water can prevent further herd depletion. Medium-term recovery efforts include re-establishing veterinary services through mobile clinics and community animal health workers, models which have been tested globally. Other strategies include forming inclusive producer cooperatives to bypass middlemen, strengthen bargaining power, and reduce conflict risks by building social cohesion. Long-term adaptation could involve value addition through local dairy processing (cheese, yogurt, ghee), investments in solar-powered refrigeration, breed improvement through artificial insemination, and innovative fodder production methods adapted to the changing climate. Framing these options by urgency and feasibility is essential: short-term humanitarian support, medium-term systems recovery, and long-term climate adaptation. Within this, targeted investment in women's dairy enterprises offers promise, since women are already the main actors in household-level dairy production but remain excluded from equipment, finance, and formal training.

What is the compounded impact of climate and conflict on livestock value chain?

Primary data from herders, veterinarians, and processors shows that climate change and armed conflict do not operate in parallel but rather interact in sequential chains that magnify each other's effects. For example, drought reduces pasture availability, pushing herders to rely heavily on purchased feed. Yet conflict-driven price spikes and border closures make this feed unaffordable, forcing many herders to sell animals at distressed prices. This practice shrinks herd sizes and undermines future productive capacity. Similarly, the destruction of veterinary systems and cold-chain facilities during the conflict left animals without access to vaccines or medicine. At the same time, heatwaves and prolonged drought further weakened animal immunity, allowing preventable diseases such as foot-and-mouth disease (FMD) and Peste des petits ruminants (PPR) to spread widely and cause high mortality.

Water scarcity adds another layer of stress as climate-induced drying of springs and wells increased dependence on fuel-powered pumps for groundwater. However, conflict-driven fuel shortages and price inflation rendered pumping increasingly unsustainable, leaving animals exposed to dehydration and reducing milk yields. Market access also reflects this compounded logic as conflict damaged roads and markets, while insecurity and checkpoints cut producers off from urban buyers. As a result, perishable products like milk are often sold cheaply to local traders, leaving producers with little income and consumers facing shortages and price volatility. The cumulative outcome is catastrophic due to widespread herd depletion, falling milk and meat yields' quantity and quality, declining household incomes, and the collapse of formal processing and distribution systems. Social vulnerabilities are also deepened, as evidenced by women who have assumed greater responsibility for herd management due to male absence but remain excluded from market participation and decision-making. Youth are also heavily affected by loss of herd inheritance, reduced access to education, and disillusionment with livestock work, pushing many toward risky labour migration.

In summary, climate change erodes the natural foundations of livestock production, while conflict dismantles the systems needed to cope. Neither climate stressors nor conflict alone would have caused the depth of collapse observed; it is their interaction, confirmed by testimonies and KIIs, that explains the scale and persistence of livestock decline in NWS. This demonstrates how sequential and reinforcing shocks dismantle not only production but also the governance and social fabric of the livestock value chain.

Case study 3: Olive Value chain

This section summarizes findings from interviews with different actors and stakeholders in the olive value chain covering (farmers, labourers, agronomists, local authorities, olive mills, water committees, transportation service providers, ag-pharmacists, and community representatives).

- Production

Before the armed conflict, Syria ranked among the top five olive and olive oil producers worldwide, with the olive tree in Syria going beyond a productive asset, but also representing a deep-rooted cultural symbol, with many studies considering Syria the historical homeland of the olive tree (Chikhi & Djelloul, 2022). Recognizing its strategic value, the government has always provided strong technical support, subsidies, and extension services through specialized research centres. By 2011, cultivated olive area reached 684,490 hectares, comprising approximately 103 million olive trees nationwide (Langreo, 2013), producing more than 1 million tons of olive fruits and 198,000 tons of olive oil (Siegel, 2023).

