Food and Agriculture Organization of the United Nations

Regional mapping of anticipatory action capacities in the Near East and North Africa agricultural sector

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Food and Agriculture Organization of the United Nations
Rome, 2025

REQUIRED CITATION
FAO. 2025. *Regional mapping of anticipatory action capacities in the Near East and North Africa agricultural sector.* Rome. https://doi.org/10.4060/cd7181en

ISBN 978-92-5-140178-1

Contents

Foreword

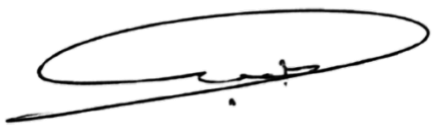
The Near East and North Africa (NENA) region is facing an increasingly complex risk landscape. Conflict, climate extremes, economic volatility, and transboundary animal and plant diseases are converging to threaten the resilience of agrifood systems and the livelihoods of millions. These challenges are growing not only in frequency and intensity, but also in their interconnectedness – compounding the vulnerabilities of rural communities and deepening food and nutrition insecurity across the region.

In this context, agriculture must be seen not only as a sector at risk, but also as a strategic entry point for proactive solutions. Anticipatory action (AA) offers a forward-looking approach to reduce the impacts of crises before they unfold. By harnessing early warning systems, risk information, and pre-arranged financing, AA helps protect lives and livelihoods. While the approach has gained ground in humanitarian practice, its application in agriculture remains limited and fragmented.

This report responds to the call from Food and Agriculture Organization of the United Nations (FAO) Members at the 37th Session of the FAO Regional Conference for the Near East and North Africa (NERC37) to strengthen AA systems for agriculture. It provides a timely assessment of the current landscape, backed by research, regional surveys, and consultations with stakeholders.

The findings offer actionable insights for governments, FAO, development partners, and practitioners. By placing agriculture at the heart of anticipatory action, we can reduce humanitarian needs, safeguard rural livelihoods, and build more resilient agrifood systems in the face of growing uncertainty.

I commend the collaborative efforts behind this important work and encourage all stakeholders to engage with its recommendations. Together, we can shift from reaction to anticipation, and from vulnerability to resilience.



AbdulHakim Elwaer
Assistant Director-General and FAO Regional Representative
for the Near East and North Africa

Acknowledgements

This document was developed through the collaborative efforts of the Food and Agriculture Organization of the United Nations (FAO) and the International Food Policy Research Institute (IFPRI). It was produced under FAO's Regional Priority 4 (RP4), *Building Resilience to Multiple Shocks in the Near East and North Africa Region*, and the FAO Regional Office for the Near East and North Africa led the process. It also contributes to FAO's global project *Scaling-up Anticipatory Action to Protect Agricultural Livelihoods and Food Security*, generously funded by the German Federal Foreign Office (GFFO).

The preparation of the document was carried out under the strategic leadership and guidance of Ayman Omer (Senior Field Programme Officer and RP4 Team Leader), and benefited from technical contributions by Elwathig Mukhtar, Niccolò Lombardi, Siphokazi Moloinyane, Hicham Assabir, Chamunoda Zambuko, Hui Xu, Zsuzsanna Kacso, PirroTomaso Perri, and Jacquelyn Pinat (all FAO).

We express our sincere appreciation to the IFPRI team for leading on the preparation of the document – particularly Sikandra Kurdi, Linda Steinhuebel-Rasheed, Fatma Abdelaziz, Abdallah Tarek, and Nada Shokry. Their expertise and dedication were instrumental in shaping the study.

Finally, we would like to thank FAO country teams across the region, as well as key informants from governmental institutions, regional organizations, and respondents to the online survey, whose valuable insights greatly enriched the development of this report.

Abbreviations

AA	anticipatory action
ACLED	Armed Conflict Location and Event Data
ARC	African Risk Capacity
CCIC	Climate Change Information Center
DG ECHO	European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations
DRM	disaster risk management
DRR	disaster risk reduction
EW4ALL	Early Warnings for All
EWS	early warning system
FAO	Food and Agriculture Organization of the United Nations
GBON	Global Basic Observing Network
GIEWS	Global Information and Early Warning System
INRA	National Institute of Agronomic Research (Morocco)
IFRC	International Federation of Red Cross and Red Crescent Societies
IPC	Integrated Food Security Phase Classification
IRC	International Rescue Committee
IWMI	International Water Management Institute
MEACAM	Middle East Anticipatory Climate Action Model
MHEWS	multihazard early warning system
NCM	National Center for Meteorology (Saudi Arabia)
NCSCM	National Centre for Security and Crisis Management (Jordan)
NENA	Near East and North Africa
NERC37	37th Session of FAO's Regional Conference for the Near East and North Africa

NGO	non-governmental organization
ORSEC	Organisation des Secours (Morocco)
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCWA	United Nations Economic and Social Commission for Western Asia
WFP	World Food Programme
WMO	World Meteorological Organization

Glossary

Anticipatory action is defined as acting ahead of a predicted hazardous event to prevent or reduce the impacts on lives, livelihoods and humanitarian needs before they fully unfold. This works best when activities, as well as trigger thresholds or decision-making rules, are pre-agreed, and decisions are made to guarantee the fast release of pre-arranged funding.[1] Terms like early action and forecast-based financing are also used interchangeably in the literature.[2]

A **hazard** is a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socioeconomic in origin.[3]

A **disaster** is a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts. The effect of the disaster can be immediate and localized, but is often widespread and could last for a long period of time.[4]

A **slow-onset hazard or disaster** is defined as one that emerges gradually over time. Slow-onset disasters could be associated with drought, desertification, sea-level rise, epidemic disease etc.[4]

An **early warning system** is an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities, systems and processes that enable individuals, communities, governments, businesses and others to take timely action to reduce the effects of disaster in advance of hazardous events.[5]

Multihazard early warning systems address several hazards and/or impacts of similar or different type in contexts where hazardous events may occur alone, simultaneously, cascading or cumulatively over time, and taking into account the potential interrelated effects.[6]

Climate change adaptation is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.[7]

Resilience is the ability of individuals, households, communities, cities, institutions, systems and societies to prevent, resist, absorb, adapt, respond and recover positively, efficiently and effectively when faced with a wide range of risks, while maintaining an acceptable level of functioning without compromising long-term prospects for sustainable development, peace and security, human rights and well-being for all. Systems, institutions, and people are considered resilient when they have at their disposal the following set of distinct capacities: (a) anticipative capacity; (b) preventive capacity; (c) absorptive capacity; (d) adaptive capacity; and (e) transformative capacity.[8]

Disaster risk financing refers to the financial mechanisms and instruments used to manage the potential economic impacts of disasters, strengthening resilience and ensuring rapid access to funds.

Executive summary

The Near East and North Africa (NENA) region faces a growing number of complex, overlapping, and compounding hazards that are undermining livelihoods, deepening food insecurity, and slowing economic development. Increasingly frequent and severe climate extremes – such as droughts, flash floods, heatwaves – are converging with transboundary plant and animal diseases, protracted conflicts, and economic volatility. These risks disproportionately impact the agricultural sector, which remains a cornerstone of rural livelihoods and food systems in the region. Smallholder farmers are particularly vulnerable, as they rely heavily on seasonal weather patterns, natural resources, and stable market access.

In this context, anticipatory action (AA) offers a promising, proactive approach to reduce disaster impacts by taking early action ahead of predictable shocks. Enabled by advances in climate forecasting, hazard modelling, and early warning systems, AA involves acting before a crisis unfolds. It uses pre-agreed triggers, protocols, and financing mechanisms to mitigate risks to lives and livelihoods. While AA is gaining traction in the NENA region, especially within humanitarian sectors, its integration into the agricultural domain remains limited and fragmented. Agricultural producers are often targeted as vulnerable recipients of humanitarian aid, rather than as essential actors whose protection is key to safeguarding food systems, rural economies, and national stability.

This report argues for a strategic expansion of AA to more systematically include the agricultural components, to place it at the intersection of humanitarian response and long-term climate adaptation. It emphasizes early protection of production systems – livestock, crops, fisheries, and natural resources – before forecasted shocks occur. By focusing on proactive risk reduction for agriculture, AA for agriculture offers a dual benefit: preserving rural livelihoods and protecting food supply chains, especially in fragile or climate-vulnerable areas.

The 37th Session of the Food and Agriculture Organization of the United Nations (FAO) Regional Conference for the Near East and North Africa (NERC37) recognized the urgency of this approach, calling for increased investment in AA systems for the agricultural sector. Priority areas include multihazard early warning systems (MHEWS), forecast-based financing mechanisms, agricultural insurance schemes, and links to social protection programmes. Yet significant gaps remain. Most AA frameworks in the region are led by international actors with limited national ownership, especially by ministries of agriculture. Early warning systems often exclude agriculture-specific risks or fail to reach rural producers. Trigger design and forecasting capacities are still nascent, and financing remains heavily reliant on external donors.

Drawing on a comprehensive literature review, interviews with key stakeholders, and regional online survey data, this report provides a detailed mapping of existing AA initiatives, agricultural hazards, and delivery capacities in the NENA region. It highlights governance, coordination, early warning, financing, and delivery challenges, while identifying promising opportunities for expanding AA to better address agricultural hazards.

Introduction

Scope and objectives

This report examines the current landscape of anticipatory action (AA) for the agricultural sector in the Near East and North Africa (NENA) region. As farm households in the region face growing risks from natural hazards, economic instability, and conflict, strengthening AA frameworks to include interventions targeted at protecting agricultural production and agrifood systems more broadly is essential to protect livelihoods, reduce humanitarian needs, and build long-term resilience.

The assessment has three main objectives:

- Assess the current status of anticipatory action
  To map and analyse existing AA initiatives, systems, and institutional arrangements relevant to the agricultural sector, including how AA is integrated into national disaster risk management (DRM) and adaptation strategies.

- Identify gaps, strengths, and opportunities
  To highlight key challenges – such as forecasting limitations, coordination barriers, or financing gaps – while also capturing promising practices, innovations, and opportunities for strengthening AA capacities in the region.

- Outline pathways for scaling up
  To propose practical pathways for expanding AA in agriculture, including integration into existing systems, improved cross-sector collaboration, and context-specific approaches adapted to the diverse risk and agricultural profiles across the NENA region.

Anticipatory action for agriculture in the Near East and North Africa region

An increasing number of hazards are endangering lives, undermining livelihoods, and hindering economic development across the NENA region. Climate extremes such as droughts and flash floods, natural hazards, animal diseases, plant pests, protracted conflicts, and economic shocks have all significantly increased over recent decades.[9,10] These overlapping hazards exacerbate vulnerabilities, particularly for agricultural households, which are highly sensitive to natural hazards, economic shocks, and conflict-related disruptions. Agricultural communities in NENA are often among the most economically disadvantaged, relying heavily on seasonal weather patterns, natural resources, and uninterrupted agrifood value chains.[9] Consequently, food insecurity remains persistent and expanding, especially among vulnerable smallholder farmers.

Given the rising frequency and intensity of these risks, effective disaster risk management is crucial to build resilience. Advances in data collection, statistical modelling, and forecasting now enable more accurate predictions of natural and conflict-related hazards.[11–13] These improvements create an opportunity for AA, a proactive approach that enables early intervention to mitigate disaster impacts before they fully unfold.[2] AA has gained prominence within the humanitarian sector as a framework to address a broad range of risks from both natural hazards and conflict,[14,15] relying on predefined risk

triggers, actions, and financing mechanisms to allow rapid response once a disaster is anticipated.[2,16] By mobilizing resources early and implementing preventive measures, AA aims to minimize crisis severity and reduce humanitarian impacts.

Efforts to promote AA frameworks in the NENA region are increasing,[17] with some initiatives focusing on key hazards and building capacities.[18] While broad AA strategies exist, agricultural components are often embedded within wider humanitarian objectives, such as cash transfers or emergency evacuations, rather than explicitly addressing food production itself as a core element of food security.[2,17,19] Agricultural households tend to be targeted primarily due to their vulnerability, not necessarily their central role as food producers. Given their dependence on land-based resources, disruptions to production and market access from hazards, whether natural or conflict, profoundly impact agricultural livelihoods.[20,21]

There is significant potential to expand primarily humanitarian AA concepts to systematically integrate the agricultural sector within AA frameworks.[5] This integration is not meant to replace existing models or long-term agricultural adaptation strategies but to complement them, positioning short-term disaster preparedness as both a tool for climate adaptation and humanitarian assistance that strengthens household and livelihood resilience over the long term. Placing farmers at the centre of food security and resilience strategies underscores their dual role as vulnerable populations and essential contributors to agrifood system continuity. Pre-emptive protection of production systems before shocks occur yields the dual benefit of preserving livelihoods and sustaining food supply chains.

Traditional agricultural policy and programme frameworks often focus on long-term climate adaptation, given the seasonal nature of agricultural production and recurring hazards such as heatwaves or floods.[5,22,23] However, alongside these gradual trends, more frequent and erratic hazards, such as extreme weather events, pest outbreaks, and conflicts, require fast, short-term responses. Early warning systems (EWS) for major hazards have improved significantly in the NENA region,[18,24,25] yet frameworks with pre-agreed financing and linked action remain scarce. As a result, many agricultural producers lack the means to prepare adequately for imminent shocks. Incorporating agricultural-specific actions within AA frameworks can effectively close the gap between long-term adaptation strategies and short-term humanitarian responses by integrating across both development and humanitarian sectors (humanitarian–development–peace nexus).[2,14,26] Thus, AA for agriculture supports immediate food security needs while contributing to rural transformation through stable agricultural livelihoods and resilient households.

Recognizing the critical role of agriculture in addressing food security challenges, the 37th Session of the FAO Regional Conference for the Near East and North Africa (NERC37) emphasized the importance of agricultural solutions to mitigate crises.[27] NERC37 specifically called for increased investment in AA systems in the NENA region focused on the agricultural sector, including the development of multihazard early warning systems (MHEWS), forecast-based financing mechanisms, the expansion of agricultural insurance schemes, and the integration with existing social protection mechanisms for vulnerable agricultural populations affected by both environmental and conflict-related risks.

To support the implementation of the recommendations, this report aims to map the most important agricultural hazards and existing AA initiatives, identifying gaps and opportunities for future regional frameworks focusing on the agricultural sector. The presented insights all originate from a

comprehensive literature review, key informant interviews, and data collected in an online survey (see Annex 1).

The state of agricultural risks in the Near East and North Africa region

Main hazards

The NENA region is increasingly exposed to a complex and compounding set of hazards that threaten agrifood systems and the livelihoods they support. These include a growing frequency and intensity of climate-related hazards, compounded by conflict and economic shocks. Together, these risks significantly undermine food security and the resilience of agricultural production systems across the region.

Meteorological and hydrological hazards represent the most significant threats to agriculture in NENA.[24] Rising temperatures, changing rainfall patterns, and prolonged droughts have a direct and often devastating impact on crop yields, livestock productivity, and water availability. Among these, drought and extreme heat events are particularly severe, often resulting in long-lasting disruptions to agricultural systems. Temperature increases have emerged as the leading climate hazard in recent years, particularly affecting the Middle Eastern Arab states.[24]

Water scarcity stands out as a critical and structural challenge across the region.[24,28] Many countries – including Algeria, Jordan, Lebanon, Libya, Morocco, Mauritania, Palestine, and Syrian Arab Republic – have experienced significant reductions in rainfall, further straining already limited water resources.[24] Groundwater is frequently overexploited, and overall water productivity in the region remains far below the global average (about 50 percent).[29] In this context, drought is often referred to as a "threat multiplier", intensifying food insecurity and deepening the vulnerability of rural communities.[24]

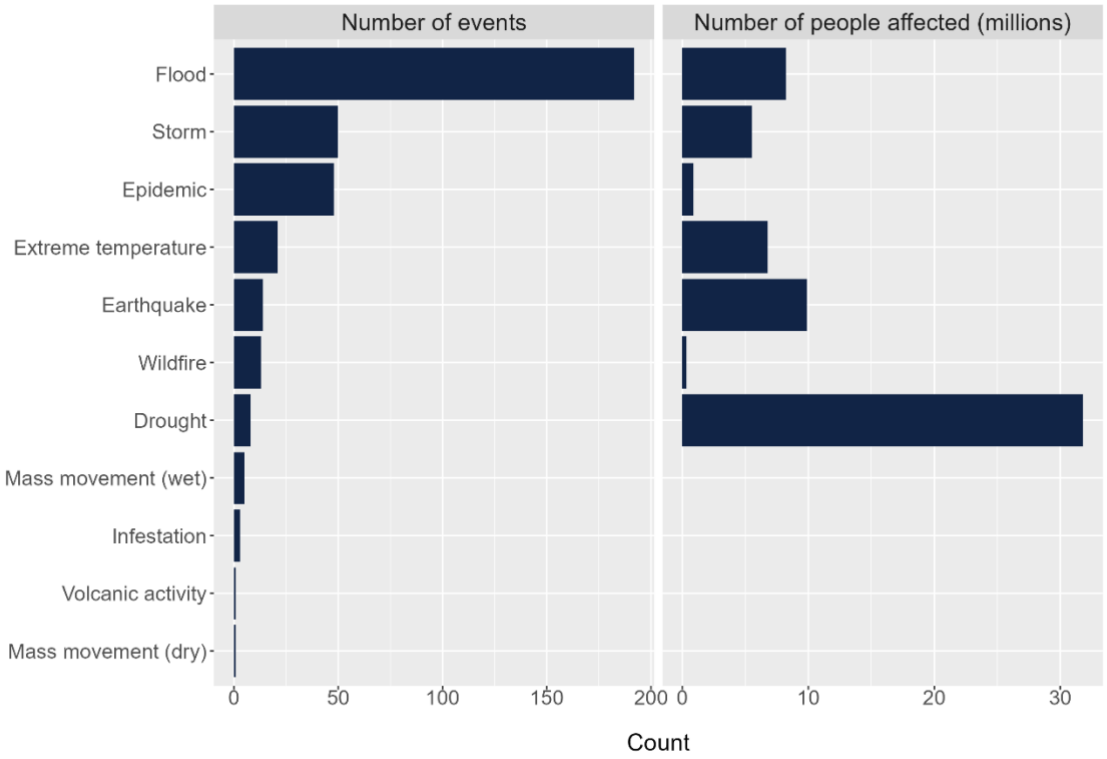
Analysing disasters in the NENA region over the past 25 years reveals a clear pattern: although short-duration events like floods account for the highest number of disaster events (left panel in Figure 1), droughts, earthquakes, floods, storms, and extreme temperatures dominate when it comes to the number of people affected. It is worth noting that – maybe with the exception of earthquakes – these are all hazards that are particularly relevant to the agricultural sector. This suggests that although the Emergency Events Database at the Centre for Research on the Epidemiology of Disasters captures disaster events more broadly, the data underlines the argument that agricultural households in the NENA region are especially vulnerable to disaster risks, highlighting the need for dedicated AA frameworks with agricultural components. Moreover, Figure 1 indicates that the frequency of hazard events does not necessarily correlate with the number of people affected. This is a critical consideration when allocating limited resources for early warning systems and AA frameworks.

Nevertheless, not all hydrological hazards are inherently detrimental. With proper infrastructure and planning, events such as floods and heavy rainfall could be transformed into opportunities through water harvesting and storage, particularly valuable in a region where water scarcity is chronic.