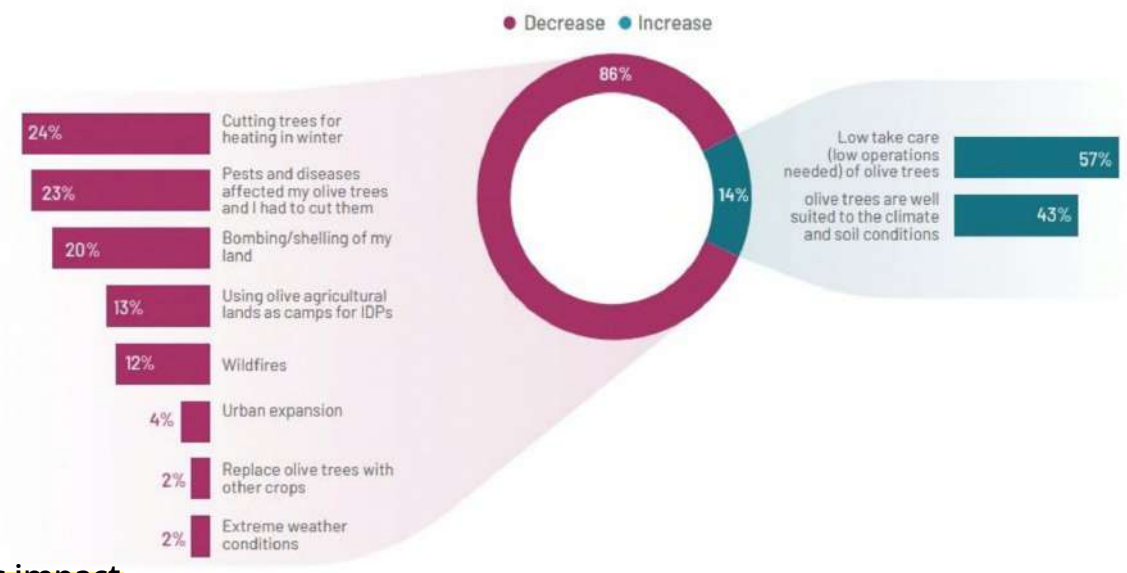
Since 2011, production has declined sharply due to the combined effects of conflict and climate change-induced stressors such as drought, heatwaves, and rainfall variability. Armed conflict drivers included large-scale displacement of farmers, technicians, and seasonal labourers, with widespread damage to orchards from logging, shelling, and land occupation by camps. It is estimated that 1.5 million olive trees were lost across NWS Syria since 2011, equivalent to about 1.5% of the national pre-conflict olive stock, but with far higher localized losses in frontline areas such as southern Idleb and western Aleppo, where interviewees reported the disappearance of entire groves.

Displacement and insecurity limited farmers' access to land, while fuel scarcity and the collapse of irrigation compounded stress on the remaining orchards. Climate events such as prolonged droughts, erratic rainfall, pest outbreaks (particularly Bactrocera oleae/the olive fruit fly, and Spilocaea Oleagina/peacock eye disease), and heatwaves that dried trees or scorched fruit were the most consistently cited factors. In higher-altitude zones, unseasonal frosts disrupted flowering, leading to depressed yields.

Primary data confirms these effects by 69% of interviewed olive farmers who linked the compounding stresses to visible reductions in yield and oil quality. 54% reported losing at least half of their pre-conflict oil output, while others estimated more severe losses , exceeding 80%. Limited irrigation access due to fuel cost spikes further undermined resilience, leaving most farmers unable to offset drought impacts. To cope, farmers adopted diverse adaptation strategies with varying success. The most common was intercropping that was practiced by about 40% of interviewed farmers, mainly with vegetables or cereals planted between olive rows. Farmers explained that this practice aimed to maximize land productivity and indirectly provide moisture to olive roots through irrigation intended for the secondary crop. However, results were mixed as agronomists estimated that intercropping improved household income stability by 10–20%, but had no measurable effect on olive yield recovery, and in some cases introduced new pests, particularly in cucurbit and solanaceous crops. Another 20% experimented with drought-tolerant olive varieties, often seedlings imported from Türkiye, but these showed mortality rates exceeding 50%, particularly in shallow soils without irrigation. Despite these challenges, olives remain relatively attractive compared to more input-intensive crops like wheat or vegetables because they require less inputs. Yet, the combination of climate variability, conflict-induced displacement, and economic collapse has sharply reduced both productivity and profitability.

Overall, while olives remain attractive compared to more input-intensive crops such as cereals, the combination of climate and conflict has sharply reduced productivity and profitability, leaving most farmers in NWS unable to maintain pre-2011 levels of production. For example, more than 70% of olive farmers in Idleb and 75% in Aleppo reported rainfall instability as the key threat, and a minority turned to alternative irrigation, though most could not afford diesel, pumps, or water trucking.

This was elaborated further by the next figure developed by iMMAP indicating this observation in further detail *Figure 21 – Olive cultivation in NWS,* (iMMAP, 2023c):



- Economic impact

During the armed conflict, the olive market in NWS became fragmented and distorted, shaped by ad hoc trade arrangements rather than organized value-chain systems. Traders developed temporary deals to move oil into regime areas, yet checkpoint fees and informal taxes absorbed a substantial share of profits, leaving producers with minimal margins. These arrangements were often intertwined with informal negotiations over water, fuel, and electricity access, underscoring the collapse of formal market governance. Local producers simultaneously faced severe price distortions due to the influx of low-quality olive oil imported from Türkiye and the resale of humanitarian food parcels containing vegetable or olive oil at below-market prices. Among 32 olive oil traders and farmers , 84% reported that these factors eroded local competitiveness and profitability, forcing farmers to delay harvests or store oil for longer in poor conditions to avoid selling at a loss.

Olive mills, though less frequently damaged by direct bombardment, faced crippling operational costs. Five mill owners described how rising fuel prices, scarcity of spare parts due to border closures and sanctions, and recurrent power outages drastically reduced extraction rates and oil quality. This resulted in a sharp contraction in production. Local agronomists estimate that average extraction efficiency and oil quality fell during recent seasons, further undermining both domestic and export potential. This was exacerbated by trade routes being closed, as the Turkish government restricted olive oil imports from Syria, demanding formal certification to protect its domestic industry. Without access to internationally accredited testing centres, all of which were based in Damascus and cut off from NWS, local producers were prevented from exporting legally. 75% of interviewed farmers and traders in Afrin and Azaz confirmed that oil was being smuggled into Türkiye, where it was repackaged and sold as Turkish-origin oil.

These unregulated channels yield limited benefit to Syrian producers, who receive only a fraction of the final sale price. Quality assurance has deteriorated sharply with official laboratories non-functional, and informal testing methods relying on colour, taste, and odour cannot meet export standards. Post-harvest handling further undermines competitiveness as most farmers still rely on plastic containers, burlap sacks, or open-air storage, which increase oil acidity and reduce shelf life. Oil is typically sold in 16-litre tins, limiting market flexibility and premium branding. Only one of six mills reported partial recycling of wastewater into fertilizer, while the rest discharge olive mill effluents directly into fields or streams, posing serious long-term soil and water contamination risks.

"Because of the conflict, women lost the head of the family, and this forced women to assume additional responsibilities and make most of the decisions to survive."

However, these expanded roles remain informal and undervalued considering that women continue to earn 20–40% less than men for comparable work, are largely excluded from market negotiations, and face strong cultural barriers to mobility and training. 57% of respondents identified local customs as a primary obstacle preventing women from attending NGO-led training or collective marketing initiatives, resulting in only one in five women accessing external support.

This imbalance represents both a vulnerability and a missed opportunity: while women sustain much of the value chain's manual labour, they lack formal ownership, finance, and decision-making power. Strengthening women-led cooperatives, improving access to small credit, and offering tailored training in olive oil grading and marketing could transform their role into a cornerstone for livelihood recovery and local economic resilience.