While conflict is not formally classified as a disaster under the Sendai Framework, it remains a major driver of disruption to agrifood systems across the NENA region.[20,30–32] Armed conflicts damage agricultural infrastructure, reduce access to farmland, disrupt supply chains, and lead to displacement of rural populations. In many cases, conflict and climate-related hazards interact, compounding and

prolonging their negative effects on food production and livelihoods.[24] This convergence – often referred to as the climate-peace-security nexus – is especially relevant in fragile contexts and must be considered when designing AA frameworks in the region.[33,34]

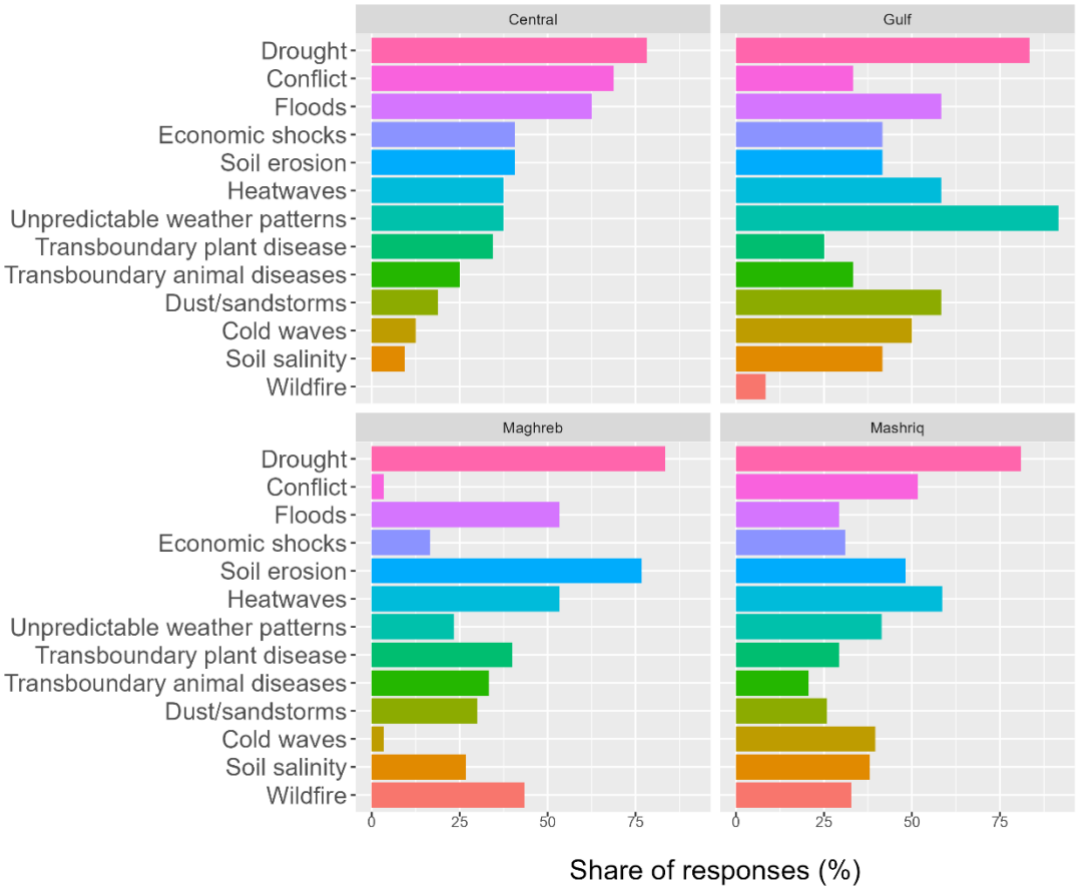
Figure 1. Number of disaster events and number of affected people in the Near East and North Africa region disaggregated by hazard types (2000–2025)



Source: Emergency Events Database at the Centre for Research on the Epidemiology of Disasters, events since 2000, NENA countries. [Cited 24 March 2025]. https://www.emdat.be/

In addition to conflict, the region is highly vulnerable to global economic shocks. Recent crises, such the war in Ukraine and the COVID-19 pandemic, have highlighted how external disruptions to global markets can rapidly affect food availability and affordability in NENA.[35,36] However, the degree of vulnerability to such shocks varies significantly across countries. Two key factors influence this: the extent to which a country depends on food imports, and how diversified its import sources are.[36] Countries that are highly import-dependent and rely on a narrow range of suppliers are more exposed to supply chain disruptions and global price volatility. Conversely, those with more diversified trade relationships tend to be more resilient. For instance, Egypt, the Sudan, and Yemen – countries heavily reliant on grain imports from the Black Sea region – were among the most affected by the supply disruptions caused by the war in Ukraine.[37] Similarly, the COVID-19 pandemic revealed the vulnerability of countries with limited domestic production and a lack of import diversification, further exacerbating food security risks.[35]

Figure 2. Main agricultural hazards in the Near East and North Africa region as indicated by respondents of the online survey by subregion



Source: Authors' own elaboration based on the results of the online survey.

Different types of hazards: The role of space and time

Agricultural hazards in the NENA region vary significantly over time and across space, shaping their impacts on food production and rural livelihoods. Temporally, some hazards manifest suddenly and intensely, such as floods, sandstorms, or extreme weather events, which cause immediate damage to crops, livestock, and infrastructure. These sudden-onset hazards can lead to sharp but relatively short-lived disruptions in agricultural productivity. In contrast, other hazards develop gradually over months or even years. Slow-onset hazards like droughts, pest and diseases, land degradation, desertification or sea-level rise as well as worsening political or economic conditions tend to erode the foundations of agricultural systems over time. Although their effects may be less visible in the short term, they gradually diminish soil fertility, reduce water availability, and destabilize rural livelihoods, undermining long-term resilience and sustainability.[38] This temporal continuum – from sudden shocks to chronic stresses – illustrates the diverse challenges facing agriculture in the region and the design of AA triggers and protocols (see section: Phased anticipatory action for agriculture).

Spatially, the importance of agricultural hazards varies considerably across the NENA subregions, reflecting differing environmental exposures and sociopolitical contexts (see Figure 2). Drought is consistently the most prominent hazard, with the highest share of responses in all four subregions – Central, Gulf, Maghreb, and Mashriq – underscoring its widespread impact across the region. Conflict emerges as a key concern in Central and Mashriq, but is reported far less frequently in the Gulf and Maghreb. Floods rank among the top three hazards in Central, Maghreb, and Mashriq, indicating their significance outside hyper-arid areas. The Gulf region stands out for its high share of responses citing unpredictable weather patterns, heatwaves, and dust or sandstorms, which are characteristic of its extreme climatic conditions. In contrast, respondents in the Maghreb place relatively greater emphasis on economic shocks and soil erosion, with lesser concern for conflict. The Central subregion shows a more balanced distribution among multiple hazards, including drought, conflict, floods, and economic shocks. These spatial patterns reinforce the importance of adapting agricultural risk reduction strategies to local hazard profiles, but also the importance of AA frameworks to consider simultaneous hazards for the agricultural sector (see section: Multihazard early warning systems).

Governance and coordination of anticipatory action for agriculture in the Near East and North Africa region

> *"In the end, it's [AA] individual efforts, not an institutionalized system."*
> Key informant interview, Egypt

Landscape and main actors in anticipatory action for agriculture

AA frameworks are inherently multistakeholder initiatives, as they must integrate technical components such as early warning systems and information dissemination, the mobilization and management of financing, and practical implementation at the local level. No single actor possesses the capacity to fulfill all these roles independently. This complexity underscores the need for clear frameworks and regulatory structures to support consistent implementation and enforcement. It also highlights the critical importance of both vertical and horizontal coordination.

The Anticipation Hub compiles the status of AA frameworks on a yearly basis. Table 1 presents the most recent overview of AA initiatives in the NENA region. As of 2024, there were six active AA frameworks in four NENA countries: Iraq, Lebanon, the Sudan, and Yemen. Two of these frameworks were also activated in 2024 (Iraq for drought and the Sudan for multihazard). An additional activation is reported for Palestine for food security, without a pre-agreed AA mechanism. There was also a big push to expand or start AA in Iraq and Mauritania. The main hazards addressed are droughts and floods. Only one AA framework in the Sudan considers multiple hazards.

In all listed initiatives, coordinating and implementing institutions are international stakeholders. It shows that in most cases there is government involvement and support for the frameworks, but we could not find any evidence of government-led AA initiatives. It is also notable that almost all active or upcoming AA frameworks are in NENA countries with a fragile setting. That is, there is no report of any frameworks in countries generally considered stable, such as the majority of Gulf or Maghreb states. Thus, it seems that AA, even if tailored to climate hazards, is generally more of an instrument in fragile settings (also for international stakeholders). This indicates that the AA concept is still very much anchored in the humanitarian sphere in the NENA region, and that expanding it to include development and agricultural sustainability targets more broadly is an important aspect to consider – both for national governments as well as the international community.

When it comes to AA frameworks that include explicit interventions for agriculture, FAO is currently leading the field in the NENA region, with programmes in the Sudan and Yemen. The AA framework in the Sudan, coordinated by Save the Children, also includes activities targeted at livestock. With several new AA frameworks under development, this represents an important opportunity to advocate for the inclusion of agricultural sector activities in Iraq and Mauritania.

Table 1. Active and upcoming anticipatory action frameworks in the Near East and North Africa region

COUNTRY	HAZARD	COORDINATING ORGANIZATION(S)	FUNDING ORGANIZATION(S)	IMPLEMENTING ORGANIZATION(S)	GOVERNMENT INVOLVEMENT*	BUDGET (USD)	PEOPLE TARGETED (REACHED)	FRAMEWORK STATUS**	ACTIVATION IN 2024*	AGRICULTURE	FRAGILE SETTING*
IRAQ	Drought	World Vision East Africa Regional Office	Aktion Deutschland Hilft	World Vision Iraq	x	33 557	7 657	A	x		x
	Drought	International Rescue Committee (IRC)	Trafigura Foundation	IRC				D		?	x
	To be determined	FAO	FAO		x			D		?	x
LEBANON	Flood	Government institutions; World Vision International	Aktion Deutschland Hilft; World Vision Canada	World Vision Lebanon	x		30 000	A			(x)
MAURITANIA	Drought	World Food Programme (WFP)	WFP Trust Fund	WFP	x			D		?	(x)
	Flood (riverine)		Italian government	Mauritanian Red Crescent				D		?	(x)
	To be determined	FAO	FAO		x			D		?	(x)

Table 1. (contd.)

COUNTRY	HAZARD	COORDINATING ORGANIZATION(S)	FUNDING ORGANIZATION(S)	IMPLEMENTING ORGANIZATION(S)	GOVERNMENT INVOLVEMENT*	BUDGET (USD)	PEOPLE TARGETED (REACHED)	FRAMEWORK STATUS**	ACTIVATION IN 2024*	AGRICULTURE	FRAGILE SETTING*
PALESTINE	Food insecurity	Start Network	Start Network	ActionAid; Age International (on behalf of HelpAge); Palestinian Agricultural Relief Committees		625 798	152 910	N	x		x
SUDAN	Multihazard	Save the Children Sudan	German Federal Foreign Office	Raise for Development and Humanitarian Aid; Save the Children Sudan; SOS Sahel Sudan	x	500 000 (327 198)	200 000 (173 010)	A	x	x	x
	Drought	FAO	FAO	FAO	x	1 000 000	59 000	A		x	x
	Drought	FAO	FAO	FAO	x	1 000 000	67 000	A		x	x
YEMEN	Storm-induced flood	Yemen Red Crescent Society	International Federation of Red Cross and Red Crescent Societies (IFRC)	Yemen Red Crescent Society		249 716	15 785	A			x

Source: Authors' own elaboration based on data from Anticipation Hub.[17]

Notes:
* X indicates "yes".
** D = "Under development", A = "Active framework", N = "No active AA framework".

Incorporating agriculture into AA frameworks will require stronger engagement with the right national government counterparts. Among all the active frameworks listed in Table 1, only the ones concerned with droughts list Ministry or Directorate of Agriculture as a government partner. For all the other frameworks, government engagement is primarily channelled through meteorological agencies, other ministries (e.g. Civil protection, Health, or Urban Planning) and regional authorities at the governorate level.

In our online survey, respondents were asked to identify the institutions responsible for preparedness and response to major agricultural hazards in their respective countries (see Figure 3). The three most frequently cited actors were ministries of agriculture, international organizations, and disaster management agencies or ministries. Among these, ministries of agriculture were identified as the primary actors for both preparedness and response – particularly for hazards like transboundary plant and animal diseases, droughts, and soil erosion – with very little variation in their role between preparedness and response.

While international organizations were recognized as leading actors in advancing more structured AA frameworks, their efforts were largely perceived to be concentrated on three agricultural hazards: droughts, floods, and conflict – the latter mainly in terms of emergency response. However, apart from conflict, ministries of agriculture were more commonly seen as the responsible authority for droughts and floods. Disaster risk management bodies, on the other hand, were more frequently associated with hazards like wildfires and sandstorms – risks that affect agriculture but also have broader implications for civilian safety and infrastructure.

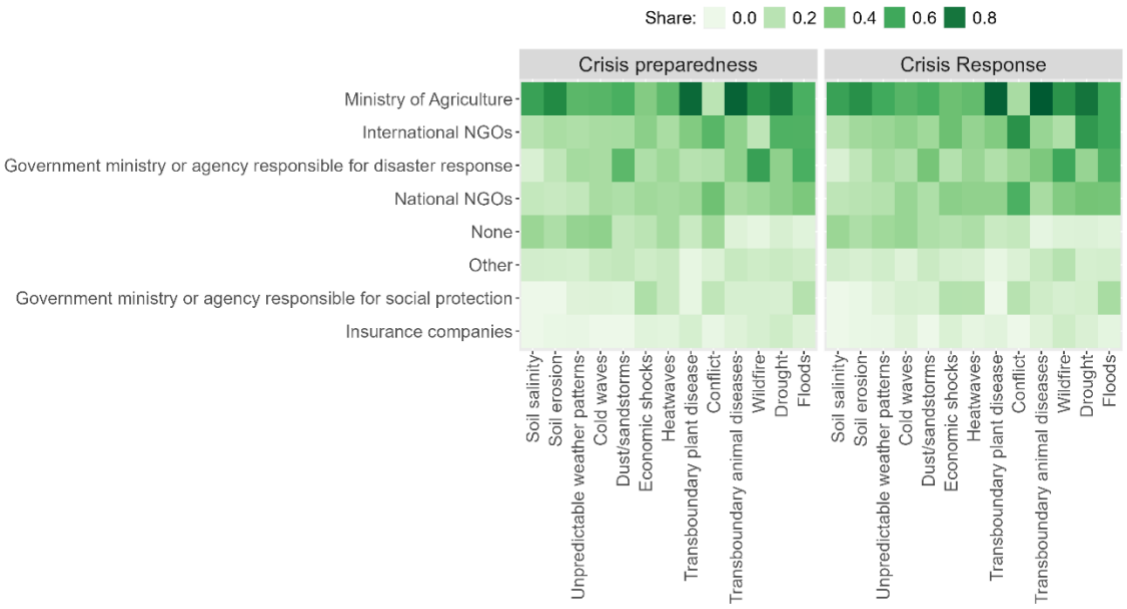
These survey insights, while not representative of the entire region, do suggest important implications for the design of agricultural AA frameworks. Ministries of agriculture must be actively involved – and in some cases may even be best positioned to lead – when AA frameworks target the agricultural sector. This may require shifting away from traditional humanitarian AA approaches that prioritize disaster risk reduction (DRR) agencies and instead moving toward more integrated frameworks that involve both agricultural and disaster management institutions within national governments.

International organizations and regional initiatives have a critical role to play in bridging these sectors. As reflected in the survey, international actors are already perceived as central stakeholders in addressing specific agricultural hazards. Given their cross-sectoral expertise and dual mandates in both humanitarian and development domains, they are well positioned to help facilitate more integrated AA approaches that are both climate- and agriculture-informed.

A critical entry point for advancing agricultural AA in the region lies in building technical capacity and promoting knowledge exchange on AA principles. Several countries in the region – such as Egypt, Jordan, Morocco, and Tunisia – already have national agricultural preparedness strategies for climate risks. However, these plans generally do not include short-term AA mechanisms to buffer the effects of rapid and unpredictable hazards. Notably, these same countries are not listed in Table 1. This observation is echoed by regional and national key informants, who highlighted training and advocacy as essential for expanding national adoption of AA frameworks. A recurring insight was that, while regional and

international stakeholders often have a good grasp of AA concepts and tools, definitions and capacity at the national level remain inconsistent and require strengthening.

Figure 3. Main actors for crisis preparedness and response for different agricultural hazards in the Near East and North Africa region



Source: Authors' own elaboration based on the results of the online survey.

Entry points through existing global and regional initiatives

The previous section has already highlighted the importance of advocacy and capacity development as critical entry points for scaling up AA frameworks in the NENA region. International organizations and regional initiatives are well positioned to play a driving role in advancing this agenda. In its most recent global review, the Anticipation Hub identified the mainstreaming and institutionalization of AA as one of the key trends in 2024,[17] reflecting a broader shift toward embedding AA within national systems and planning processes. Building on this momentum, leveraging regional and international platforms to promote multisectoral and multihazard AA frameworks – with explicit inclusion of agricultural risks – offers a strategic pathway to enhance the relevance, ownership, and sustainability of AA efforts across the region.[5] Therefore, the objective of this section is to provide an overview of the key stakeholders and platforms involved not only in AA but more broadly in preparedness, as this landscape represents the network of potential collaborators and enablers essential for supporting and advancing AA initiatives.

Entry points for anticipatory action in agriculture through existing FAO global initiatives

At the NENA regional level, one key entry point for implementing AA for agriculture lies in leveraging the FAO–WFP global initiative "Hunger Hotspots FAO–WFP early warnings on acute food insecurity" (see Table 2).[39,40] While this initiative does not include AA mechanisms and cannot replace country-level efforts to set up AA protocols, it still provides data-driven early warnings and forecasts on where acute food insecurity is most likely to deteriorate with actionable recommendations. These assessments can be used to identify agricultural areas most at risk, such as rainfed zones, conflict-affected regions, and pastoral areas, and accordingly prioritize geographic targeting for AA interventions for agriculture, including seed distribution, livestock health campaigns, or irrigation support. Indicators highlighted in the report, such as conflict escalation forecasts, projected rainfall deficits or heatwaves, or trends in food price spikes or livelihood disruptions, can serve as triggers for agriculture AA in the region. FAO's existing partnership with WFP facilitates a better regional collaboration, as WFP is already active in AA or EWS in the NENA region, and both organizations are working to scale up AA globally.[41]

Table 2. FAO existing global initiatives with potential entry points for anticipatory action in agriculture in the Near East and North Africa region

	FAO–WFP HUNGER HOTSPOTS	FAO–WFP AA SCALING UP STRATEGY (2023)
OBJECTIVE	Identify countries and regions at risk of acute food insecurity deterioration, and provide timely, evidence-based early warnings and recommendations to inform proactive humanitarian and agricultural responses.	Expand and institutionalize AA across regions and sectors by building national and local capacities, integrating AA into disaster risk management systems, and linking early warnings to pre-agreed, agriculture-based interventions.
ORGANIZATIONS	Jointly led by FAO and WFP, with contributions from other UN agencies, Integrated Food Security Phase Classification (IPC) partners, and governments.	Joint initiative by FAO and WFP in collaboration with other institutions.
FUNDING	Core funds from FAO and WFP, supplemented by donor contributions (e.g. European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO), Germany, and Norway).	Dedicated AA mechanisms (e.g. FAO's Special Fund for Emergency and Rehabilitation Activities); Central Emergency Response Fund AA pilot funding; the AA Task Force; and bilateral donor support.

Table 2. (contd.)

	FAO–WFP HUNGER HOTSPOTS	FAO–WFP AA SCALING UP STRATEGY (2023)
MAIN ACTIVITIES	Biannual publication of hotspot alerts and forecasts, which also includes: ▪ Analysis of conflict, weather, and market risks. ▪ Recommendations for early action at country/regional levels. ▪ Coordination with IPC and GRFC reporting.	Strategy to: ▪ Develop hazard-specific triggers (e.g. drought, flood, conflict). ▪ Design and implement agriculture-based AA (e.g. seeds, feed, veterinary care). ▪ Build capacity for governments and communities. ▪ Embed AA into early warning and response frameworks. ▪ WFP AA pilots in the Sudan, Yemen, Syrian Arab Republic, Iraq. ▪ FAO forecast-based action in the Sudan and Yemen.