- Challenges and opportunities

Olive value chain actors described how recurrent droughts, erratic rainfall, late frosts, and frequent pest infestations weaken trees and reduce yields, undermining both oil quantity and quality. These stresses are compounded by high costs for fuel, fertilizers, pesticides, and irrigation, while damaged roads and mills further disrupt processing and transport. Market access is equally constrained due to insecurity, border closures for export and limited control for imports. Imported olive oil and internationally procured humanitarian parcels further distorted demand and flooded the market with low-quality imported oil, pushing many farmers into distress sales. Women, who provide much of the labour in harvesting, processing, and household-level value addition, remain excluded from decision-making and face wage disparities and cultural barriers that limit their access to markets and training. Together, these pressures erode profitability and threaten the long-term viability of the sector.

At the same time, a range of adaptation and opportunity pathways were noted with some farmers intercropping between olive trees to diversify food and income. Others have begun experimenting with drought-resistant varieties, though mortality rates remain high but further efforts could yield positive results. Drip irrigation and rainwater harvesting are being piloted, and small groups of producers are exploring organic practices. Local mills and processors have identified opportunities in higher-value products such as olive pickles, soap, and cosmetics. These could strengthen income sources if supported with better storage, sustainable energy, and packaging. Cooperative initiatives, though still limited, are seen to bypass middlemen and improve bargaining power, while targeted training and microfinance could enable women to move from informal labour to more legally and culturally visible leadership roles. These experiences highlight both the fragility of the current system and the potential for recovery through climate-resilient practices, local value addition, and more inclusive cooperative structures.

What is the compounded impact of climate and conflict on livestock value chain?

Primary data from farmers, mill owners, and community representatives shows that climate change and armed conflict do not act separately but reinforce each other in predictable sequences that dismantle the olive value chain in NWS. Recurrent droughts and increasingly erratic rainfall weaken trees and reduce yields, forcing farmers to rely on irrigation. Yet conflict-driven fuel price spikes and the destruction of irrigation networks make irrigation unaffordable or impossible, leaving trees even more vulnerable to pests and diseases. Outbreaks of olive fruit fly and peacock eye disease then spread unchecked, as the conflict has also dismantled agricultural extension services.

Many families have been forced to abandon groves or sell land, breaking intergenerational ties to olive farming. These field-level stresses cascade through processing and markets as poor-quality fruit produces high-acidity oil, while conflict-driven trade fragmentation and Turkish import restrictions trap producers in oversupplied local markets with depressed prices . Rising costs for fuel, fertilizers, and packaging priced in foreign currency combine with revenues in devalued Syrian or Turkish lira to erode already thin margins. Mills operate at a fraction of their former capacity, constrained by damaged infrastructure, scarce spare parts, and fuel shortages.

The compounded crisis is also deeply gendered when observing women, who play a primary role of the olive labour force, now shoulder expanded responsibilities in harvesting, processing, and land management due to male displacement or migration. Yet they remain excluded from market negotiations, training, and access to modern tools. This contradiction means women bear the heaviest workloads under worsening climate stress but have the fewest opportunities to adapt, reinforcing structural inequalities.

For youth the situation is no brighter, as they face reduced access to formal education and employment, leading many to abandon olive farming altogether and migrate or shift to precarious income sources. While some adaptation efforts are visible, such as piloting drought-resistant varieties, intercropping, or NGO-supported technical trainings, these measures remain fragmented and often inaccessible particularly to youth, women, and smallholders. Youth also struggle to access these opportunities, while even successful pilots are undermined by insecurity, lack of credit, and aid dependency.

Farmers consistently stress that while conflict has been the most immediate driver of destruction, climate change poses the deeper and more permanent threat.

In summary, climate change erodes the natural foundations of olive cultivation, while conflict strips away the systems needed to process, trade, and adapt. Together, they trap producers in a downward spiral of declining yields, fractured markets, and gendered vulnerabilities, transforming the olive sector from a historically export-oriented system into a fragile, subsistence-oriented struggle for survival.