Source: Authors' own elaboration.[39,41]

Entry points for anticipatory action in agriculture through other existing global initiatives

Another promising entry point for AA for agriculture in the NENA region lies in building on the shared objectives of global initiatives aimed at reducing the humanitarian impact of anticipated disasters through early actions or humanitarian AA (see Table 3). Existing technical, financial, and distributional infrastructures and initiatives can provide a strong foundation for establishing AA with agricultural components in the region. The complementarity of agriculture expertise, provided by organizations, such as FAO, and anticipation networks in the region offers strong potential for operational collaboration to scale agricultural AA approaches. The following are some examples of the main global initiatives in the region repeatedly mentioned by key informants:

The Start Network: The Start Network offers a valuable entry point for advancing Agricultural AA through its specialization in anticipation alerts and trigger-based financing, through mechanisms like the Start Fund designed to mitigate the impacts of anticipated disasters. This specialization allows for a promising partnership to strengthen the operational part of AA in agriculture in the NENA region. Its operational presence in countries such as Lebanon (population movement), the Sudan (floods), Iraq, where there is overlap with other FAO agriculture resilience efforts,[42,43] creates an opportunity to build on existing partnerships and infrastructure. This includes leveraging established anticipation alert systems and funding mechanisms to support AA for agriculture, while also expanding the alerts to integrate agricultural and climate-specific hazard forecasting and linking them to broader early warning systems.

World Vision Middle East and Eastern Europe: World Vision Middle East and Eastern Europe is one of the few humanitarian agencies actively working on humanitarian AA in the NENA region as part of global World Vision AA efforts.[44] It's deep community presence and experience in delivering humanitarian aid as part of humanitarian AA at scale offers valuable opportunities to support Agricultural AA particularly in

facilitating “last-mile delivery”. By combining agriculture focused technical expertise with World Vision community-level impact data, AA capacities can significantly be improved. World Vision’s strong grassroots networks in child protection and food security in countries, such as Iraq, Lebanon, Syrian Arab Republic, and Yemen,[45–47] provide an existing foundation of local partnerships that can be leveraged to scale up AA for agriculture. Additionally, it’s ongoing involvement in cash transfer programmes, presents an opportunity to integrate climate risk tools to expand those interventions toward AA for agriculture. World Vision’s presence also allows for the testing and refinement of delivery mechanisms to improve the efficiency of AA delivery to agricultural households.

African Risk Capacity (ARC): ARC is a specialized agency of the African Union that helps member states plan, prepare for, and respond to climate-related disasters through innovative risk management and insurance mechanisms. ARC’s parametric insurance models and risk pools for hazards, such as droughts, floods and cyclones, provide a potential financing mechanism for AA, even though currently ARC insurance models are still designed for rapid response. In addition to financial tools, ARC also supports governments in designing early response plans or disaster risk reduction protocols, offering again a valuable complement to agriculture-specific technical expertise for contingency planning.[48] Since ARC is already present in Libya, Mauritania, and the Sudan, there is also potential for geographic expansion to neighbouring countries, such as Algeria, Egypt, Morocco, and Tunisia, to help establish a regional approach to AA for agriculture. ARC’s explicit commitment to broadening coverage across additional African countries – supported by its landmark USD 11.7 million partnership with the United States of America Government in 2024 to scale up access to parametric insurance and grow its risk pool[49] – further supports the strong potential of operational expansion in the North Africa region.

Table 3. Global initiatives with potential entry points for anticipatory action in agriculture in the Near East and North Africa region

	THE GLOBAL START NETWORK	WORLD VISION	AFRICAN RISK CAPACITY (ARC)
OBJECTIVE	AA to prevent or reduce the humanitarian impact of disasters.	AA to minimize the impact of disasters on vulnerable groups.	Strengthening continent’s DRM systems through innovative solutions
ORGANIZATIONS	Start Network members and partners in each recipient country.	World Vision Middle East and Eastern Europe in collaboration with affected communities.	Specialized agency of the African Union, and ARC Insurance Company Limited (ARC Ltd).
FUNDING	Start Fund.	Aktion Deutschland Hilft.	Various donor partners.

Table 3. (contd.)

	THE GLOBAL START NETWORK	WORLD VISION	AFRICAN RISK CAPACITY (ARC)
MAIN ACTIVITIES	▪ Anticipation alert when a disaster is forecasted. ▪ Capacity building. ▪ Dissemination of tools and resources. ▪ Provision of rapid funding.	▪ AA training conducted with key stakeholders. ▪ Activation of early warning systems. ▪ Cash transfers to purchase seeds and fodder in preparation for drought and rain scarcity seasons.	▪ Capacity building. ▪ Risk pooling services.
NENA COUNTRIES	Iraq, Lebanon (conflict and displacement), South Sudan (disease).	Pilots in Iraq, Lebanon, Syrian Arab Republic (2023 until end of 2024).	Libya, Mauritania, the Sudan.

Source: Authors' own elaboration.[43–49]

Entry points for anticipatory action in agriculture through existing regional initiatives

Existing regional initiatives provide entry points for anticipatory action in agriculture (see Table 4). The two main initiatives are:

Anticipation Hub MENA Community of Practice (CoP): The Anticipation Hub MENA CoP is a regional platform that brings together actors, researchers, policymakers and local implementors committed to advancing AA across the NENA region, including FAO, WFP, IFRC, World Vision, International Organization for Migration, national governments, national meteorological services, as well as research institutes and universities. It is a joint initiative by the German Red Cross, IFRC, and the Red Cross Red Crescent Climate Centre. The primary funding is provided by the German Federal Foreign Office. Through this collaborative framework of technical coordination, advocacy, knowledge exchange, and collaborations, the CoP aims to enhance anticipatory measures to disasters.[50,51] By being part of the CoP dialogues, agriculture-focused expertise can be integrated into policy frameworks, protocols, or operational plans to establish AA with agricultural components. The CoP offers a collaborative space with already active stakeholders, providing a platform for agriculture-focused engagements. It also enables learning from regional best practices, especially in conflict-affected or fragile contexts. Additionally, the platform presents an opportunity to lead capacity-building sessions related to agriculture-based forecasting and AA, fostering wider awareness and endorsement of AA for agriculture.

The Middle East Anticipatory Climate Action Model (MEACAM): MEACAM is a regional initiative aimed at strengthening climate resilience by supporting early warning systems and AA frameworks tailored to specific risks and vulnerabilities in the Middle East.[52] The integration of agriculture-focused risk assessments and monitoring, such as FAO's Global Information and Early Warning System (GIEWS), to the MEACAM's advanced spatial predictive model and data can significantly enhance the regional relevance

and timeliness of agricultural AA in the region, especially in conflict-affected areas, such as in Iraq, Syrian Arab Republic, or Yemen. By combining these tools, more precise targeting and earlier activation of agricultural responses can be achieved.

Table 4. Regional initiatives with potential entry points for anticipatory action in agriculture in the Near East and North Africa region

	ANTICIPATION HUB MENA COP	THE MIDDLE EAST ANTICIPATORY CLIMATE ACTION MODEL (MEACAM)
OBJECTIVE	Scale up AA and ensure a coordinated, evidence-based approach to DRR	Address key technical gaps in the NENA region EWS landscape → Modular design of spatial data → EWS tailored for AA
ACTORS	Anticipation Hub (German Red Cross, IFRC, Climate Centre), WFP, Risk-informed Early Action Network, United Nations Development Programme (UNDP), national governments, nongovernmental organizations (NGOs) and local partners	Mercy Corps
FUNDING	Various donor partners (e.g. Sida, UKAid, European Union, United Nations)	DG ECHO
MAIN ACTIVITIES	▪ Advocacy, evidence and positioning for AA ▪ Knowledge exchange and technical excellence for AA ▪ Development of multiyear strategic framework/roadmap	▪ Publicly accessible online platform with near real-time predictions for flash flooding and agricultural drought → Priority given to areas with high concentrations of migrants, refugees and internally displaced people
NENA COUNTRIES	All	Iraq, Yemen, and Syrian Arab Republic

Source: Authors' own elaboration.[50–52]

While some regional initiatives have made important strides in advancing risk monitoring or drought preparedness in the NENA region, some also experience the common challenge of ensuring lasting impact beyond project timelines. Launched in 2018 by the International Water Management Institute (IWMI) and supported by USAID, the MENA drought project aimed to build national capacities for drought risk management through EWS, vulnerability assessments, and drought action planning.[53] In Jordan, Lebanon, and Morocco, the project successfully supported government institutions in developing localized EWS and action plans tailored to rainfed and irrigated systems.[54,55] However, with the project's conclusion and despite these achievements, the initiative's project-based nature and limited duration have raised

questions among key informants from Jordan and Morocco about long-term impact and sustainability. Without strong mechanisms for institutionalization, continued funding, and policy integration, there is a risk that the tools and knowledge generated may not be fully embedded into national systems or scaled to other at-risk areas. This underscores a broader issue mentioned by key informants in the region, where externally funded climate resilience projects often deliver promising short-term results but struggle to translate into durable structural change.

Agriculture in national disaster risk management strategies and governance

National Disaster Management Offices are central to DRM strategies and governance in NENA. Normally under the direct control of the head of state these committees steer countries' response in the event of an emergency or disaster. While in most cases not anticipatory, National Disaster Management Offices and related institutional arrangements are the backbone of DRM and DRR in many countries and thus also an important entry point for AA for the agricultural sector.

Spotlight Box 1. Example of disaster risk management procedures from four Near East and North Africa countries

Morocco

Morocco employs a multi-tiered disaster response system that integrates national, regional, and local authorities under a coordinated framework. Central to this system is the ORSEC Plan (Organisation des Secours), established in 1970 and enhanced after significant events like the 2004 Al Hoceima earthquake. A systematic response to disasters is ensured by the ORSEC Plan, which clearly defines duties and responsibilities at different administrative levels. At the national level, the Monitoring and Coordination Center, established in 2007, oversees disaster response coordination. During emergencies, this centre makes it easier to allocate resources and make decisions centrally. Morocco's administrative structure comprises 12 regions, each governed by a Wali (Regional Governor) appointed by the King. These areas are separated into provinces and prefectures, each of which is headed by a governor. In the event of a disaster, the respective Governor activates the ORSEC Plan, mobilizing resources and personnel. In order to provide efficient on-site management and coordination, this activation results in the establishment of an Operational Command Post near to the disaster site and a Fixed Command Post at the prefectural or provincial headquarters.

Spotlight Box 1. (contd.)

Egypt

In Egypt, the national disaster response process is structured across three primary levels: strategic, tactical, and operational. At the strategic level, the National Committee for Crisis/Disaster Management and Disaster Risk Reduction is the central authority responsible for setting national policy and coordinating high-level response activities. This committee is chaired by the Prime Minister and includes ministers from key sectors – such as defence, interior, health, foreign affairs, local development, and information – as well as representatives from the intelligence services and domain-specific experts. After a significant disaster, the committee is promptly called into action to evaluate the situation and offer broad guidelines for the national response framework. Following the strategic decision-making, the Coordinating Committee for Crisis/Disaster Management operates at the tactical level. The task of converting the strategy directions into workable reaction strategies falls to this committee. It facilitates coordination among ministries, allocates resources, monitors implementation progress, and ensures that operational-level actors are following the guidance provided. This level acts as a vital bridge connecting the response of the central government to ground-level operations. At the operational level, the response is carried out by local authorities, primarily governorates and municipalities. Governors coordinate with local branches of national institutions such as civil defence, health departments, and law enforcement to manage immediate relief efforts and public safety. These local organizations carry out the directions from higher up and report back to the tactical and strategic levels.

Jordan

Jordan has established a multi-tiered disaster response system that integrates national, regional, and local authorities under a coordinated framework. Central to this system is the National Centre for Security and Crisis Management (NCSCM), which serves as the high-level authority responsible for coordinating national efforts in disaster risk reduction (DRR). The National Catastrophe Risk Reduction Strategy 2023–2030, a roadmap created through nationwide discussions to evaluate the capability of the current DRR system and the prevailing catastrophe threats, is implemented under the direction of the NCSCM. In order to successfully mitigate disasters, this strategy seeks to improve coordination among various civil and official agencies. At the operational level, the Civil Defense Directorate, established in 1956 under the Ministry of Interior, plays a pivotal role in disaster response. Civil defence and emergency services, such as firefighting, rescue operations, and ambulance services, are the responsibility of the Civil Defense Directorate. It operates in close collaboration with other institutions to ensure a swift and effective response to emergencies. The Directorate has also been involved in developing comprehensive plans for encountering emergencies and disasters, aiming to gather available capabilities from all organizations and utilize them strategically during crises.

Spotlight Box 1. (contd.)

Saudi Arabia	Saudi Arabia employs a disaster response system that integrates national, regional, and local authorities under a coordinated framework. Central to this system is the General Directorate of Civil Defense, established in 1953 and operating under the Ministry of Interior. The Directorate is in charge of public safety and responding to crises, disasters, and other situations that could endanger public safety. Over the years, its scope has expanded to include various emergency response services. Complementing the General Directorate of Civil Defense is the National Center for Meteorology (NCM), established in 2019 under the Ministry of Environment, Water, and Agriculture. NCM is responsible for weather forecasting, issuing early warnings, and working with international meteorological agencies to employ the latest technologies.

The degree of formalization of DRM protocols varies across countries. Spotlight Box 1 provides an illustrative overview of official procedures and relevant government bodies in four case study countries. Except for Saudi Arabia, none explicitly identify ministries of agriculture as permanent members of DRM structures. However, key informants indicated that agricultural ministries are often engaged on an ad hoc basis when agriculture-specific threats emerge. In Egypt, for instance, the Ministry of Agriculture and Land Reclamation, the Ministry of Water Resources and Irrigation, and the Egyptian Meteorological Authority were frequently cited as central to past DRM responses. This suggests a gap between formal governance arrangements and actual practice. Similarly, key informants from Morocco emphasized that, despite the presence of a national-level DRM strategy, central coordination mechanisms are weak. Morocco's crisis coordination still relies heavily on ad hoc structures, with special taskforces or budget authorizations often activated only after damage is evident. In contrast, subnational coordination under the authority of regional governors was described as comparatively strong and responsive. This may be linked to the traditionally active role of the Royal Foundation and civil society organizations in implementation.

These findings underline the need for in-depth country-specific assessments of legal, institutional, and operational conditions before advancing the integration of AA for agriculture into national adaptation frameworks. While a full review across all NENA countries is beyond the scope of this report, the case studies presented in the annex offer a useful starting point. Additionally, a unified assessment framework identifying key institutional, legal, and operational dimensions stakeholders could support the alignment and scaling of regional AA initiatives for agriculture.

Anticipatory action as complementary to adaptation strategies

Similar to existing disaster response strategies that could be leveraged to advance AA for agriculture in national resilience strategies, many NENA countries have climate adaptation strategies and policies in place to prepare their agricultural sector for the climate challenges of the coming decades. However, we did not find any evidence that these adaptation strategies include dedicated AA mechanisms.

"Preparedness" is rather interpreted as long-term or seasonal adaptation through large-scale infrastructure investments (e.g. dams against floods, EWS infrastructure).

Moreover, there is an increasing push towards climate-smart agriculture in the region.[56] While not AA, this is an important development to support the effectiveness of potential AA frameworks for agriculture in the future. That is, unsustainable agricultural management systems can increase disaster risk and also the risk to be hit harder by conflict.[5] Considering the very low water productivity of NENA agricultural systems (see section: The state of agricultural risks in the Near East and North Africa region), sustainable and integrated water management practices have big potential in the region. Furthermore, crop diversification, intercropping, or agricultural waste management have been identified as promising climate-smart agriculture practices in the region.[22] Leading the climate-smart agriculture movement in NENA are countries such as Morocco, Tunisia, Iran, and Syrian Arab Republic, while Jordan, Lebanon, Iraq, and Egypt joined more recently.[56]

Long-term climate change adaptation and more short-term AA for agriculture can thus be thought as complementary. More specifically good agricultural practices at farm level are not only good in hazard scenarios, but also beneficial under "normal" circumstances, with the added bonus of making short-term support when disaster strikes more effective. In the academic literature, the connection between short- and long-term strategies for resilience is often discussed as part of the humanitarian–development–peace nexus.[2,14,26] A study from South Sudan, for example, advocates to rephrase humanitarian assistance into a broader definition as development assistance.[14] This means, even though AA is a short-term tool it has long-term impacts on recipients' resilience. This requires it to be integrated into general development strategies.[57] While these authors discuss the humanitarian–development–peace nexus in the context of AA for conflict settings, the argument still holds for AA with a focus on agriculture. That is, AA for agriculture should be understood and promoted as one tool within the broader toolbox of agricultural development and climate adaptation strategies.

Table 5. Status of National Adaptation Plans for Near East and North Africa countries

NATIONAL ADAPTATION PLAN STATUS	COUNTRIES
SUBMITTED	Sudan (2016), Kuwait (2019–2030, published 2021), Morocco (2022–2030, published 2024), Jordan (2022, published 2025)
IN PROGRESS	Projected submission in 2025: Mauritania, Iraq Projected submission in 2026: United Arab Emirates No projected submission year: Algeria, Tunisia, Egypt, Oman, Saudi Arabia, Lebanon, Syrian Arab Republic
NOT INITIATED	Libya, Yemen

Source: Authors' own elaboration based on information from the National Adaptation Plan tracking tool, UN Climate Change. [Cited 19 August 2025]. https://napcentral.org/nap-tracking-tool

At the regional level, there is an ongoing movement to develop National Adaptation Plans under the Cancun Adaptation Framework established at COP 16. The Green Climate Fund supports both the formulation and implementation of these plans. Although National Adaptation Plans are not agriculture-specific, they typically identify agriculture as a key sector vulnerable to climate risks. As summarized in Table 5, only four NENA countries have submitted their National Adaptation Plans to date. Notably, none of these explicitly reference AA. Ten additional countries are currently in the process of developing their National Adaptation Plans, with submissions expected between 2025 and 2027.

This widespread reassessment of national adaptation strategies presents a timely opportunity to advocate for the integration of AA into these frameworks. Given the absence of AA in the plans submitted so far, a coordinated regional initiative could help raise awareness and embed AA (for agriculture) more systematically within future adaptation planning.

Spotlight Box 2. Morocco's path to more anticipatory action in their climate adaptation strategy

Among countries in the NENA region, Morocco stands out for its structured progress toward AA. While the term "anticipatory action" is not widely used in national discourse, the country has made significant advances in operationalizing some preparedness efforts, particularly for droughts. These include institutionalized response pathways, risk-informed agricultural planning, and an expanding ecosystem of local-level actors engaged in pre-emptive efforts. Most notably, Morocco's experience with insurance, feed and seed distribution, and water-saving subsidies has positioned it ahead of many of its regional peers.

Institutionalized response pathways

Over the past two decades, Morocco has gradually moved from ad hoc crisis response toward routine, seasonal preparedness, especially for drought, its most persistent hazard. Government institutions now oversee pre-crisis planning that includes early seed and livestock feed distribution, irrigation incentives, and access to subsidized inputs for vulnerable farmers.

Morocco's proactive irrigation support system becomes operational during dry seasons. Key informants highlighted Morocco's investment in drip irrigation and water-saving incentives, particularly for smallholders. These programmes, in place since the late 2000s, were described as effective tools to reduce long-term drought vulnerability and were seen as adaptation tools. Through the Ministry of Agriculture and regional agricultural offices, the Government monitors rainfall trends and soil moisture early in the agricultural season, and when indicators show signs of water scarcity, it activates a package of support measures for farmers to switch to water-efficient practices. These include subsidized access to drip irrigation systems, flexible financing schemes, sometimes in partnership with the Agricultural Development Fund, to help farmers finance their irrigation systems in preparation for dry season. Key informants emphasized that these systems, while not always labelled as "anticipatory", are increasingly triggered based on seasonal risk assessments.

Spotlight Box 2. (contd.)

The Ministry of Agriculture plays a central coordinating role, supported by technical forecasts and hydrological monitoring that inform operational decisions before the peak of the agricultural season. This comes in addition to Morocco's agricultural insurance scheme, co-financed by the government and implemented through the Mutuelle Agricole Marocaine d'Assurance, was frequently cited as a regional model for agricultural risk-sharing. Although payouts are still post disaster, the system's scale and public-private design reflect strong institutional commitment to protecting farmers from recurrent shocks.

A climate-resilient agricultural strategy

Morocco's national agricultural strategy, Green Generation 2020–2030, embeds climate resilience into development planning. Key informants highlighted how this strategy encourages a shift toward drought-tolerant tree crops, investment in drip irrigation, and support for technologies that reduce dependence on erratic rainfall. These efforts build on earlier reforms under the Green Morocco Plan and reflect a clear commitment to transforming agriculture risk management into resilience planning. Key informants emphasized that these investments are not short-term relief or emergency measures, they are strategic anticipatory investments designed to reduce Morocco's long-term exposure to climate variability and strengthen rural adaptation.

Community-level implementation and traditional knowledge

A final coordination challenge in the context of AA and DRM more broadly that still needs to be discussed is the frequent disconnect between national-level strategies and local-level implementation. In our interview, several key informants highlighted that while national institutions are responsible for setting priorities and allocating resources, they often do so without meaningful consultation or coordination with local actors. They further elaborate that, as a result, the stakeholders most critical for effective AA implementation, such as NGOs, civil society organizations, farmer cooperatives, and community associations, are frequently excluded from early planning processes. Informants from Egypt and Morocco also noted that successful coordination, where it exists, is often driven by individual leadership or personal relationships, rather than by formalized or institutional mechanisms. Consequently, informal community-based networks often take the lead in operationalizing early warning and response, sometimes even acting ahead of national systems.

This reality underscores the importance of community-centred approaches in the design and implementation of AA and EWS frameworks. The literature has picked up on this notion with a growing recognition of the value of community-based early warning systems.[58] These systems emphasize the integration of scientific and local knowledge, and are particularly effective in areas where access to national systems is limited or delayed. For example, studies on drought responses in Nicaragua and Ethiopia show that involving communities in forecast development enhances local ownership and builds farmers' technical capacity to manage agricultural risks proactively.[57] Further research in the same line

distinguishes between “last-mile” and “first-mile” approaches to EWS.[16,59] While traditional systems typically focus on the final dissemination of warnings (last-mile), more inclusive models begin with community needs and priorities (first-mile), ensuring that interventions are both technically sound and socially relevant. Moreover, indigenous and traditional knowledge, which is built over generations, often allows a much deeper understanding of local hazards and thus can provide important insights informing suitable AA activities.[58] Thus, without meaningful engagement at the community level, EWS and AA systems risk being underutilized or poorly adapted to local conditions.[60] In this context, integrating community-based early warning systems into national systems offers a promising pathway to strengthen the effectiveness and inclusiveness of AA mechanisms.[58] These locally anchored systems can serve as vital bridges between formal scientific forecasts and community decision-making processes.

In addition to technical implementation, community-based approaches are also critical for addressing the intersection of climate and conflict risks. Evidence from Africa and Asia shows that droughts can prolong or intensify violence, especially for agriculture-dependent and marginalized groups in low-income countries. As such, AA programming must be conflict-sensitive and responsive to local dynamics. An illustrative case comes from South Sudan, where an AA initiative was developed in collaboration with local peace committees.[17] This effort combined machine learning-based early warnings with community inputs to facilitate peace dialogues, prevent displacement, and even support the return of displaced populations. Such examples highlight the importance of embedding AA within broader humanitarian–development–peace nexus frameworks.

Key findings – governance and coordination

Gaps

1. AA frameworks in the region are largely driven by international actors, with minimal government leadership and little formal involvement from ministries of agriculture.
2. There is a persistent lack of coordination between national and local levels and across sectors, leading to siloed efforts that hinder the development of integrated, multihazard AA systems.
3. Despite clear synergies, climate change adaptation strategies rarely incorporate short-term AA mechanisms, missing the opportunity to align immediate AA with long-term climate resilience goals for the agricultural sector.
4. Local actors and indigenous knowledge are not systematically included in AA planning, despite their proven value in enabling context-specific, timely, and inclusive AA.

Key findings (contd.)

Strengths

1. International organizations such as FAO, WFP, and Save the Children are actively leading and supporting AA frameworks, particularly in fragile contexts, bringing technical expertise and operational capacity.

2. Initiatives like the Anticipation Hub MENA Community of Practice and MEACAM offer structured spaces for coordination, knowledge exchange, and policy dialogue on AA across sectors and countries.

3. In countries like Morocco and Egypt, local actors – such as NGOs, cooperatives, and civil society organizations – have shown strong capacity to operationalize AA, often acting more quickly and effectively than national systems.

Opportunities

1. Support institutional integration of AA into national systems by advocating for and assisting governments in embedding AA – particularly agriculture-focused AA – into national disaster risk reduction (DRR), climate adaptation, and agricultural development strategies, ensuring leadership from relevant ministries such as agriculture and planning.

2. Strengthen vertical and horizontal coordination by facilitating structured engagement between national, subnational, and local actors, as well as across sectors, to align priorities and harmonize implementation of multihazard, multisector AA systems.

3. Invest in local partnerships and inclusive delivery systems by supporting NGOs, farmer cooperatives, and civil society organizations that have demonstrated capacity for timely AA delivery, while integrating indigenous knowledge and community-based early warning systems into formal AA frameworks.

4. Leverage regional platforms and data systems such as MEACAM and the Anticipation Hub MENA Community of Practice to foster cross-country collaboration, enhance technical coherence, and encourage knowledge exchange that improves agriculture-specific AA governance.

5. Advance coordinated advocacy and awareness-raising at regional and national levels to promote the relevance of AA for agriculture, demonstrate its complementarity with long-term adaptation goals, and increase political commitment and investment in sustainable AA governance.

Early warning system and forecasting capacities

> *"There are scattered efforts … FAO works in early warning systems, WFP works on early warning systems, Ministry of Water works on early warning systems, Ministry of Agriculture works on early warning systems."*
>
> Key informant interview, Yemen

Forecasting, risk information, and early warning systems

One of the core requirements for an AA framework is accurate and reliable hazard forecasts that can define thresholds to signal the onset of a specific hazard, serving as triggers for AA. As such, it is unsurprising that much of the discourse in DRR and AA has focused on the technical dimension of climate data, forecasting capacity, and EWS. Studies and reports show substantial (technical) progress in weather forecasting and EWS development,[16,59] including expanded regional coverage across the NENA region.[18]

At the regional level, the FAO GIEWS on food and agriculture is one of the most elaborate EWS tailored towards the agricultural sector. It was established by FAO in response to the early 1970's food crises, with the aim of improving global food security by providing timely and accurate information on food supply and demand. Its core functions include continuous monitoring of agricultural conditions, early warning of potential food crises, and support to governments and other actors through data-driven assessments. It produces a range of critical reports and tools, including *Quarterly Global Reports* covering global cereal markets outlooks, *Country Briefs* updated two to three times a year to summarize national food security situations, and *Special Reports* published on demand in response to acute situations, such as those from Crop and Food Security Assessment Missions. Dedicated GIEWS country briefs are currently publicly available for all countries of the NENA region – except for Bahrain, Kuwait, Oman, Palestine, Qatar, and the United Arab Emirates, as these might be perceived as relatively stable food security contexts.[61] However, these countries may still be included in broader regional analyses or special reports. In addition to these reports, GIEWS provides access to several tools and datasets, including the Agriculture Stress Index, monthly updated Cereal Supply and Demand Balance Sheets and the Food Price Monitoring and Analysis tool, as well as remote sensing-based monitoring systems that track vegetation, rainfall, and crop conditions in near real time.[62]

All these outputs are essential for early warning, AA, and the design of timely responses, particularly in fragile and protracted crisis contexts where early interventions are crucial to mitigate the impacts of food insecurity. Among many examples of GIEWS' effectiveness in predicting and warning early on crises, one notable example from the NENA region was in early 2023, when GIEWS identified Lebanon as a country at high risk of escalating food insecurity due to its worsening economic crisis, currency depreciation, and rising food prices.[63] These early warnings were crucial in mobilizing humanitarian responses and guiding policy decisions to mitigate the impact. Table 6 presents additional regional EWS initiatives.

Table 2. Examples of additional regional initiatives for early warning systems in the Near East and North Africa region

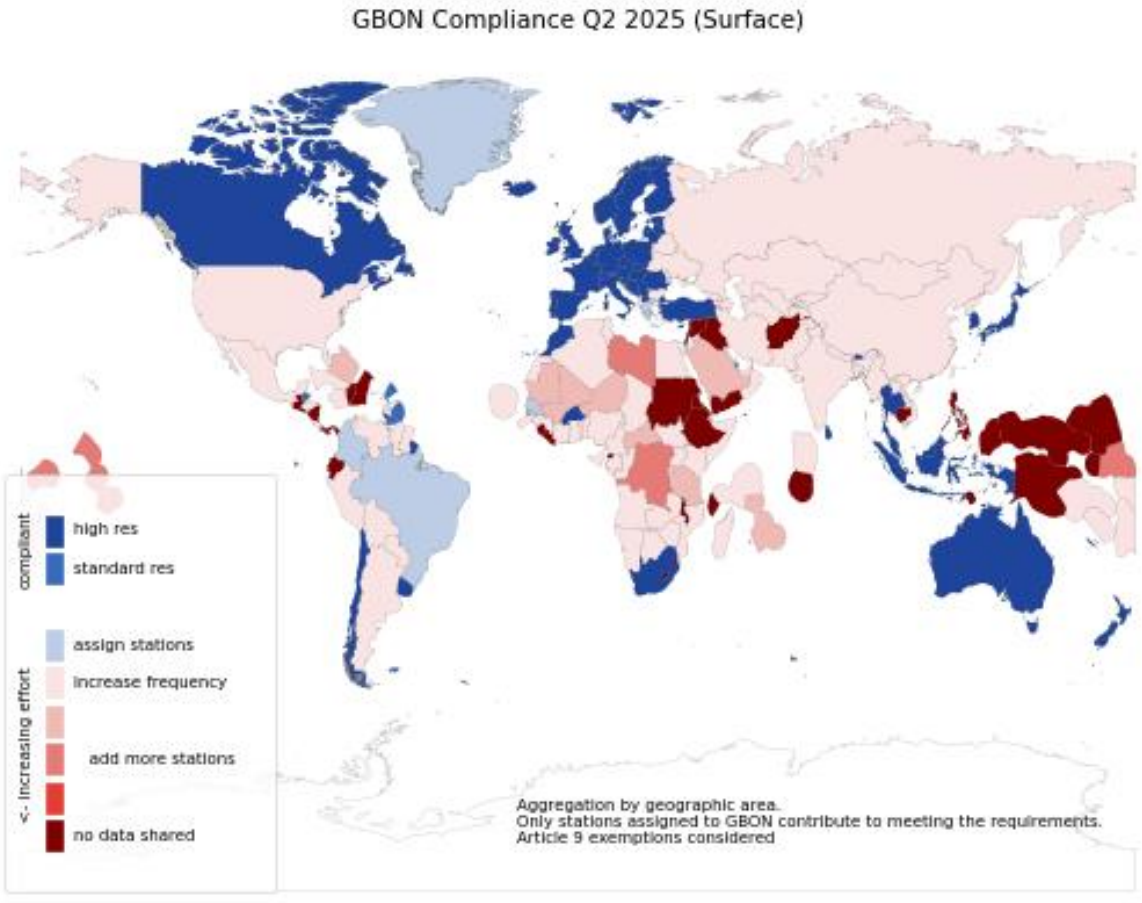
	EARLY WARNINGS FOR ALL (EW4ALL)	WISER	MENADROUGHT	ARAB CLIMATE OUTLOOK FORUM AND REGIONAL INITIATIVE FOR THE ASSESSMENT OF CLIMATE CHANGE IMPACTS ON WATER RESOURCES AND SOCIOECONOMIC VULNERABILITY IN THE ARAB REGION
OBJECTIVE	Universal early warning coverage within five years (2023–2027)	Delivery of weather and climate services	Improved drought monitoring Improved water and agriculture systems management	Regional platform to enhance climate resilience across the Arab region
STAKEHOLDERS	World Meteorological Organization (WMO); pillar leads: United Nations Office for Disaster Risk Reduction (UNDRR), International Telecommunication Union, IFRC	UK Met Office	IWMI, USAID	United Nations Economic and Social Commission for Western Asia (UNESCWA), League of Arab States, WMO, Gulf Cooperation Council
MAIN ACTIVITIES	Executive Action Plan presented at COP27: to strengthen MHEWS, optimize international cooperation, and align climate financing	Co-production of climate-sensitive interventions to priority needs EWS improvements resilience financing through impact-based forecasting strengthening institutional capacity	Demand-driven applied research and technical support project potential for integrated approach/EWS across the region	Seasonal climate outlooks based on inputs from national meteorological services and regional centres
COVERAGE	All, currently engaged: Iraq, Palestine, Syrian Arab Republic, Yemen	Iraq, Palestine, Morocco, Syrian Arab Republic, Yemen	Morocco, Jordan, Lebanon (projects ended)	Morocco, Saudi Arabia, Egypt

Source: Authors' own elaboration. [53,53,64–67]

Data availability and technical capacity

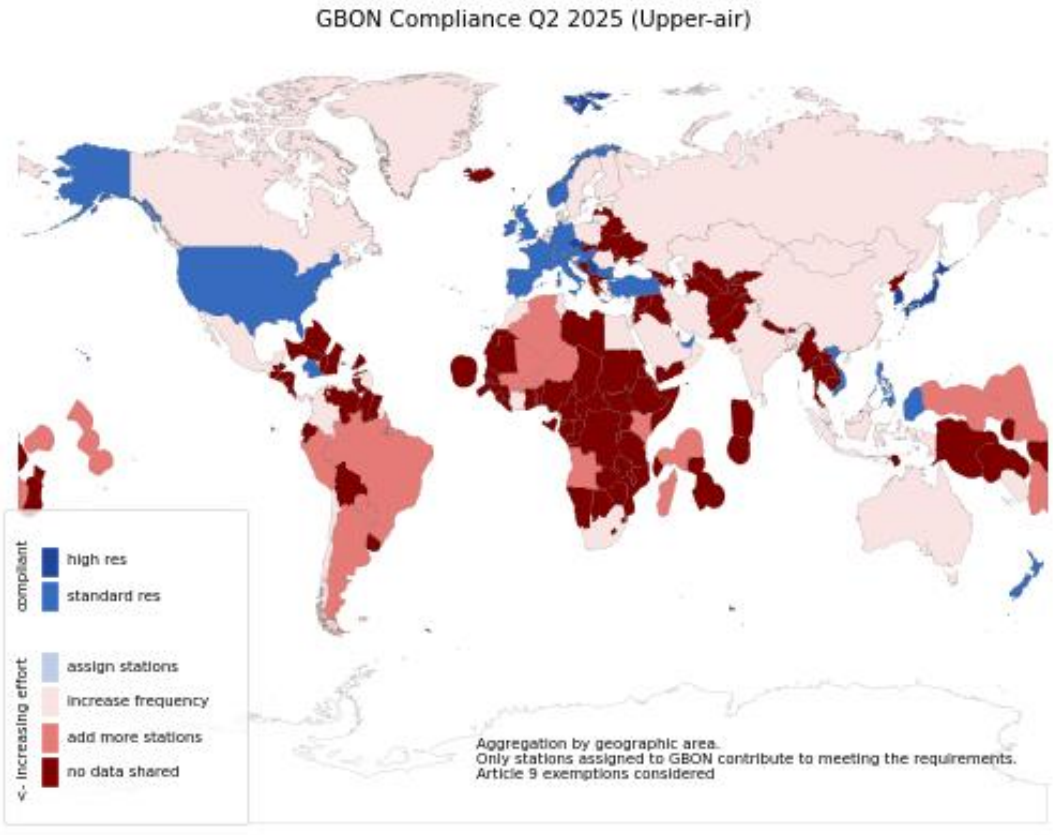
Existing EWS in the NENA region often lack the scale, integration, and functionality required to trigger timely and effective AA. A significant barrier is the quality and availability of data. Meteorological, agricultural, and demographic data are frequently outdated, incomplete, or inaccessible. Reliable forecasts require a consistent database ideally spanning a long time, for both risk factors (e.g. weather) and vulnerability indicators.[14] Given that agricultural production is often very context specific, agrometeorological forecasts also require a high spatial disaggregation to provide reliable warnings to farmers. This has also been highlighted in the FAO flagship report *The Impact of Disasters on Agriculture and Food Security 2023*, where the need for better data on the impact of disasters on agriculture is identified as a crucial gap in advancing evidence-based risk reduction.[5]

Figure 4. Global overview of national Global Basic Observing Network compliance for surface measurements (Q2 2025)



Note: Refer to the disclaimer on page ii for the names and boundaries used in this map.
Source: Global Basic Observing Network Compliance application. In: *WMO*. [Cited 10 September 2025]. https://gbon-compliance.wmo.int/)

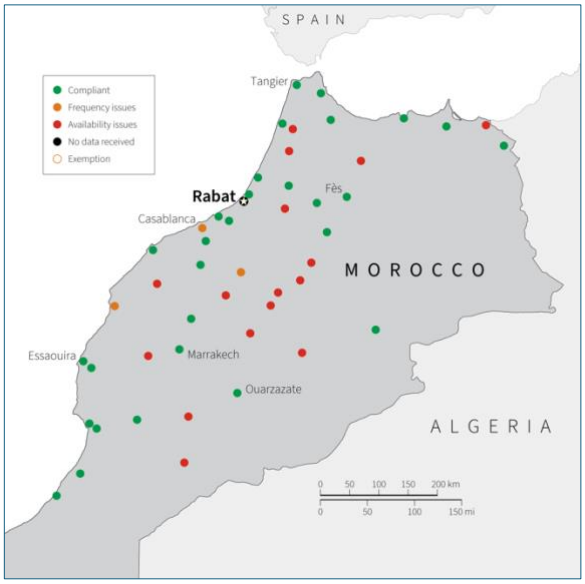
Figure 5. Global overview of national Global Basic Observing Network compliance for upper-air measurements (Q2 2025)



Note: Refer to the disclaimer on page ii for the names and boundaries used in this map.
Source: Global Basic Observing Network Compliance application. In: *WMO*. [Cited 15 September 2025]. **https://gbon-compliance.wmo.int/**)

To facilitate and establish uniform international standards for EWS requirements, the WMO established the Global Basic Observing Network (GBON) as part of their Integrated Global Observing System.[68] Based on available stations for surface (Figure 4) and upper-air measurements (Figure 5), the WMO categorizes countries by GBON compliance and needs for improvements. Looking at the GBON compliance for surface measurements, for example, only Morocco and Qatar receive the status of GBON compliant. All other NENA countries still need to increase efforts to meet the minimum requirements for surface measurement, with Yemen, the Sudan, Syrian Arab Republic, and Iraq not sharing any data at all. A likely reason for the missing data is the fragile and conflict-affected contexts. According to survey respondents and key informants from Syrian Arab Republic, the Sudan, and Yemen, both data availability and forecasting capacity face significant challenges. A key informant from Yemen, for example, mentioned that security issues often prevent ground data collection, forcing reliance on satellite data, which may be inaccurate without proper validation. Yemen's example shows efforts toward preparedness despite these constraints (see Spotlight Box 3), but the gap between data quality and forecast reliability remains critical.

Figure 6. Global Basic Observing Network compliance – surface and upper-air weather stations



Source: United Nations Geospatial. 2005. Map of Morocco. In: *United Nations.* New York, USA, UN. [Cited 12 March 2025]. https://www.un.org/geospatial/content/morocco
Data adapted from GBON Compliance app. In: *WMO*. [Cited 10 September 2025]. https://gbon-compliance.wmo.int/
Note: Refer to the disclaimer on page ii for the names and boundaries used in this map.

Figure 7. Global Basic Observing Network compliance Egypt – surface and upper-air weather stations

Source: United Nations Geospatial. 2012. Map of Egypt. In*: United Nations*. New York, USA, UN. [Cited 12 March 2025]. https://www.un.org/geospatial/content/egypt
Data adapted from GBON Compliance app. In: *WMO*. [Cited 10 September 2025]. https://gbon-compliance.wmo.int/
Note: Refer to the disclaimer on page ii for the names and boundaries used in this map.

In Figure 6 and Figure 7, we compare the status of surface stations for Morocco (GBON compliant) and Egypt (not GBON compliant). In both countries, there are a large number of stations with data frequency and availability issues. However, in Morocco, station density is higher, and the geographic distribution of compliant stations appears well enough to satisfy GBON requirements.