Section 3: Summary and Further Insights

This research demonstrates how the compounded impact of climate change and armed conflict have undermined Syria's agri-food system. Across all value chains, production losses stem from the interaction of environmental degradation and institutional collapse. Wheat yields have fallen due to prolonged water scarcity, soaring input price , and disrupted markets; olive cultivation has been damaged by heat stress, pests, and neglected orchards; and livestock herds have sharply declined under drought, disease outbreaks, and the collapse of veterinary and fodder systems. These overlapping shocks erode food security, livelihoods, and community resilience at both household and regional levels.


Taken by Violet Media Team
Aleppo Syria - OCT 2025

The evidence confirms a clear causal pattern where climate change erodes the natural foundations of production, while armed conflict dismantles the systems and institutions needed to cope. Neither factor alone could have produced such widespread collapse, but their interaction explains the depth, scale and persistence of Syria's agriculture decline.

Importantly, perceptions among local actors reveal nuanced understandings of these intertwined crises. While climate change is widely viewed as a long-term and inescapable threat, the armed conflict, despite its devastation, is seen as a temporary condition that will eventually subside. When asked which stressor had affected them more, respondents were divided. Producers such as farmers and herders emphasized climate impacts, whereas processors, traders, and transporters pointed to conflict-related barriers. This differentiation underscores how each stressor strikes at different stages of the value chain.

Yet within this compounded crisis lie emerging opportunities for transformation. The collapse of outdated agricultural services and centralized governance structures has inadvertently created space for innovation and reform. Women, propelled by economic and demographic pressures, have assumed central roles in farming, herding, and processing, positioning them as key agents of adaptation and recovery. Farmers are increasingly experimenting with renewable energy solutions such as solar-powered irrigation, while growing awareness of resource depletion is driving interest in climate-smart and sustainable practices. Compared with neighbouring countries, Syria's agriculture may now be more open to change precisely because old systems have broken down. There is little appetite to return to pre-conflict models, an observation echoed by both producers and technical experts.

While the interaction of armed conflict and climate change remain complex, it is not insurmountable. This juncture represents both a crisis and a unique opportunity to reimagine Syria's food systems by rebuilding institutions, integrating climate resilience, and promoting gender inclusive governance and women's empowerment.

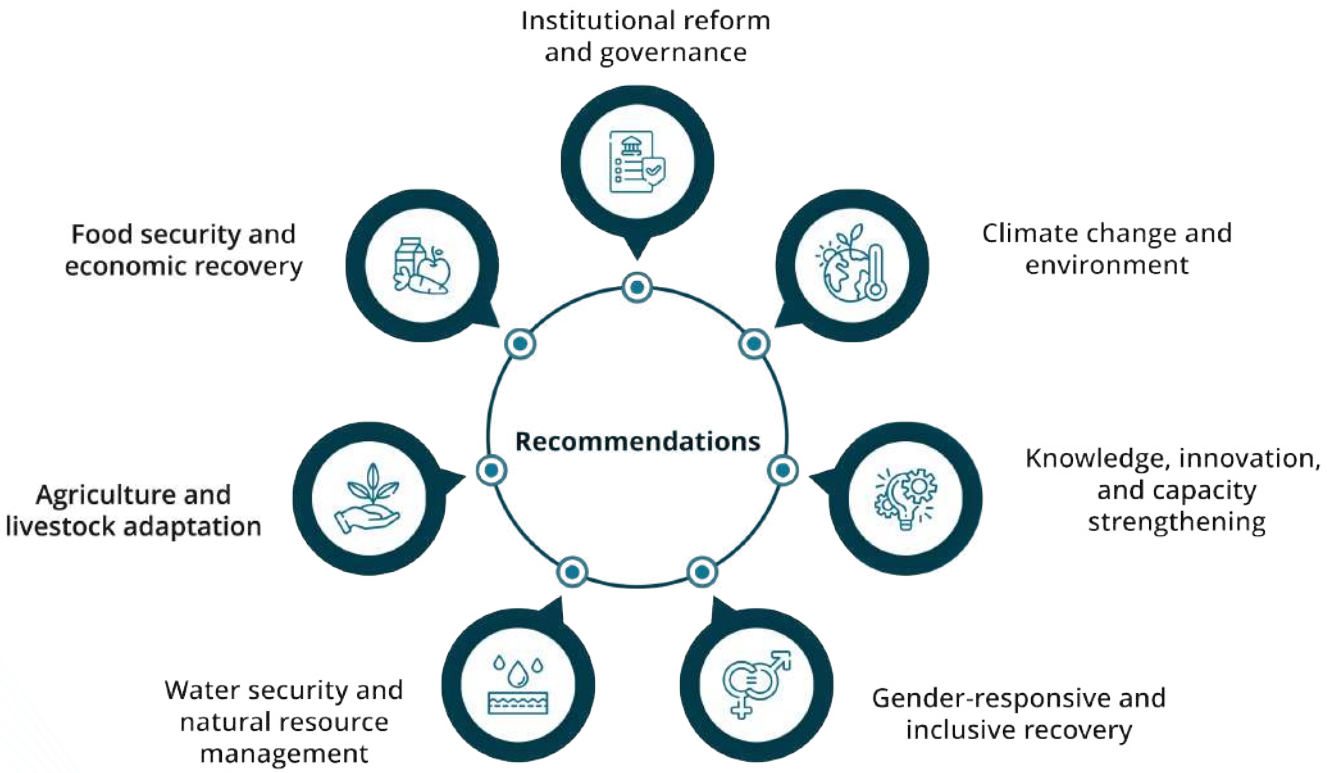
The following chapter presents recommendations and practical pathways to advance institutional reform, food security, and climate adaptation, ensuring that Syria's recovery is both sustainable and resilient.

Chapter IV: Recommendations

This study set out not only to document the compounded effects of climate change and armed conflict on agriculture in Northwest Syria but also to capture community-led perspectives on recovery and adaptation. The recommendations presented here therefore reflect analytical conclusions and locally grounded insights from farmers, herders, local leaders, technical experts, and institutional stakeholders. These are shaped by lived experiences, practical constraints, and the recognition that a sustainable recovery must integrate immediate humanitarian relief, medium-term systems restoration, and long-term climate adaptation. The evidence underscores that armed conflict and climate change interact as mutually reinforcing stressors.

Armed conflict weakens governance and institutions, while climate pressures degrade the natural resource base. Addressing this dual crisis requires a sequenced, multi-dimensional approach that simultaneously restores institutional capacity, strengthens local economies, rebuilds social cohesion, and enhances resilience to environmental shocks. Accordingly, the recommendations are structured across three timelines:

- Immediate-term (0–1 year) – stabilize livelihoods and protect remaining productive assets.
- Medium-term (1–3 years) – rebuild systems, restore capacity, and consolidate recovery.
- Long-term (3–5 years) – transition toward sustainable, climate-resilient agri-food systems.



Each of the seven thematic areas below represents a core pillar of Syria's recovery and adaptation pathway, linking governance reform, resilience-building, and inclusive growth:

1. ***Institutional reform and governance:*** Rebuild the governance architecture of Syria's agricultural and food systems to ensure coordination, accountability and equitable participation. This includes reactivating agricultural institutions, harmonizing humanitarian and development planning, and embedding conflict sensitivity and peacebuilding within agrifood policies. Additionally, strengthening multi-year funding frameworks and promoting transparent, decentralized management will help restore trust and functionality in local governance.

2. ***Food security and economic recovery:*** Revive food production and rural economies through localized, market-based recovery. Priorities include rehabilitating productive infrastructure, supporting cooperatives, facilitating access to finance, and promoting inclusive value chains that connect farmers to markets. These actions should balance urgent food security needs with long-term strategies for economic diversification, job creation, and resilience against global price shocks.

3. ***Agriculture and livestock adaptation:*** Foster climate-resilient agriculture and livestock systems to stabilize yields and protect rural livelihoods. This entails expanding drought-tolerant and heat resistance crop varieties, scaling up conservation agriculture, investing in sustainable fodder production, and restoring veterinary and agriculture extension services. Integrated training and access to modern equipment are essential to rebuild technical capacity and productivity.