One critical advantage of complying with uniform international standards for meteorological measurements is the improved opportunity and ease of integrating cross-country warnings. In addition to multihazard approaches (see section: Multihazard early warning systems), regional integration of EWS and AA frameworks can significantly enhance effectiveness and capacity sharing, especially when agro-climatic zones extend beyond national borders. An important initiative in this context is the *Regional Integrated Multi-Hazard Early Warning System for Africa and Asia*.[69] So far, only Yemen is a member of the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia, but including additional NENA countries could provide a regional mechanism to help countries meet GBON requirements and ultimately move closer to the goal of comprehensive MHEWS.

Spotlight Box 3. Crisis preparedness in a fragile state setting – the case of Yemen

AA in a fragile setting is heavily reliant on external actors. Yemen is an example of how cross-agency collaboration can work to develop monitoring systems and response plans including agriculture. The civil war in Yemen, since 2015, split the country under two warring governments, devastated the economy, and left half of the population dependent on international aid for basic needs.[70] In this context of protracted crisis, international NGOs have worked towards a coordinated response including in monitoring and preparing responses for spikes in food insecurity.

A major milestone in this coordination is the development of the Yemen Preparedness Plan for Food and Nutrition Security Crises,[71] one of the most complete applications globally of standardized approach to collaborative planning through the Global Alliance for Food Security. The Yemen Preparedness Plan creates a system for defining and responding to an extraordinary crisis for food security. On the data monitoring side, there are two major reporting frequencies, the biannual IPC report and bi-monthly Joint Monitoring Report. Both reports integrate monitoring data from in-person and remote food security, nutrition and market price and availability surveys and food availability projections reflecting expert assessments of impacts of weather, pest, and animal disease impacts on agricultural production. If an escalation in risk is identified by a cross-agency committee, the plan can be triggered, leading to a global call for mobilization of resources.

Within the Yemen Preparedness Plan, agriculture risks are mainly covered through a qualitative approach. This is largely due to a constraint of data availability: the quantitative Joint Monitoring Report indicators are selected among those that are available with broad geographical coverage in Yemen and so are focused more on market availability and self-reported food insecurity at the household level than on agricultural production. Normalized Difference Vegetation Index is a potential indicator on agricultural production from remote sensing, but the modelling and interpretation that is needed makes it infeasible for regular monitoring currently.

While the Yemen Preparedness Plan involves a high amount of coordination among international external actors, involvement of local institutions is limited. In part, this is because technical agencies are split between the rival Sana'a-based and Aden-based authorities and are only able to coordinate via UN agencies that work with both governments, and in part because local state capacity is extremely limited. [72] The majority of agricultural extension and infrastructure development in Yemen is externally funded. Local NGOs such as the Public Works Program and Social Fund for Development work closely with international donors on targeting and implementation on the ground, but decisions on funding levels and priorities in terms of AA versus response reflect choices by the international donors.

Spotlight Box 3. (contd.)

The Food Security Technical Secretariat in Aden coordinates monitoring of food security risks between the relevant government ministries and the Civil Aviation and Meteorology Association and produces a monthly snapshot report on climatic conditions and the potential impacts on agricultural production. However, both technical modelling capacity and data constraints limit the completeness of these reports.

In addition to the lack of local ownership, the downside of AA being primarily directed by international donors is that beyond the joint preparedness plan, individual NGOs and UN agencies have their own funding structures which means a lack of coordination between separate efforts on early warning and AA.

Beyond climate change: Economic shocks and fragility

Up to this point, the discussion of data availability and forecasting capacity has primarily focused on climate-related hazards affecting the agricultural sector. However, two additional factors – conflict and economic shocks – have also played a significant role in shaping agricultural productivity and development in recent decades.[35,36]

In fragile contexts, forecasting faces two distinct challenges: (a) Forecasting other hazards within fragile settings (see section: Data availability and technical capacity), and (b) predicting the occurrence and escalation of conflict. Predicting conflict escalation itself remains a complex task, as most forecasting models rely heavily on historical data. A recent study by Bazzi *et al.*[73] using detailed and high-resolution datasets from Colombia and Indonesia, applied machine-learning techniques to assess the feasibility of early warning systems for conflict. While the models were quite good at identifying persistent violence hotspots, they only poorly predicted new or sudden outbreaks of violence, highlighting the inherent unpredictability of such events. Note that this refers explicitly to technical constraints regarding forecasting. With platforms such as the *Armed Conflict Location and Event Data* (ACLED) project[74] or the *Uppsala Conflict Data Program*, timely and spatially disaggregated data is readily available. For NENA countries such as Yemen, ACLED even provides a dedicated *Conflict Monitor* with additional conflict event categories and interactive mapping tools.[75]

In terms of economic shocks, many countries in the NENA region are highly import-dependent and therefore vulnerable to disruptions in international commodity markets.[76] For example, droughts or conflicts in major wheat-producing countries (e.g. the war in Ukraine) can have significant downstream effects on agrifood value chains across the region.[37] Based on responses from our key informants, Saudi Arabia appeared most confident about managing such risks. Spotlight Box 4 summarizes the core components of Saudi Arabia's approach to addressing import dependency and safeguarding domestic food security outlined by informants in our interviews.

Spotlight Box 4. Beyond borders – the hidden risks in Saudi Arabia's food security strategy

Saudi Arabia's food security strategy is defined by its heavy reliance on global agricultural markets and its growing portfolio of farmland investments abroad. Through entities such as the Saudi Agricultural and Livestock Investment Company, Saudi Arabia has invested in agricultural production across countries like the Sudan, Egypt, Ukraine, and Argentina. These investments are intended to hedge against shocks by ensuring access to the food supply even during global crises. However, respondents noted that the approach remains largely reactive. When disruptions occur, whether due to conflict, drought, or trade restrictions, the default response is to switch suppliers, rather than engage in anticipatory planning or resilience-building in key partner countries.

Despite the scale of these investments, no structured mechanisms exist to anticipate or mitigate risks in supply countries. There are no regional early warning partnerships, insurance arrangements, or joint preparedness protocols with host governments or local producers. This creates a major challenge in Saudi Arabia's agricultural risk management strategy. Several informants emphasized the need to shift from short-term trade adjustments to more proactive engagement.

A key barrier identified by respondents is the fragile institutional environment in many of the countries where Saudi Arabia invests. Political volatility, weak governance, and recurrent disruptions make it difficult to establish long-term risk partnerships or implement early warning systems jointly with host governments.

This import-centric model has helped buffer domestic production shocks, but respondents agreed it cannot insulate Saudi Arabia from external climate or geopolitical crises.

Without mechanisms to assess and manage transboundary agricultural risks, Saudi Arabia's food security remains vulnerable to disruptions beyond its borders. AA planning will need to extend beyond domestic hazards to include structured risk monitoring and early response systems in key import regions, especially as climate volatility and political instability increase.

Multihazard early warning systems

Although agricultural hazards differ in relevance across the NENA region (see section: The state of agricultural risks in the Near East and North Africa region) and may require distinct systems to monitor specific threats – such as pests versus climate-related events – integrated MHEWS are often recommended as gold standard for disseminating alerts to stakeholders.[58] Aligned with the Sendai Framework for Disaster Risk Reduction 2015–2030 and the recent UN initiative, EW4All, the development and implementation of MHEWS has gained increasing momentum with an ambitious target to achieve universal MHEWS coverage by 2027.[25,77] The idea of MHEWS is to deliver integrated alerts and coordinated responses for multiple, potentially interconnected hazards – whether occurring simultaneously, sequentially, or cumulatively over time – by accounting for their compound impacts and cascading effects across sectors and systems.[6] Risks are generally categorized into interconnected clusters

that serve as building blocks for MHEWS: chemical, biological, environmental, social, meteorological and hydrological, extraterrestrial, technological, and geophysical hazards.[58] While not all these risk types are directly relevant to the agricultural sector in NENA countries, integrated MHEWS remain valuable tools for advancing effective AA frameworks, especially given the complex risk landscape in many countries – where climate, conflict, and economic shocks often intersect.

As part of the EW4All initiative, the Sendai Monitor[78] and the EW4All Dashboard[79] track national progress toward operational MHEWS. Progress is measured across four key pillars:[25]

- **Pillar 1:** Disaster risk knowledge
- **Pillar 2:** Detection, observation, monitoring, analysis, and forecasting of hazards
- **Pillar 3:** Warning dissemination and communication
- **Pillar 4:** Preparedness and response capabilities

In Table 7, we present the most recent data from both the Sendai Monitor and EW4All Dashboard for all NENA countries with available entries. The Sendai Monitor provides self-assessment scores from countries, ranging from 0 to 1, with a score of 1 indicating a fully comprehensive MHEWS. In contrast, the EW4All Dashboard includes assessments of countries' technical capacity under Pillar 2, conducted by WMO, based on data availability.

According to self-assessments, more than 60 percent of NENA countries report having an MHEWS, with an average score of 0.54. Only Algeria and Qatar report near-complete systems, while most countries fall in the 0.2 to 0.6 range. A closer look at the four pillars reveals that only 26 percent of NENA countries submitted scores for all four, suggesting that many of the reported systems may be partial or fragmented. Countries tend to rate their capacities highest for Pillars 2 and 3, while scoring significantly lower on Pillar 1 (risk knowledge) and Pillar 4 (preparedness).

A particularly striking discrepancy emerges between national self-assessments and WMO evaluations. While most countries report high confidence in their forecasting and detection capabilities (with self-reported scores often exceeding 0.8), the WMO was only able to assess Pillar 2 capacity for three countries: Jordan, the Sudan, and Syrian Arab Republic. For the remaining countries, either no data were available, or data were not shared. This points to a significant gap between perceived national capacity and internationally recognized data standards for effective early warning systems (see also section: Data availability and technical capacity).

If functional, MHEWS offer benefits for all three dimensions of the humanitarian–development–peace nexus. Standardized MHEWS could significantly improve the chances of reaching all affected farmers – particularly smallholders, who often lack access to formal alerting and monitoring systems – thereby enabling timely risk mitigation. This likely explains why increased investment in MHEWS tailored to the agricultural sector was identified as a key priority at NERC37 for advancing AA in the NENA region.

Table 7. State of multihazard early warning systems in the Near East and North Africa region

Country	Sendai Report since	Focal point	MHEWS self-assessment					WMO ASSESSMENT
			Overall	Pillar 1: Knowledge	Pillar 2: Detection	Pillar 3: Dissemination	Pillar 4: Preparedness	Pillar 2: Detection
Algeria	2023	Délégation Nationale aux Risques Majeurs	0.95	0.81	1	1	1	
Bahrain	2021		0.6		1	0.9	0.5	
Egypt	2015	Egyptian Cabinet	0.64	0.44	0.85	0.8	0.48	
Iraq	2018	Ministry of Health and Environment	0.46		0.84	1		
Jordan	2016	NCSCM	0.68	0.56	1	1	0.17	Basic
Kuwait	2015	Head of Plans and Information Division at Kuwait Fire Service Directorate; Lieutenant Yousef Mohammad Alkhatlan – Kuwait Fire Service Directorate	0.25				1	
Lebanon	2016	Presidency of Council of Ministers	0.59	0.41	1	0.9	0.06	
Morocco	2015	Ministère de l'Intérieur	0.48		0.93		1	
Qatar	2015		1	1	1	1	1	
Saudi Arabia	2020		0.25				1	

Table 7. (contd.)

Country	Sendai Report since	Focal point	MHEWS self-assessment					WMO ASSESSMENT
			Overall	Pillar 1: Knowledge	Pillar 2: Detection	Pillar 3: Dissemination	Pillar 4: Preparedness	Pillar 2: Detection
Sudan	2015		0.21			0.8	0.03	Less than basic
Syrian Arab Republic								Basic
United Arab Emirates	2019	National Emergency and Crisis Management Authority	0.58	0.7	0.6	1		
Yemen	2023		0.38		1	0.5		
Average			0.54	0.65	0.92	0.89	0.62	

Source: Authors' own elaboration based on information from the Sendai Monitor (https://sendaimonitor.undrr.org/) and EW4All Dashboard (https://earlywarningsforall.org/site/early-warnings-all/dashboards/early-warnings-all-dashboard).

It should be noted, however, that while this integrated approach is sound in principle, several authors in the academic literature highlight ongoing challenges in practical implementation (as was also indicated during the discussion of Active and upcoming AA frameworks in the NENA region (see Table 1).[77,80] Even if technical capacity to produce reliable forecasts is available, warnings and alerts must still be tailored to reflect local realities and needs (Pillar 3). Similarly, to the challenges discussed around community-level integration in AA governance, inclusive and locally grounded strategies to enhance the effectiveness of people-centred MHEWS is key.[80] Given the challenges identified in the region surrounding coordination and technical capacities, it is worth highlighting one technical solution. The Common Alerting Protocol is the international standard format that ensures that the same message with standardized elements can be sent over multiple platforms (i.e. cellular phones, social media, radio, television), increasing trust and ensuring clear message delivery.[58] As the majority of NENA countries already use the Common Alerting Protocol in their national meteorological agencies,[a] adoption of the Protocol by agricultural agencies involved in risk monitoring can allow for similar dissemination channels to be used for agricultural early warning.

Key findings – early warning systems and forecasting capacities

Gaps

1. Many existing early warning systems in the NENA region remain single hazard focused or fragmented, limiting their ability to address the interconnected risks that affect agriculture, such as climate extremes, conflict, and market shocks.

2. Low compliance with international standards, like GBON, across most NENA countries, especially in fragile states, hinders the generation of high-quality, integrated meteorological data critical for agricultural forecasting.

3. Self-assessed national capacities often overestimate actual technical performance, particularly for hazard detection and forecasting, with few countries meeting the minimum requirements for comprehensive MHEWS.

4. Despite the growing emphasis on MHEWS, agricultural agencies are often not fully integrated into national systems, leading to a disconnect between available forecasts and agricultural decision-making.

5. There is a lack of localized, agro-specific early warning messages, which limits the ability of farmers, especially smallholders, to take timely and informed action.

[a] For the full list, please see: https://alert-hub.s3.amazonaws.com/cap-sources.html

Key findings (contd.)

Strengths

1. The NENA region has seen technical advancements in forecasting tools and expanded EWS coverage, supported by platforms like GIEWS.
2. Multihazard frameworks are increasingly recognized as essential for capturing the complex, overlapping risks that affect agriculture, aligning well with the region's exposure to compound shocks.
3. Several countries have adopted the Common Alerting Protocol, creating a foundation for harmonized, multiplatform dissemination of early warnings relevant to multiple sectors, including warnings tailored to agriculture.
4. The Sendai Framework and EW4All initiative provide structured guidance for countries to assess and strengthen their MHEWS, with many NENA countries already engaging in the process.

Opportunities

1. Scaling up MHEWS tailored to the agricultural sector offers a clear path to improve AA by ensuring that farmers receive integrated, context-specific warnings for multiple hazards.
2. Integrating agricultural agencies more fully into national MHEWS frameworks can improve the relevance and uptake of early warnings within rural communities.
3. Expanding the use of the Common Alerting Protocol by agricultural institutions would enable more consistent and efficient communication of agro-climatic risks across channels already trusted by the public.
4. Regional cooperation through platforms like the Regional Integrated MultiHazard Early Warning System for Africa and Asia could help countries overcome technical and institutional gaps, supporting the development of transboundary agro-climatic early warning systems.
5. Investing in local-level risk knowledge (Pillar 1 of MHEWS), including farmer-centred vulnerability and exposure mapping, would enhance the precision and usefulness of early warnings for AA.

Triggers and protocols

> *"Even when the warning comes, there is no clear guidance on what farmers should do."*
> Key informant interview, Jordan

Existing anticipatory action protocols focused on the agricultural sector

The section Landscape and main actors in anticipatory action for agriculture and Table 1 provided an overview of the AA landscape in the NENA region. This section takes a closer look at the specific activities implemented under the active AA frameworks, as of 2024. The focus is on identifying components that explicitly address the agricultural sector or could be readily adapted to support agricultural households.

Of the six AA frameworks active in 2024, three include explicit agricultural interventions. Both of FAO's drought-focused AA programmes in the Sudan and Yemen feature a range of activities targeting crop and livestock farmers. These interventions primarily focus on water harvesting, seed distribution, and the promotion of home gardening. Additionally, Save the Children's multihazard AA framework in Sudan directly supports livestock-reliant households.

The remaining AA interventions are more broadly geared toward humanitarian needs; however, two types of activities within these frameworks may still hold significant relevance for agriculture: cash and voucher assistance, and early warning systems. Where agricultural markets are functional, cash or voucher-based support can enable farmers to purchase critical inputs, especially in regions with high crop diversity or where pre-positioning time-sensitive inputs is logistically challenging (see section: Beyond cash transfer – access to inputs at the right time).

The effectiveness of such interventions for agriculture is closely tied to the quality and timing of early warnings. Four out of the six AA frameworks, listed in Table 8, currently include early warning components. If these systems were expanded to deliver agriculture-specific alerts – tailored to planting calendars, crop cycles, or livestock conditions – they could serve as practical entry points for integrating agriculture more fully into existing AA frameworks. Such adaptations could also offer replicable models for future AA programming in the region.

Table 8. Overview of anticipatory action protocols of active anticipatory action frameworks in the Near East and North Africa region

COUNTRY	HAZARD	COORDINATING ORGANIZATION(S)	ANTICIPATORY ACTIONS
IRAQ	Drought	World Vision East Africa Regional Office	• Capacity building • Cash and voucher assistance • Early warnings
LEBANON	Flood	Government institutions; World Vision International	• Capacity building • Cash and voucher assistance • Early warnings • Evacuations • Flood prevention • Food and nutrition; non-food support; protection, gender and inclusion; shelter
SUDAN	Drought	FAO	• **Agriculture:** water harvesting and land preparation; distribution of improved seed varieties and tools; support to home gardening • **Livestock:** water harvesting for livestock; animal health care; distribution of fodder seeds
	Multihazard	Save the Children Sudan	• Capacity building • Early warnings • Flood prevention • Food and nutrition • Livestock • Health; non-food support; protection, gender and inclusion; protecting assets
YEMEN	Drought	FAO	• Cash and voucher assistance • **Livestock:** water harvesting for animals • **Agriculture:** provision of inputs for home gardens
	Storm-induced flood	Yemen Red Crescent Society	• Shelter • Protecting assets • Water, sanitation and hygiene • Cash and voucher assistance • Health • Early warnings

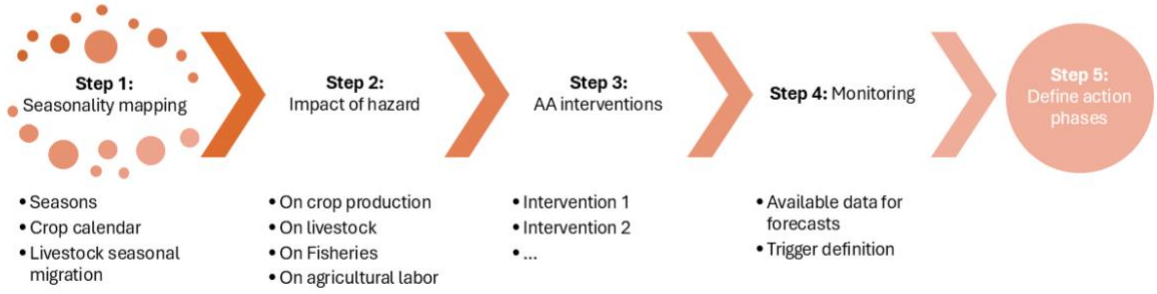
Source: Authors' own elaboration based on data from Anticipation Hub.[17]
Note: The words in bold indicate actions targeted at agriculture.

Phased anticipatory action for agriculture

The agricultural sector is especially vulnerable to slow-onset hazards, such as droughts, pest infestations, and seasonal rainfall deficits. Unlike sudden-onset events like floods or storms, these hazards develop gradually, often over weeks or months, and their impacts on agricultural systems, crop failure, livestock stress, or food price spikes, are shaped by timing, exposure, and accumulated stress.