4. ***Water security and natural resource management:*** Ensure sustainable and equitable access to water as a cornerstone of agricultural recovery. Key actions include the rehabilitation of irrigation networks, investment in water harvesting, improving groundwater recharge, and integrated solar and wind -powered water systems. Strengthening water governance and ecosystem restoration will mitigate conflict over resources and secure the natural base of Syria's food systems.

5. ***Gender-responsive and inclusive recovery:*** Recognise women and marginalized groups as key actors in recovery and adaptation. Expand access to land, finance, training, and leadership positions and ensuring fair wages and safe working conditions. Empowering women in agricultural governance not only enhances productivity but also promotes social cohesion and more equitable resource management in post-conflict settings.
6. ***Knowledge, innovation, and capacity strengthening:*** Invest in localized research and applied innovation, to drive adaptive and informed agricultural planning. Strengthen linkages between farmers, researchers, and policymakers through participatory knowledge platforms, digital tools and early warning systems. Capacity building programs should prioritize practical field-based learning to enable responsive, evidence-based decision-making.

7. ***Climate change and environment:*** Embed climate adaptation and environmental management at the core of Syria's reconstruction efforts. Integrate renewable energy solutions into agricultural production and rural services, promote afforestation and waste recycling, and establish environmental standards in rebuilding efforts. Mainstreaming low-emission, resource-efficient development will reduce vulnerability to future

Building on the strategic priorities outlined above, the following detailed recommendations translate these themes into practical, time-bound actions that respond directly to the intersecting challenges of armed conflict recovery and climate adaptation in NWS. Recognizing that Syria's agri-food system operates under conditions of political uncertainty, fragmented governance, and heightened environmental stress, the proposed interventions are sequenced across short-, medium-, and long-term horizons to align humanitarian relief with recovery and resilience-building efforts. Each thematic area identifies targeted roles for local councils, NGOs, women's groups, farmers' associations, private actors, and donors. Together, these measures form a coherent framework that links urgent stabilization needs (such as feed, seed, and water support) to structural transformation (including renewable energy integration, cooperative strengthening, and institutional reform).

Timeline/ Thematic Area	Institutional Reform & Governance	Food Security & Economic Recovery	Agriculture & Livestock Adaptation	Water Security & Natural Resources	Climate & Environment	Knowledge & Capacity
Immediate-term (1–0 year) Actors: (Local councils, NGOs, Donors, women groups, farmers groups)	Adopt flexible financing & multi-year cycles: short-term humanitarian grants ignore seasonality; flexible, multi-year financing reduces wasted inputs and improves adaptation planning. Repair climate-damaged agricultural infrastructure: conflict destroyed silos/mills and drought increased post-harvest losses. Rehabilitation (using renewable energy) protects harvests and reduces emissions. Establish and support community-level resource governance: conflict eroded state oversight and drought fuels competition over water/pastureLocal committees with women's representation reduce disputes and ensure equitable access. Introduce social protection mechanisms: link food vouchers and cash-for-work to land rehabilitation and irrigation repair, prioritising women-headed households and IDPs.	Localise production & grain stocks: armed conflict blocks imports; local reserves reduce volatility. Include small-scale, renewable-powered silos at community level. Implement cash-for-work and vouchers: link CFW to soil restoration and canal clearing, while ensuring women and youth participation. Support local cooperatives for input distribution reduces market distortion and ensures equitable input access.	Roll out veterinary campaigns and mobile clinics: Prevent herd collapse in drought-hit and displaced zones. Provide targeted subsidies (fodder, seeds, fertilizer): protect smallholders from input price spikes. Deliver training/tools for women and smallholders: equip them with irrigation kits, solar dryers, dairy processors, and basic repair skills. Encourage small-scale household fodder cultivation builds feed security during droughts.	Promote household rainwater harvesting and recharge ponds: stabilize water access and reduce conflict. Support community water committees: ensure equitable, gender-balanced water management and maintenance oversight.	Integrate basic climate-risk screening in all agriculture projects: avoid maladaptation (e.g., unsuitable crops, groundwater depletion). Launch small-scale renewable pilots: solar pumps and dryers reduce fuel dependency. Start local awareness campaigns: link deforestation, waste burning, and soil degradation to climate vulnerability.	Conduct rapid applied research: especially important considering new pests (climate effect) and lost extension (armed conflict effect). Quick studies + adaptive seed trials in Zone 3/2 fill urgent knowledge gaps. Build quick-response climate data hubs: collect and share localized rainfall/ temperature info with farmers via SMS.