This slow onset poses a particular challenge for AA: defining precise trigger points becomes difficult because risk signals may be ambiguous or evolve unevenly across time and space. However, this challenge also presents a strategic opportunity. Instead of relying on a single, binary trigger, AA in agriculture can benefit from a phased or layered approach, where action intensity and financing increase over time as risk levels become clearer and forecasts more confident.

Figure 8. The five steps for developing a phased anticipatory action framework



Source: FAO. 2022. *Striking before disasters do – Promoting phased anticipatory action for slow-onset hazards. Position paper.* Rome. https://doi.org/10.4060/cc2213en

Recognizing these challenges, FAO has outlined a five-step phased approach to AA (see Figure),[38] which is particularly relevant for NENA countries facing multiple slow-onset hazards (e.g. drought). The five steps can be summarized as follows:

- **Step 1:** Develop a detailed map of agricultural and livestock seasons.
- **Step 2:** Identify the potential impacts of a selected hazard (e.g. drought) on all parts of the agricultural production system.
- **Step 3:** Decide which action is needed, for which agricultural sub-sector, and at what point in time.
- **Step 4:** Identify what data is available and define appropriate triggers for action.
- **Step 5:** Map out the different phases of action based on risk progression.

The key to phased AA is the creation of a detailed crisis timeline, with staggered triggers that activate different interventions based on the severity and timing of the hazard, and the vulnerability of the affected agricultural sector. Importantly, developing such a timeline requires in-depth disaster risk knowledge. This directly relates to Pillar 1 of the MHEWS framework – presented in the section: Early warning system and forecasting capacities – where NENA countries reported relatively low

self-assessment scores for disaster risk knowledge. Improving this knowledge base and strengthening related capacities could therefore serve as an effective entry point to support the development of phased AA frameworks tailored to the agricultural sector in the NENA region.

Trigger accuracy

A critical component of any AA protocol is the establishment of pre-defined triggers that initiate early interventions and release funding. However, given existing constraints around data availability and technical forecasting capacity, it is understandable that governments and operational partners may be hesitant to fully commit to forecast-based financing mechanisms. Many lack confidence in the accuracy and reliability of available forecasts, and consequently, in the robustness of the triggers used to activate AA. This concern is echoed in responses from our online survey, where over 25 percent of participants identified the lack of reliable data to inform forecasts as a key barrier to implementing AA effectively.

Beyond issues of data access, there are also inherent technical challenges associated with forecasting itself. Most importantly, forecasts are probabilistic by nature.[13] That is, they do not provide certainty but rather a range of possible outcomes with associated probabilities. This means decision makers must work with imperfect information and accept a level of risk when triggering actions. Additionally, although forecasting models in the academic literature have become increasingly sophisticated, accounting for variables such as seasonality, historical anomalies, and compounding risks, these models are rarely translated into operational practice. Humanitarian agencies and practitioners often rely on simpler tools or pre-existing systems.[13]

Thus, linking substantial financial resources to forecast-based triggers – particularly when these forecasts may not yet fully capture vulnerability dynamics – amplifies the inherent uncertainty of disaster risk financing. Drawing on AA approaches developed in conflict-affected settings, where data limitations are especially pronounced, some researchers have advocated for greater flexibility in the design of formal AA frameworks. For example, in a model used in South Sudan interventions are activated not through fixed forecast thresholds, but rather via a high-level taskforce and a public project-tracking dashboard.[14] A similar recommendation was made by one of our key informants from Yemen, who noted that both governments and private sector actors, including insurers, may face difficulties with highly specific trigger definitions in contexts where data availability and forecast reliability are limited. As reflected in the Yemen Preparedness Plan, one proposed solution is a hybrid model that combines high-level indicator-based (e.g. weather, food security) forecasting with decision-making structures – such as cross-agency committees – that determine when AA financing and implementation should be activated (see Spotlight Box 3).

Key findings – triggers and protocols	
Gaps	1. Only three of the six active AA frameworks in the NENA region explicitly include components addressing agriculture. 2. Low disaster risk knowledge by NENA countries might limit the development of phased, sector-specific AA triggers. 3. Lack of data and technical capacity for risk forecasts can erode trust in forecast-based intervention and likely is a barrier to AA development.
Strengths	1. Some existing AA frameworks, such as those by FAO in the Sudan and Yemen and Save the Children in the Sudan, provide targeted interventions for both crop and livestock farmers. 2. AA frameworks without specific agricultural components include actions that can be expanded to address smallholder needs (e.g. tailored early warnings).
Opportunities	1. Invest in building disaster risk knowledge to facilitate both MHEWS development and phased AA for agriculture in the NENA region. 2. Flexible or hybrid trigger models that combine forecast indicators with decision-making committees, as used in conflict-affected contexts, could be adapted for data-scarce countries in the NENA region to improve AA implementation.

Financing mechanisms

> *"While Egypt has many qualified professionals, those responsible for lobbying and applying for funding often lack the capacity to draft compelling proposals or conduct the risk assessments needed to build a strong case for support."*
>
> Key informant interview, Egypt

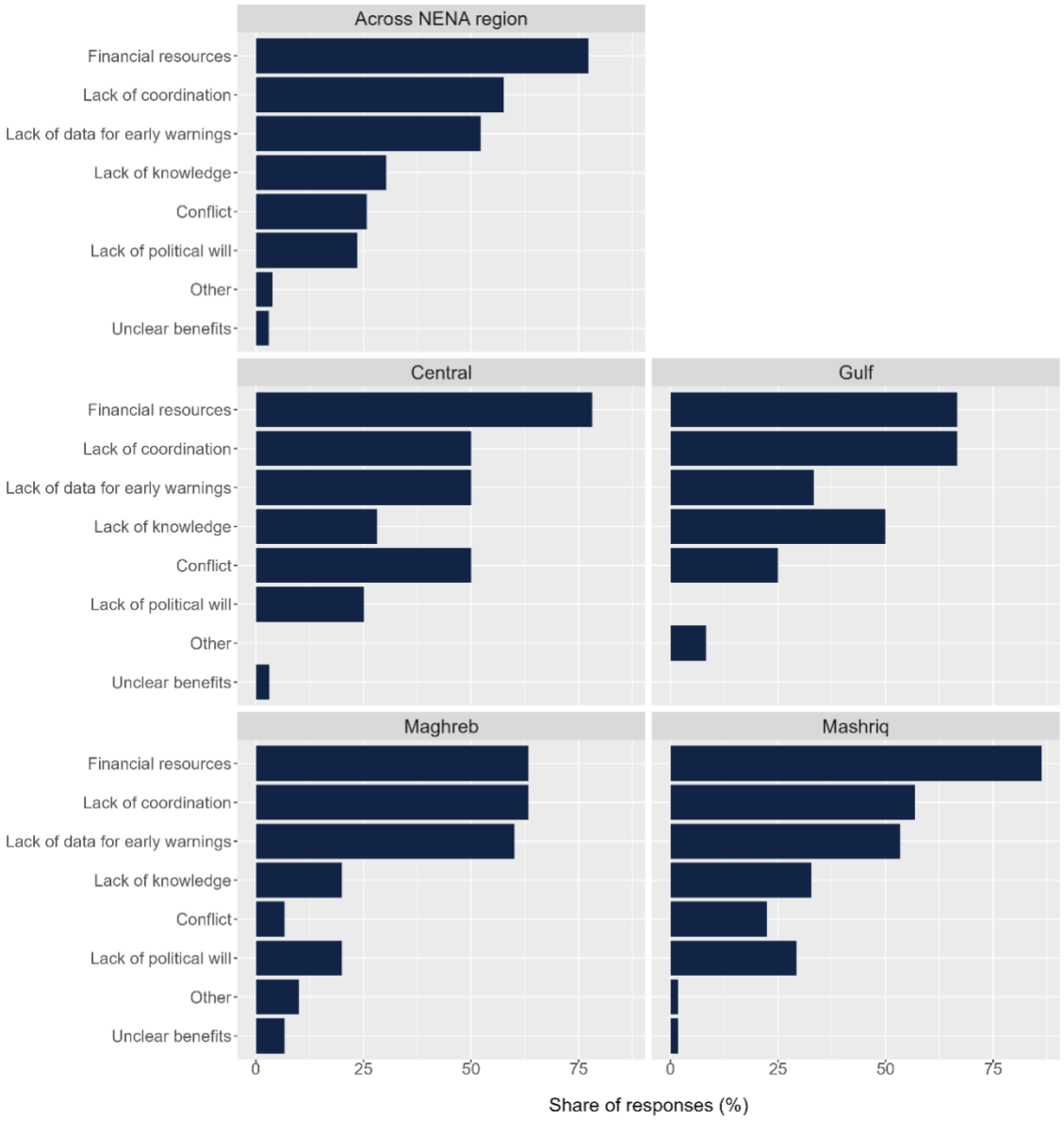
The financial constraint

In their yearly report, the Anticipation Hub is also tracking the funding that is dedicated to AA on the global level. Funding levels have been fluctuating over the last few years, with a big jump between 2022 and 2023 (from USD 54 million to almost USD 200 million), but a decrease between 2023 and 2024 (around USD 110 million).[17] Table 8. Overview of AA protocols of active AA frameworks in the NENA region, which summarizes the AA frameworks currently active in the NENA region, all programmes together add up to a budget of around USD 2.7 million (USD 3.3 million when including the activation in Palestine without pre-agreed framework). Notably USD 2.5 million go to AA frameworks including agricultural interventions. However, when comparing the budget assigned to AA in the NENA region with the total 2024 AA budget, only 2.5 percent of the total funding for AA in 2024 was allocated towards countries in the NENA region. Thus, funding levels for AA in the NENA region remain very low.

We also see this reflected in the responses to our online survey. Figure 9 shows that almost all respondents indicated financial constraints as a major barrier to AA in NENA. Figure 9 also illustrates the distribution of responses from the[b] online survey, disaggregated by subregions. Financial constraints seem particularly pronounced in the Central and Mashriq subregions, where more than three-quarters of respondents cited limited financial resources as a major barrier to the advancement of AA frameworks. This may be attributed to the fragile contexts in several countries within these subregions, which often leads to prioritization of crisis response and broader humanitarian efforts. In contrast, in the relatively more stable Gulf and Maghreb subregions, financial limitations are reported with a frequency comparable to that of coordination challenges. Nevertheless, more than half of the respondents from these regions also identified financial constraints as a significant challenge.

[b] Note that as discussed in Box 1, the results for the Central subregion are predominantly driven by responses for the Sudan.

Figure 9. Major barriers to anticipatory action for agriculture identified in online survey, differentiated by subregion



Source: Authors' own elaboration based on online survey.
Note: Respondents were allowed to give a maximum of three responses.

While financial resources for humanitarian and development initiatives are generally limited, the specific financial mechanisms associated with AA and disaster risk financing present additional complexities. These instruments require that funds be allocated in advance and are only disbursed upon the activation of a pre-defined, forecast-based triggers – introducing a high degree of temporal uncertainty. This stands in sharp contrast to conventional budget planning along fiscal years and implementation of development

or government projects more broadly, which typically operate within defined timeframes and use outcome indicators measured at regular intervals.

Existing financing mechanisms at national level for anticipatory action

At present, we could not find any evidence of country-led AA initiatives in the NENA region. The closest related policy domains are DRM and EWS, but even within these fields, concrete information on dedicated national budgets is scarce. Most operational AA efforts in the region continue to rely heavily on international financing and donor support (see Table 1). Among national investments, those most relevant to AA tend to be linked to the development and strengthening of forecasting capacities and early warning infrastructure. As outlined earlier, several countries have made notable progress in this area. However, these investments are not yet complemented by financial mechanisms that allow for timely and pre-planned action based on forecast information. Institutional priorities still largely favour post-disaster response over anticipatory spending.

Reasons indicated by key informants to explain this behavior were a) a perceived high risk of misallocating funds in case of erroneous forecasts of a disaster and b) the intangible or delayed visibility of successful AA outcomes. One exception to this general pattern is Saudi Arabia, where key informants appeared less concerned about funding availability. The Agricultural Development Fund and the Reef Program were mentioned by several respondents. The Agricultural Development Fund offers recovery loans and aid in response to major shocks, while the Reef Program is a government scheme aimed at supporting rural livelihoods, particularly in climate-vulnerable farming communities in the southwest. However, both programmes are reactive rather than preventive, and support is only available after losses have been incurred. Moreover, disbursement processes are often slow and subject to delays.

Fiscal and administrative constraints were also mentioned as an additional barrier by key informants. The argument was that governments operate under tight budgetary conditions, limiting their capacity to earmark or “park” funds for low-frequency or irregular hazards. As shown in Figure 1, droughts appear to have the largest impact on people’s livelihoods in the NENA region, but their occurrence is still relatively scarce and erratic, compared to other hazards. In such contexts, allocating resources for potential future events – particularly those occurring only once every few years – might be viewed as fiscally inefficient. Nonetheless, most governments in the NENA region maintain contingency funds for disaster response, which, although traditionally used for post-crisis relief, could offer a potential entry point for integrating AA into existing DRM portfolios. Redirecting a portion of these funds toward forecast-based, pre-emptive action would not necessarily require the creation of entirely new financing structures, but rather a shift in how existing resources are allocated and activated.

Overcoming these administrative constraints, another potential entry point for advancing AA implementation and capacity could centre around the development of AA mechanisms for seasonal hazards. Seasonal risks offer a more predictable context in which to pilot anticipatory interventions, generate empirical evidence on their effectiveness, and promote institutional learning. Such initiatives could facilitate the integration of early warning systems, financing strategies, and implementation protocols into a more coherent AA and adaptation frameworks.

Access to international climate finance

Beyond financing mechanisms on the national level, there also exists a growing variety of international funds that could cover AA for agriculture frameworks. A study by Easton-Calabria[14] outlines an issue: that funds specifically dedicated to AA often only have a funding cycle of a few months. For humanitarian efforts this is already quite short, but even more so in development and agricultural contexts. As a potential solution, Attoh and Amarnath[16] propose reframing agricultural AA as part of broader climate adaptation and resilience strategies. This approach could facilitate access to a wider range of international funding streams targeted at climate-related challenges. Such a shift aligns well with earlier discussions on integrating AA for agriculture into national adaptation strategies (see section: Anticipatory action as complementary to adaptation strategies), as well as the need for longer planning horizons in AA programming (Section: Different types of hazards: The role of space and time).

Table 9 presents an overview of several international climate finance mechanisms currently accessible in the NENA region. While some of these funds are broad in scope and relate to general climate finance, others such as the InsuResilience Global Partnership are explicitly designed to support AA initiatives. The Climate Risk and Early Warning Systems Initiative and the Systematic Observations Financing Facility are more related to the establishment of MHEWS.[25]

Table 9. Examples of funds for international climate finance and eligibility of Near East and North Africa region countries

	DESCRIPTION	COUNTRIES
ADAPTATION FUND	Financing projects that enhance resilience against climate-induced hazards	Egypt, Iraq, Jordan, Lebanon, Mauritania, Morocco, Sudan
GREEN CLIMATE FUND	Bridge climate financing gaps in MENA by supporting ambitious projects that align with national climate priorities	Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Saudi Arabia, Sudan, Syrian Arab Republic, Tunisia, Yemen
INSURESILIENCE GLOBAL PARTNERSHIP	Providing financial protection against climate and disaster risks for 500 million people annually in MENA by 2025, collaborates with MENA CoP to link AA to risk financing	Morocco
SYSTEMATIC OBSERVATIONS FINANCING FACILITY	UN Multi-Partner Trust Fund established in 2021 by the WMO, UNDP, United Nations Environment Programme, USD 107 million for 61 countries so far	South Sudan Sudan (on hold)

Table 9. (contd.)

	DESCRIPTION	COUNTRIES
CLIMATE RISK AND EARLY WARNING INITIATIVES	Providing financial support to developing countries to establish early warning systems for climate-related hazards	Open to official development assistance – eligible Least Developed Countries and Small Island Developing States (e.g. Yemen, Sudan)
ITALY'S AICS	Funded EWS projects	Lebanon, Sudan
UK'S FOREIGN, COMMONWEALTH AND DEVELOPMENT OFFICE	Funding WISER MENA and PHENOMENAL projects	Egypt, Iraq, Jordan, Morocco, Palestine, Syrian Arab Republic, Tunisia, Yemen

Source: Authors' own elaboration.

While international climate finance offers a promising avenue for governments to expand their budgets for pre-emptive action in the agricultural sector, its uptake in the NENA region remains relatively limited. Key informants identified capacity constraints as a major barrier to accessing these funds. Specifically, the application processes are often described as highly bureaucratic and complex, frequently requiring several months (or even years) to complete. As such, building and maintaining institutional capacity to effectively develop and submit proposals for international climate finance was identified as a critical entry point for strengthening the financial foundations of agricultural AA in NENA countries.

Overcoming investment hesitancy

Generating robust empirical evidence on the impact and cost-saving potential of AA interventions is a critical step toward strengthening their appeal to national stakeholders. A number of reports have attempted to estimate the return on investment of AA, with some suggesting that each dollar spent could yield returns as high as USD 6.7.[81] However, it is essential to clarify the basis of such comparisons. Stakeholders are typically less interested in contrasting AA with a scenario of no intervention, and more concerned with understanding the cost-effectiveness of anticipatory versus post-disaster responses.[82]

Despite growing interest, empirically rigorous impact evaluations remain limited. Where available, existing studies tend to focus almost exclusively on cash transfers, which are not specifically linked to the agricultural activities. For instance, a recent study on cash transfers following monsoon floods in Nepal found a statistically significant short-term improvement in household food security and mental well-being for recipients of anticipatory transfers compared to those receiving post-disaster assistance.[19] However, these differences disappeared within three months, as households that received post-disaster transfers caught up to the same welfare levels. Notably, the study found no statistically significant differences in agricultural activities between the groups at any point. In a similar study in Nigeria, results indicate only modest short-term benefits of AA for households affected by floods.[83] Nonetheless, the study identified some positive shifts in coping strategies among AA recipients, which could potentially contribute to greater long-term resilience. Another study emphasizes that when aiming to optimize the value of

forecasts and EWS it has to be clear that the true value will only be evident when they are planned to be implemented for a long time.[13] That is, while the actual interventions might be only short-term, the actual impact and cost-benefit potential might take up to a decade to show. This is an interesting connection to the humanitarian–development–peace debate as it underlines that short-term actions such as AA are best placed into strategies with a long-term perspective.

These findings underscore the need for more comprehensive analysis and context-specific evidence, particularly with a focus on agriculture. While cash transfers may play a supportive role in certain contexts and are already part of most of the existing AA frameworks in NENA, they are not always sufficient when the primary objective of the AA framework is to protect crops and harvests. In such cases, timely provision of agricultural inputs such as pesticides, drought-resistant seeds, or animal feed may be critical. While cash transfers can provide financial means, they do not guarantee that the necessary inputs are available and accessible to farmers in the market, especially if a hazard increases overall demand. A more nuanced understanding of the costs and benefits for agricultural production of different AA designs, timing, and targeting, is thus essential.

Insurance and financial tools

Another instrument relevant to disaster risk financing is insurance, particularly emerging models that link payouts to automated, data-based triggers. Among these, index-based insurance schemes are among the most widely known.[84,85] The general idea being that it is not farmers' individual losses determining the payout of the insurance, but a pre-defined objective risk trigger correlated with yield losses (e.g. weather indicator).[84] A growing body of literature has examined the impacts of such financial products on agricultural producers and rural livelihoods, with findings generally indicating positive outcomes.[86,87] These insurance schemes are typically designed to address recurrent climate-related hazards, making them more appealing to farmers who face frequent and predictable risks.

Although index-based insurance is not anticipatory in the strictest sense – its primary objective is to protect livelihoods after a shock rather than safeguard harvests in advance – the underlying mechanism of pre-defined trigger-based disbursement aligns closely with the financing principles of AA. As such, these existing instruments could be adapted or expanded to serve as entry points for developing more anticipatory approaches to managing agricultural and climate-related risks.

One of the leading examples on financial products for climate hazards in the NENA region is Morocco. In the agricultural sector, the government co-finances weather-indexed insurance through a partnership with the Mutuelle Agricole Marocaine d'Assurance, covering drought, frost, and other risks. While this insurance system was cited by several key informants as one of the most advanced in the region, it covers only strategic crops. Meanwhile, some informants highlighted that it is not fully anticipatory as payouts are still triggered post-loss and are not yet tied to forecast indicators or risk thresholds.

Key informants from Saudi Arabia mentioned a pilot agricultural insurance scheme, which is currently tested to cover risks such as frost damage and pest outbreaks. The model is being designed in partnership with the private sector and may eventually extend to cover a broader range of climate-related risks. While promising, it is not yet scaled nationally.

In Egypt, key informants offered a mixed assessment of Egypt's existing financial risk management mechanisms for farmers and rural communities. A few mentioned the Livestock Insurance Fund, which has been in operation since 1959 and includes proactive elements such as seasonal health monitoring and subsidized veterinary and livestock vaccination services. However, no comparable large-scale crop insurance programme is currently operational. Still, informants did mention that some efforts are underway to improve the insurance landscape. According to the Financial Regulatory Authority, work is ongoing in collaboration with the Egyptian Insurance Federation to design new agricultural insurance models tailored to farmers' needs. These efforts aim to utilize satellite imagery and other technologies for better crop damage assessment and more efficient claims processing. The recently enacted Unified Insurance Law (Law 155/2024), which took effect in July 2024, includes dedicated provisions for agricultural insurance and natural disaster coverage. Although uptake remains limited, stakeholders consider these developments a critical step toward strengthening protection against climate-related risks in the agricultural sector.

Key findings – financing mechanisms	
Gaps	1. AA in the NENA region receives a disproportionately small share of global funding, with only 2.5 percent of 2024 AA financing allocated to the region. 2. There is a near-total absence of country-led AA financing mechanisms, with most efforts relying heavily on international donor funding. 3. Complex application procedures and limited institutional capacity hinder access to international climate finance for many NENA countries. 4. Index-based insurance schemes and disaster contingency funds, though present in some countries, are typically reactive and not tied to anticipatory triggers.
Strengths	1. Several NENA countries are piloting or expanding insurance and financial tools relevant to agricultural risk management. 2. Existing national disaster response funds in the region could serve as a foundation for integrating anticipatory financing without creating new structures. 3. International funding platforms like the Green Climate Fund and the InsuResilience Global Partnership already include NENA countries in their eligibility.

Key findings (contd.)

Opportunities

1. Advocacy for reallocating a portion of existing national DRM budgets toward forecast-based action can provide a practical entry point for scaling AA.

2. Framing AA for agriculture as part of broader climate adaptation strategies could help NENA countries access more sustained international funding streams.

3. Seasonal hazards offer a predictable testing ground for AA financing models and institutional learning.

4. Index-based insurance schemes could be adapted to incorporate forecast-based triggers, aligning with the anticipatory principles of AA.

5. Embedding rigorous impact evaluations in AA financing mechanisms can help demonstrate cost-effectiveness and increase investment confidence from national stakeholders.

Delivery mechanisms

> *"There's capacity to do more, but right now the safety net is only activated after we can quantify what people have already lost."*
> Key informant interview, Jordan

Leveraging existing social protection infrastructure

The landscape of social protection in the NENA region is quite heterogeneous but several countries have quite extensive systems with potential to be expanded to cover more pre-emptive actions.[88] Table 10 provides an overview of some of the most prominent examples.

Table 10. Major cash transfer programmes in the Near East and North Africa region

COUNTRY	CASH TRANSFER PROGRAMME
EGYPT	Takaful
JORDAN	Takaful
MOROCCO	Tayssir
TUNISIA	National Program for Needy Families
SUDAN	Thamarat Family Support Program
YEMEN	Cash for Nutrition Program (World Bank)
LEBANON	Emergency Crisis and COVID-19 Response Social Safety Net Project (World Bank)

Source: Authors' own elaboration.

Key informants from Morocco, for example, stated that the country has made notable progress in expanding its social protection system, especially following the COVID-19 pandemic and recent earthquake response. According to key informants, the Universal Social Protection Law from 2021 and the national strategy to expand health coverage and child allowances represent a shift toward more proactive risk reduction at the household level. In Egypt, several key informants noted that the Ministry of Social Solidarity provides emergency compensation intended to support affected households, including smallholders, in the aftermath of extreme weather events and other hazards. However, this assistance is reactive in nature, becoming accessible only after a shock has occurred and losses have been officially

verified. Similarly, Jordan's social protection system has undergone expansion in recent years, particularly through national targeting initiatives and donor-supported safety net programmes. Respondents emphasized the role of the Ministry of Social Development, which manages the National Aid Fund and implements the Takaful cash transfer programme.

These social protection systems are key to supporting vulnerable populations during times of crisis, providing cash transfers and essential livelihood support. They are already designed to reach the most at-risk households and have established the infrastructure and communication channels needed for effective outreach. As such, leveraging this existing institutional framework AA targeting and delivery presents a clear and practical opportunity.

The role of digital tools

We have already discussed the role of digital tools in the dissemination of alerts under Pillar 3 of EWS. The increasing penetration of information and communication technology, including in some remote areas, offers an important opportunity to build more inclusive EWS and AA frameworks. Note, however, there is still evidence that access to information and communication technology in rural areas across the NENA region remains underdeveloped.[89] Additionally, platforms like the Common Alerting Protocol, which consolidate alerts from various sources, have the potential to make dissemination even more effective (see section: Multihazard early warning systems). This is particularly relevant for agriculture, where risk information is often time-sensitive and timely action is crucial. Digital tools can play a key role in improving information flow and supporting more effective AA in response to early warnings.

Across the case study countries, numerous key informants emphasized the critical role of digital tools in strengthening the dissemination of early warnings and improving communication with farming communities (see Table 11). In Saudi Arabia, informants highlighted the country's advanced digital infrastructure and extensive mobile communication networks as a strong foundation for scaling up farmer-targeted early warning services. In Jordan, digital technologies have been integrated into the Takaful cash transfer programme, enhancing its efficiency and transparency through features such as online registration systems, automated eligibility checks, and e-wallet-based disbursements. In Morocco, the adoption of digital innovations is growing, with informants referencing the deployment of drones for crop monitoring, simulation tools for risk analysis, and mobile alerts for early warnings. Nevertheless, the scale of implementation remains limited, and access – especially among farmers in remote areas – continues to be a significant barrier. In Egypt, the Climate Change Information Center (CCIC), under the Ministry of Agriculture, operates an SMS-based alert system that currently serves over one million farmers. This system provides localized, crop-specific advisories – such as alerts on frost, wheat rust, and seasonal temperature changes – aligned with regional agro-climatic conditions.

Table 11. Examples of digital tools reported by key informants

COUNTRY	APPLICATIONS OF DIGITAL TOOLS
SAUDI ARABIA	▪ Widespread mobile communication systems ▪ Digital EWS for drought and pests
JORDAN	▪ Digitalization of Takaful cash transfer programme
EGYPT	▪ SMS-based alert system (reach > 1 million farmers)
MOROCCO	▪ Drones for crop monitoring ▪ Risk simulation tools ▪ Mobile-based early-warning alerts

Source: Authors' own elaboration based on key informant interviews.

It is important to note, however, that these digital advancements are primarily utilized for advisory purposes rather than serving as direct triggers for AA. Consequently, their effectiveness depends heavily on farmers possessing both the technical capacity and financial resources to act on the information received. A recurring concern among key informants was that limited digital literacy and constrained access to mobile technologies among farmers significantly diminish the impact of SMS- or app-based early warning systems. In the absence of complementary outreach and support mechanisms, these tools risk failing to convert information into timely and effective on-the-ground responses. This is a concern that is also supported by empirical evidence in the academic literature.[90]

Beyond cash transfer – access to inputs at the right time

Cash transfers and vouchers are widely used tools in humanitarian assistance, particularly when rapid relief is required. For instance, in a study comparing AA programmes implemented by the Red Cross and Red Crescent across 19 countries, cash transfers were included as a core AA intervention in 9 of those countries.[2] Moreover, the most recent Anticipation Hub report shows that cash and voucher assistance leads by far the list of AA interventions (73 percent).[17] This is also visible in the active AA frameworks in the NENA region (see Table 8), where four out of five programmes include cash or voucher transfers.

There is research indicating that households receiving anticipatory cash transfers five days before a flood in Bangladesh reported faster recovery and lower asset losses compared to those who did not.[91] Another study observes positive associations between anticipatory cash transfers for flood risks in Nigeria and long-term household resilience.[83] However, rigorous impact evaluations of such programmes remain limited, particularly with respect to agricultural households. Existing studies often focus on short-term food security, coping mechanisms, or broader resilience outcomes, rather than agricultural-specific indicators. While cash transfers may enable farmers to act on early warnings, their effectiveness is also contingent on market availability of key inputs (e.g. pesticides) and farmers' technical capacity to use

them effectively. This underscores the importance of incorporating both in-kind support and knowledge-based interventions into agricultural components of AA frameworks.

In the section Existing anticipatory action protocols focused on the agricultural sector, we presented details on the first AA frameworks in the NENA region that target non-cash AA for farm households. However, we found no impact evaluations for these programmes, and rigorous evidence on the effectiveness of these types of AA is even scarcer than that available for cash transfer-based AA. A notable exception is an evaluation of a forecast-based intervention in Mongolia, where cash transfers were combined with veterinary kits to protect livestock from an impending harsh winter.[15]

Although there is a lack of impact evaluations, studies still document AA programmes that incorporate agricultural components, such as livestock evacuation and treatment, distribution of millet or cowpea seeds, provision of veterinary kits, early harvesting support, and pre-positioning of food storage bags.[2] Additional in-kind interventions found in the literature include stress-tolerant crop varieties, pest and disease control, short-cycle seeds, early harvesting, and small-scale irrigation equipment.[5] These examples offer valuable entry points for integrating agriculture more fully into AA frameworks, as pre-emptive measures that secure harvests and protect livestock are critical for sustaining rural livelihoods during and after shocks. Hence, there is ample opportunity to add rigorous evaluation procedures to existing AA frameworks for agriculture in the NENA region and beyond. The same holds for the five new AA frameworks currently under development in the NENA region (see Table 1).

However, despite these promising trends of agricultural components in AA frameworks, most AA programmes are still designed with the general population in mind, and agricultural considerations are often added only later or used solely as vulnerability indicators. As a result, interventions addressing sector-specific knowledge, such as optimal irrigation timing, use of improved inputs, or management of plant and animal pests, are rarely central to current AA programming. Approaches like phased AA or better tailoring of early warning alerts to agricultural needs present clear opportunities to more effectively integrate the agricultural sector into humanitarian AA.

Key findings – delivery mechanisms	
Gaps	1. Most social protection systems in the NENA region remain reactive, with assistance activated only after shocks are verified. 2. Agricultural-specific interventions in AA frameworks are often overlooked or added as afterthoughts, rather than being integrated from the outset. 3. Limited digital literacy and information and communication technology access, especially in rural areas, hinder the reach and effectiveness of digital early warning systems and AA tools. 4. Rigorous impact evaluations, especially for in-kind and agriculture-focused AA programmes, are largely absent across the region.
Strengths	1. Several NENA countries have well-established national cash transfer systems that already reach a large share of vulnerable populations. 2. Digital technologies such as e-wallets, online registration, and SMS alerts are already being used to improve efficiency and outreach in some social protection and early warning systems.
Opportunities	1. Existing cash transfer programmes can be adapted to deliver anticipatory support based on forecast-based triggers before shocks occur. 2. There is strong potential to leverage existing digital infrastructure and tools to operationalize the dissemination of AA, such as early warnings for agricultural producers. 3. The existence and development of new AA frameworks in the region offers a timely opportunity to integrate rigorous impact evaluations of AA, especially for non-cash agricultural interventions.

Recommendations and conclusion

This study reviews and maps existing AA frameworks in the NENA region, assessing their potential for application in the agricultural sector. In this section, we summarize the key themes that emerged from the literature review, key informant interviews, and online survey. We then provide six recommendations, identifying promising and practical entry points to support the advancement of agricultural AA in the NENA region.

Main findings

1. Limited government ownership – AA frameworks in the NENA region are predominantly initiated and managed by international actors, with limited engagement from national governments. Ministries of agriculture, in particular, are often not formally involved in AA planning or implementation, reducing alignment with national agricultural priorities. This lack of institutional ownership limits sustainability and scale-up potential.
2. Weak coordination across levels and sector – AA efforts are often siloed, with poor coordination between national, subnational, and sectoral stakeholders. This fragmentation prevents the development of coherent, multihazard AA systems that can effectively link early warning to AA across agriculture, disaster risk management, and social protection. The absence of shared protocols and information flow weakens overall system responsiveness.
3. Insufficient integration with climate and development planning – Although climate adaptation and agricultural development strategies are gaining prominence, they rarely include short-term anticipatory mechanisms. This disconnect undermines the potential to link immediate protective actions with long-term resilience objectives. Aligning AA with adaptation planning could unlock new funding streams and ensure more consistent support for agricultural communities.
4. Forecasting and early warning systems remain underutilized for agriculture – Many NENA countries have made technical progress in forecasting, but agricultural agencies are not fully integrated into national early warning systems. As a result, farmers often lack timely, agro-specific warnings that would allow them to prepare for impending shocks. This gap reduces the effectiveness of AA for the agricultural sector.
5. Low inclusion of agricultural triggers and tailored protocols – Only three of the six active AA frameworks in the region explicitly include agriculture-specific components, such as protocols for protecting crops or livestock. This limits the capacity of AA systems to deliver timely and relevant support to farmers. Furthermore, low availability of localized risk data impedes the development of phased or sector-specific triggers.
6. Disproportionately low AA financing in NENA – In 2024, only 2.5 percent of global AA funding was allocated to countries in the NENA region, despite the region's high exposure to compound risks. Agricultural AA programmes are particularly underfunded, even though food systems are central to livelihoods and stability. This funding gap constrains the development of new frameworks and the scaling of existing ones.

7. **Existing financial tools are predominantly reactive** – Financial instruments, such as disaster contingency funds or insurance schemes, exist in some NENA countries but are typically activated only after a disaster occurs. These tools are not yet linked to forecasts or risk triggers and thus do not support anticipatory approaches. This limits the potential to act before losses occur.
8. **Social protection systems provide untapped delivery potential** – Many NENA countries already operate large-scale cash transfer systems that reach vulnerable populations, including smallholder farmers. However, these systems are almost exclusively reactive and have not yet been adapted to deliver anticipatory assistance. With the right modifications, they could serve as scalable channels for agricultural AA.
9. **Digital access and local delivery capacity vary widely** – Although digital tools like SMS alerts and e-wallets are used in some countries, rural areas often face barriers in digital literacy and connectivity. Additionally, local NGOs and cooperatives have shown capacity for timely action but are not systematically included in formal AA systems. These disparities reduce the reach and effectiveness of early warning dissemination and response.
10. **Lack of impact evidence undermines buy-in** – There is a significant lack of rigorous evaluations of AA interventions in the region, particularly for agriculture-specific or in-kind measures, such as seed distribution or animal feed. This limits the ability to demonstrate cost-effectiveness and long-term value to decision makers. As a result, investment in AA remains limited and often pilot-driven.

Recommendations

Advocacy

1. **Support mainstreaming and institutionalization of AA (for agriculture)** – Support national governments, especially ministries of agriculture, planning, and finance, in taking a leading role in designing, financing, and implementing AA frameworks. Government ownership is critical for sustainability and for embedding AA with agricultural components into broader disaster risk management, food security, and adaptation agendas.
2. **Advocate for reallocating DRM budgets toward agricultural AA** – Encourage national stakeholders to dedicate a portion of existing disaster response funds to forecast-based agricultural interventions. This reallocation does not require creating new structures, but rather repurposing existing resources for timely support to farmers ahead of shocks.
3. **Frame agricultural AA as a complement to climate adaptation** – Position AA for agriculture as a critical tool within long-term adaptation and resilience strategies, especially in contexts of seasonal or recurring climate risks. This framing increases policy relevance and enhances eligibility for sustained international climate finance.
4. **Raise awareness of agricultural AA's dual impact on livelihoods and food systems** – Promote the message that timely interventions for farmers not only reduce humanitarian needs but also safeguard national food production, agri-value chains, and economic stability – particularly relevant in countries with fragile or import-dependent food systems.

Knowledge

5. Invest in rigorous impact evaluations of agricultural AA interventions – Prioritize evaluations of sector-specific interventions, such as early provision of seeds, livestock feed, or veterinary care, to demonstrate cost-effectiveness and resilience benefits. This evidence is essential to shift policy and funding from reactive to anticipatory approaches in agriculture.
6. Enhance local-level risk knowledge tailored to agriculture – Support community-based assessments that map agricultural risks, vulnerabilities, and coping strategies. Engaging farmers, cooperatives, and extension services helps ensure that early warnings and AA protocols reflect local needs and realities. Traditional and indigenous knowledge can provide critical insights in improving local-level implementation of AA for agriculture.
7. Use seasonal hazards as testing grounds for AA for agriculture – Pilot AA frameworks with agricultural components around predictable, recurrent risks (e.g. seasonal drought, pest outbreaks) to develop context-relevant models, build institutional experience, and generate lessons that can inform broader AA programming.
8. Document and disseminate lessons from AA pilots with agricultural components in NENA – Consolidate learnings from existing AA frameworks (e.g. FAO Sudan, Save the Children Sudan) to inform future scale-up. This includes sharing models for hybrid triggers, decentralized delivery, and coordination mechanisms suited to agricultural contexts.

Technical Capacity

9. Support full integration of agricultural agencies into national MHEWS – Facilitate collaboration between ministries of agriculture and meteorological institutes on designing agro-specific forecast products and early warnings. This will improve the timing, relevance, and uptake of AA messages among farming communities.
10. Promote the use of digital communication tools for agricultural AA – Utilize SMS, mobile apps, and social media platforms to disseminate tailored early warnings and preparedness advice to farmers. Where digital access is limited, explore radio, local extension agents, and voice messaging in local dialects.
11. Support forecasting accuracy through better data systems – Investments in meteorological and agricultural monitoring infrastructure can help to meet global standards like GBON. Accurate and location-specific data are essential to develop reliable triggers and build trust in AA among decision makers and farmers.
12. Leverage regional platforms for technical exchange on AA for the agricultural sector – Facilitate engagement with regional mechanisms like MEACAM, Regional Integrated Multi-Hazard Early Warning System for Africa and Asia, and the Anticipation Hub MENA to facilitate peer learning, joint training, and development of transboundary early warning systems for shared agricultural risks such as drought or locust outbreaks.

Programming

13. Leverage social protection systems to enable AA delivery to farmers – Explore and promote opportunities to modify existing cash or in-kind transfer programmes to allow pre-disaster payouts based on forecasts. This can provide smallholders with the liquidity to protect crops, livestock, or assets before a shock hits, reducing long-term recovery needs.
14. Develop flexible and locally adapted trigger models for agriculture – Combine technical forecast indicators with contextual decision-making tools (e.g. local expert committees or rapid assessments) to develop phased triggers that reflect both meteorological thresholds and agricultural realities.
15. Collaboration among international stakeholders to include agricultural interventions into AA frameworks from the outset – Design AA frameworks with explicit agricultural components, such as drought-tolerant seeds, pest control, irrigation inputs, or animal health support, ensuring timely delivery to farmers at risk of production losses.
16. Partner with local actors to deliver agricultural AA at scale – Collaborate and invest in NGOs, cooperatives, and farmer groups who have local reach and delivery capacity. These actors can mobilize faster and more effectively than national systems, especially in remote or fragile areas.
17. Digitize early warning and delivery systems for agriculture – Support mobile platforms and digital registration systems to streamline beneficiary targeting, early warning dissemination, and AA implementation. These tools can reduce delays, improve coverage, and support monitoring and evaluation.
18. Mainstream AA (with agricultural components) into national DRM and agricultural policies – Advocate for AA principles, such as risk-informed planning, pre-positioned financing, and sector-specific response protocols, to be embedded in agriculture, climate, and disaster strategies, rather than treated as parallel pilot programmes. AA frameworks should always ensure government involvement.