Timeline/ Thematic Area	Institutional Reform & Governance	Food Security & Economic Recovery	Agriculture & Livestock Adaptation	Water Security & Natural Resources	Climate & Environment	Knowledge & Capacity
Medium-term (1–3 years) Actors: (Local councils, NGOs, Donors, local universities, women groups, farmers groups)	Establish localized climate and early warning systems: conflict disrupted national networks; localised systems help farmers adapt planting schedules. Strengthen extension and seed centres: conflict dismantled services; restoring them with drought-tolerant, climate-resilient varieties and women extension agents rebuilds trust. Develop cooperative-run markets: middlemen exploit fragmented markets; cooperatives stabilise prices and improve transparency. Advance waste and rubble recycling initiatives: conflict left rubble, climate degraded soil. Community-led recycling and composting restore farmland and prevent contamination. Support local tax and market reforms: encourage equitable taxation, reducedfees on sustainable farming, and incentives for women-led enterprises.	Support youth and women-led SMEs: develop micro-enterprises in Agri-processing, dairy, and seedling nurseries. Strengthen producer cooperatives: facilitate collective bargaining, equipment sharing, and local market access.	Establish fodder banks: buffer shortages during extreme drought. Promote soil restoration: encourage composting, organic fertilisers, and climate-smart land practices. Implement Artificial Insemination and livestock registration pilots: improve breeds and track health, while noting political sensitivities.	Shift to drip irrigation and smart agriculture: reduce fuel and water use. Support groundwater monitoring systems: local data improves management and reduces over-extraction.	evelop local climate adaptation plans: based on community risk mapping and livelihood diversification. Strengthen ecosystem restoration: tree planting on degraded rangelands and buffer zones around farms. Link rubble reuse to land rehabilitation: combine climate and recovery goals.	acilitate farmer –researcher working groups: co-design adaptive trials to ensure local relevance. Deploy digital crop/price info apps: rebuild transparency and market connectivity.

Timeline/ Thematic Area	Institutional Reform & Governance	Food Security & Economic Recovery	Agriculture & Livestock Adaptation	Water Security & Natural Resources	Climate & Environment	Knowledge & Capacity
Long-term (3–5 years) Actors: (National ministries, chambers of commerce, NGOs, Donors, private banks, local universities, women groups, farmers groups, private sector)	Strengthen agricultural banks and credit access: enable affordable, climate -resilient loans for farmers. Establish water-sharing agreements: reduce transboundary risks worsened by drought and scarcity.	Revive exports: rebuild certification labs, ensure domestic food security before expanding trade.	Adopt national grazing legislation: prevent overuse and degradation of rangelands, promoting rotational grazing and reforestation.	Invest in desalination and wastewater reuse: large-scale, renewable-powered plants for long-term resilience.	Introduce green reconstruction codes: integrate energy efficiency and sustainable materials. Update NDCs and reengage in global frameworks: align with climate financing opportunities. Expand renewable energy infrastructure through solar/wind grids, private-sector partnerships, and incentives.	Institutionalize research-to-policy mechanisms: Ensure evidence-based planning through joint task forces.

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Annex 1

Climate and Conflict Events

in Syria 2010 - 2025

prepared by: Violet Media Team

بنفسج
VIOLET

SPARC
Supporting Pastoralism and Agriculture in Recurrent and Protracted Crises

ODI Global

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