Notes

1. **IASC (Inter-Agency Standing Committee).** 2024. *Outcome Document, Commitments, Grand Bargain Caucus on Scaling Up Anticipatory Action*..
2. **Tôlier de la Poterie, A. *et al.*** 2023. Anticipatory action to manage climate risks: Lessons from the Red Cross Red Crescent in Southern Africa, Bangladesh, and beyond. *Climate Risk Management*, 39, 100476.
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Annex 1.
Material and methods

To obtain a comprehensive understanding of AA efforts in the NENA region and their relevance for the agricultural sector at regional and country levels, the study combines information from secondary sources, such as government strategy documents and technical reports by various stakeholders, with primary data collected through key informant interviews and an online questionnaire. The primary data collection focuses both on the regional level and internationally led AA initiatives in the region, as well as on country-level strategies and policies related to agricultural resilience, DRR and DRM.

Review of secondary information: A comprehensive review of literature and secondary information was conducted to establish a foundational understanding of AA in the NENA region, with a particular focus on the agricultural sector. The review draws on peer-reviewed publications, grey literature, project evaluations, policy documents, and reports from international organizations such as FAO, WFP, IFRC, and the Overseas Development Institute. Secondary information sources also included data from global platforms like the Anticipation Hub, GIEWS, and MHEWS assessments. This desk-based research provided critical insights into existing AA frameworks, early warning systems, governance structures, and financing mechanisms, while also identifying key gaps, emerging trends, and opportunities for expanding AA tailored to agriculture in the region.

Key informant interviews: Key informants have been selected through purposive sampling to identify individuals with relevant knowledge and expertise for future AA programming for the agricultural sector in the region. Informants were chosen based on their professional experience, leadership roles, and direct involvement in AA, DRR, EWS, or other relevant areas related to AA for agriculture. To capture regional as well as national insides, the interviews were conducted with regional experts and experts from five selected case study countries. These countries are Morocco, Egypt, Jordan, Saudi Arabia, and Yemen. Countries were selected based on specific criteria including main agricultural hazards (e.g. drought, floods, conflict, pests and diseases, economic shocks, etc.), income (high, middle and low income), and subregional representation.

For the country case studies, informants included representatives from relevant ministries, national hydrometeorological departments, local or international organizations working on AA and DRM/DRR, and technical staff involved in specific elements of AA, such as EWS and financial institutions. At the regional level, informants represent major international organizations involved in AA in the NENA region. The study prioritized gathering insights from government officials, sector experts, and community leaders to ensure diverse perspectives. In total 39 experts have been interviewed and Table A1.1. provides a disaggregated overview of the key informant interview sample by case study country and affiliations.

The interviews followed a semi-structured format, allowing for a standardized approach while providing flexibility to explore relevant topics for each informant. An interview guide was developed with core questions on EWS, awareness of AA protocols, financing and coordination of DRR and AA, while also allowing informants to elaborate on topics such as general AA capacity, challenges, and opportunities. This adaptive format ensured a comprehensive understanding of key issues while maintaining consistency

across interviews. Interviews, conducted via video conferencing, lasted around 60 minutes each and were recorded to ensure accurate transcription. Moreover, notetaking using a structured template allowed to capture essential insights. Thematic analysis was employed to examine the data, identifying patterns, recurring themes, and key insights that emerged across the interviews.

Online survey: An online questionnaire was designed to capture both quantitative and qualitative data, including a mix of closed-ended questions (e.g. Likert scale items, multiple-choice questions) and open-ended questions to gather measurable data and more detailed qualitative insights. The focus of the online questionnaire was to collect insights on EWS and AA existence, functionality, implementation barriers, and avenues for future programming. Respondents answered questions about the NENA country they were most familiar with.

The online questionnaire was distributed to a diverse range of participants involved in AA and the agricultural sector, including government officials, technical experts, local stakeholders, and representatives from NGOs working in DRM and agriculture. Leveraging on email lists based on networks from FAO country offices, a regional community of practice list shared by WFP, and regional contact points for the Common Alerting Protocol, ensured wide distribution and response from almost all NENA countries. In total 133 responses were received (see Table A1.1).

Table A1.1. Sample of experts interviewed in key informant interviews

	NUMBER OF INTERVIEWS	AFFILIATIONS
REGIONAL	9	WFP; IFRC MENA; WISER MENA; Centro Internazionale in Monitoraggio Ambientale; UNESCWA; League of Arab States;
EGYPT	8	Egyptian Ministry of Environment; Information and Decision Support Center; Egyptian Ministry of Water Irrigation Management; Egyptian Meteorological Authority in the Civil Aviation Ministry; CCIC at the Agriculture Research Center (ARC); General Administration for Locust and Agricultural Pest Control
JORDAN	6	Jordan Ministry of Local Administration; University of Jordan; Water Environment and the Climate Change Center; NCSCM; Jordan Valley Authority; Meteorology Department at King Abdulaziz University
MOROCCO	5	IWMI; National Institute of Agronomic Research (INRA); International Center for Agricultural Research in the Dry Areas; UNICEF
SAUDI ARABIA	6	King Saudi University; National Center for Vegetation Cover Development and Combating Desertification; the General Administration of Agricultural Guidance in Saudi Arabia;

Table A1.1. (contd.)

	NUMBER OF INTERVIEWS	AFFILIATIONS
YEMEN	5	Agriculture and Food Security Departments at The World Bank; Yemen Meteorological Stations Department; The Yemen Food Security Technical Secretariat; FAO Yemen;
TOTAL	39	

Source: Authors' own elaboration based on key informant interviews.

A note on representativeness and interpretation

While we gathered responses from most NENA countries, the online questionnaire sample is not representative of all expert perspectives within each country, as participation was voluntary. Additional details on respondents' affiliations and areas of expertise are provided in Annexes 2 to 5. Note also that the data reflects input from experts and stakeholders only; due to the methods used, we were unable to include insights from farmers or farmers' associations.

Furthermore, we sometimes group responses by subregion for a more disaggregated analysis in the subsequent report. However, this approach may introduce bias, as countries with disproportionately high response rates (e.g. the Sudan or Lebanon, see Table A1.2) could influence observed patterns; this also holds for full sample statistics.

Table A1.2. Distribution and number of conducted key informant interviews and responses to the online survey

Region	Country	Key informant interview number	Number of responses to the online survey
Central	Egypt	8	4
	Sudan		28
Gulf	Saudi Arabia	6	4
	Yemen	5	5
	Qatar		1
	Oman		1
Maghreb	Morocco	5	11
	Mauritania		4
	Algeria		5
	Tunisia		5
	Libya		5
Mashriq	Jordan	6	3
	Syrian Arab Republic		9
	Iraq		13
	Lebanon		20
	Palestine		13
Regional		9	
Total		**39**	**131**

Source: Authors' own elaboration based on key informant interviews and responses to the online survey.
Note: Key informant interviews were held in 5 countries and with 9 regional experts. Responses to the online survey were collected from 16 countries.

Annex 2.
Case study: Morocco (key informant interview insights)

Section 1. Main hazards

Morocco faces a chronic and intensifying set of climate-related hazards that are reshaping its agricultural risk profile. Among these, drought was cited by all key informants as the most severe and recurring challenge, now viewed not as an occasional crisis but a "structural feature" of Morocco's agricultural calendar. The country has experienced up to seven consecutive years of below-average rainfall, and respondents repeatedly emphasized that the severity and recurrence of drought are pushing the agricultural sector toward chronic water stress. As one respondent explained:

> *"We have entered a new normal; farming now means planning for drought, not just reacting to it."* (Key informant interview 21)

Heatwaves were the second most cited hazard, with interviewees warning that increasingly high temperatures are shifting planting cycles and damaging crops during sensitive growth periods. These temperature extremes often coincide with other climatic hazards such as hailstorms and floods, compounding stress on crops and livestock, particularly in the pre-harvest stage.

Sea level rise and saltwater intrusion are not yet widespread concerns, but water salinization and aquifer depletion are emerging threats in intensively irrigated areas, such as Souss-Massa and Saïss plain. Informants also highlighted the compounding effects of market volatility and social vulnerability, particularly when climate shocks overlap with rising food prices or declining remittance income in rural areas. As one respondent put it:

> *"Drought is not just a climate issue – it's an economic and social shock for small farmers."* (Key informant interview 26)

Despite this threat landscape, Morocco has shown signs of long-term adaptation. Experts highlighted a policy-driven shift toward more resilient farming systems, including a move from cereals to drought-tolerant tree crops (such as olives and almonds), as well as a national push to promote conservation irrigation, particularly drip systems. As one expert explained:

> *"We are moving toward high-value, drought-resilient crops. The days of relying on rainfed wheat are behind us."* (Key informant interview 31)

Informants also referenced occasional earthquakes, as seen in the 2023 event, which damaged livestock and agricultural infrastructure in some mountain regions.

Section 2. Evaluation of crisis management and disaster risk reduction systems

Morocco has made substantial investments in DRR and agricultural risk management. Most key informants agreed that the country has developed a solid technical and institutional foundation for responding to climate-related shocks, particularly drought. While the system remains largely reactive in its operational procedures, many of its components, including early warning dissemination, drought monitoring, insurance mechanisms, and rural social protection, provide a base for future anticipatory efforts.

Early warning systems and forecasting infrastructure

Respondents described Morocco's national meteorological agency (MétéoMaroc) as technically capable, issuing seasonal forecasts, drought alerts, and flood monitoring updates. Forecasts are also produced by other national and international research institutions, including INRA and IWMI. These actors contribute a range of climate data and indices tailored for agricultural and water resource planning.

Morocco stands out for its long-standing drought monitoring systems, and several key informants emphasized the promising role of IWMI's Composite Drought Index, which can provide a three- to four-month lead time, offering a potential entry point for forecast-based AA triggers. Despite this technical progress, early warnings are not yet linked to formal activation protocols or budgeted response plans in the agriculture sector.

> *"Forecasts are there, but structured action based on those forecasts is still developing."*
> (Key informant interview 20)

A recurring challenge raised by respondents is the fragmentation of data systems. Forecasts are generated by multiple institutions, MétéoMaroc, INRA, IWMI, and various ministries, but access remains uneven, and data coordination is limited. Digital innovations such as drones for crop monitoring, simulation tools, and mobile-based early warning alerts are growing in use. However, informants stressed that these tools remain limited in scale, and farmer-level accessibility is still a barrier, particularly in remote areas.

Social protection and financial risk tools

Morocco has made notable progress in expanding its social protection system, especially following the COVID-19 pandemic and recent earthquake response. According to key informants, the Universal Social Protection Law (2021) and the national strategy to expand health coverage and child allowances represent a shift toward proactive risk reduction at the household level and was described by respondents as a meaningful step towards resilience.

In the agricultural sector, the government co-finances weather-indexed insurance through a partnership with the Mutuelle Agricole Marocaine d'Assurance – covering drought, frost, and other risks. While this insurance system was cited by several informants as one of the most advanced in the region, it covers only strategic crops. Meanwhile, some informants highlighted that it is not fully anticipatory as payouts are still triggered post-loss and are not yet tied to forecast indicators or risk thresholds.

Institutional coordination and emergency response

Crisis response in Morocco is centrally managed, typically coordinated through inter-ministerial committees formed after major events. Institutions such as the Ministry of Agriculture and the Directorate for Risk and Disaster Management under the Ministry of Interior play key roles in risk monitoring and emergency coordination. However, respondents emphasized that formal anticipatory planning at the national level remains weak, and decision making often depends on political will and short-term priorities.

> *"We have institutions that monitor risks, but in a crisis we still need special committees to manage the response. That shows the system isn't fully institutionalized."*
> (Key informant interview 26)

Morocco's crisis coordination still relies heavily on ad hoc structures, with special taskforces or budget authorizations often activated only after damage is evident.

In contrast, coordination at the subnational level was described as comparatively strong. Several respondents noted that at the subnational level, response systems benefit from active participation by local authorities and civil society, though capacity varies by region. Respondents expressed optimism about growing local involvement, especially where drought risk is persistent and government–NGO partnerships are in place.

Section 3. Morocco's growing capacity for anticipatory action

Among countries in the MENA region, Morocco stands out for its structured progress toward AA. While the term "anticipatory action" is not widely used in national discourse, the country has made significant advances in operationalizing some preparedness efforts, particularly for drought. These include institutionalized response pathways, risk-informed agricultural planning, and an expanding ecosystem of local-level actors engaged in pre-emptive efforts. Most notably, Morocco's experience with insurance, feed and seed distribution, and water-saving subsidies has positioned it ahead of many of its regional peers.

Institutionalized response pathways

Over the past two decades, Morocco has gradually moved from ad hoc crisis response toward routine, seasonal preparedness, especially for drought, its most persistent hazard. Government institutions now oversee pre-crisis planning that includes early seed and livestock feed distribution, irrigation incentives, and access to subsidized inputs for vulnerable farmers.

Morocco's proactive irrigation support system becomes operational during dry seasons. Interviewees highlighted Morocco's investment in drip irrigation and water-saving incentives, particularly for smallholders. These programmes, in place since the late 2000s, were described as effective tools to reduce long-term drought vulnerability and were seen as adaptation tools. Through the Ministry of Agriculture and regional agricultural offices, the government monitors rainfall trends and soil moisture

early in the agricultural season, and when indicators show signs of water scarcity, it activates a package of support measures for farmers to switch to water-efficient practices. These include subsidized access to drip irrigation systems, flexible financing schemes, sometimes in partnership with the Agricultural Development Fund, to help farmers finance their irrigation systems in preparation for the dry season.

> *"Drought is no longer treated as a shock – it's expected. The systems are evolving to plan for it, not just respond."* (Key informant interview 26)

Respondents emphasized that these systems, while not always labelled as "anticipatory," are increasingly triggered based on seasonal risk assessments. The Ministry of Agriculture plays a central coordinating role, supported by technical forecasts and hydrological monitoring that inform operational decisions before the peak of the agricultural season.

This comes in addition to Morocco's agricultural insurance scheme, co-financed by the government and implemented through the Mutuelle Agricole Marocaine d'Assurance, was frequently cited as a regional model for agricultural risk-sharing. Although payouts are still post-disaster, the system's scale and public–private design reflects a strong institutional commitment to protecting farmers from recurrent shocks.

A climate-resilient agricultural strategy

The national agricultural strategy, Green Generation 2020–2030, embeds climate resilience into development planning. Respondents highlighted how this strategy encourages a shift toward drought-tolerant tree crops, investment in drip irrigation, and support for technologies that reduce dependence on erratic rainfall. These efforts build on earlier reforms under the Green Morocco Plan and reflects a clear commitment to transforming agriculture risk management into resilience planning.

Interviewees emphasized that these investments are not short-term relief or emergency measures, they are strategic anticipatory investments designed to reduce Morocco's long-term exposure to climate variability and strengthen rural adaptation.

Leveraging local networks for early response

A major factor distinguishing Morocco's progress is the active role of local actors in AA. Respondents consistently pointed to the contributions of civil society organizations, NGOs, farmer cooperatives, and community associations in implementation. These groups help translate early warnings into localized preparedness by coordinating resource distribution, facilitating irrigation access, or by providing direct support at the farm level. In many areas, these local systems act before national response mechanisms are activated, serving as informal but effective community-based early warning systems.

> *"Central-level coordination is reactive, but governors often move fast – they know their communities and can activate support quickly."* (Key informant interview 23)

"In some places, it's the local networks that move first – before the national system kicks in." (Key informant interview 21)

This strong horizontal link between local actors and national systems represents a critical entry point for scaling up anticipatory action in a decentralized manner.

Section 4. The way forward

While AA is not yet fully institutionalized in Morocco's agricultural risk management system, the country has laid a strong foundation. Key informants emphasized that Morocco's institutional infrastructure, especially within the Ministry of Agriculture, INRA, and MétéoMaroc, offers a natural platform to scale up anticipatory approaches in a more systematic and coordinated way. Several opportunities exist to strengthen Morocco's capacity to act early. Stakeholders highlighted both national-level reforms and decentralized innovations that could be scaled or formalized to improve preparedness planning.

Proposed priorities for strengthening anticipatory action in Morocco:

- Formalize AA protocols that link seasonal forecasts and drought monitoring to predefined agricultural responses, such as early seed and fodder distribution, or emergency irrigation support.
- Leverage the existing insurance system by exploring forecast-based financing models. This could include developing early disbursement rules based on drought probability or rainfall deviation thresholds, building on Morocco's partnership with the Mutuelle Agricole Marocaine d'Assurance.
- Expand the anticipatory role of Morocco's Green Generation strategy, embedding early warning thresholds, agro-climatic zoning, and climate-smart infrastructure investments into long-term agricultural planning.
- Strengthen subnational coordination frameworks, building on the relatively strong role of regional governors and local agricultural offices. Future reforms could include formalizing governor-led and civil society preparedness committees and ensuring decentralized access to response funds.
- Promote structured engagement with civil society organizations and farmer cooperatives, who already serve as local intermediaries for AA. These networks could be integrated into national early warning dissemination and pre-crisis planning cycles.
- Invest in scaling digital advisory tools, including mobile-based alerts and farmer-facing decision dashboards. While Morocco has made progress with early-stage tools (e.g. drone use and simulations), digital inclusion remains a challenge.
- Establish a unified digital risk platform to integrate weather forecasts, pest and disease surveillance, hydrological data, and soil metrics into a single advisory system for farmers and planners. This platform could address long-standing data fragmentation issues.

Annex 3.
Case study: Egypt (key informant interview insights)

Section 1. Main hazards

Egypt is increasingly facing a complex and evolving climate hazard landscape, one that poses growing risks to both its agricultural production and rural livelihoods. While the country is not frequently affected by high-magnitude sudden-onset disasters such as earthquakes, key informants emphasized the intensification of **slow-onset and compounding climate stressors** that are steadily undermining agricultural resilience. As one respondent put it, Egypt is experiencing a "silent climate change", referring to the gradual disruption of traditional seasonal rhythms without dramatic visible events, but with major implications for agricultural systems.

Among the most prominent hazards cited by respondents are **flash floods and extreme rainfall events,** particularly in areas like Alexandria, Sinai, and the Red Sea coast. These events are becoming more frequent and unpredictable. One case described by the Egyptian Meteorological Authority involved more than ten times the average rainfall within 24 hours, overwhelming drainage systems and triggering emergency response measures. These intense precipitation events not only damage infrastructure but also lead to soil erosion and agricultural loss.

Respondents also commonly pointed to a broader set of **climate-related stressors** that are steadily undermining seasonal predictability and crop performance. **Increasingly erratic temperature patterns** were frequently cited, including cold waves, frost events, and prolonged heatwaves, particularly for their role in disrupting crop cycles and undermining the reliability of the traditional agricultural calendar. Several experts pointed out that **frost damage** is often amplified when early morning sun hits frost-covered plants, leading to rapid crop deterioration. **Heatwaves** have also become more common, creating additional stress for winter crops during critical growth and harvesting periods. **Sandstorms and dust events** are contributing to localized crop damage, particularly in vulnerable horticultural systems and during early planting stages. These extreme weather conditions have had damaging effects on wheat and high-value fruit crops such as olives and mangoes, forcing farmers to make increasingly uncertain decisions about planting and harvesting schedules.

Climate change is also driving a marked increase in **biological and pest-related hazards**, including outbreaks of fall armyworm, fruit fly, rodents, and red palm weevil. According to officials from the Ministry of Agriculture and Land Reclamation, pest behavior has become less seasonal and more difficult to predict, undermining the effectiveness of routine control strategies. **Water scarcity and soil salinization** were cited by experts as slow onset but critical hazards, particularly in the Nile Delta. Sea-level rise, reduced freshwater availability, and inefficient irrigation practices are compounding pressures on already stressed agricultural zones. Respondents from the Ministry of Water Resources and Irrigation and ARC emphasized that these water-related stressors are expected to intensify over the next decade, posing long-term challenges to sustainable agriculture and food security.

Section 2. Evaluation of crisis management and disaster risk reduction

Egypt has made progress in establishing social protection mechanisms and early warning infrastructure. However, most respondents characterized the country's disaster risk management systems as largely reactive rather than anticipatory. While some proactive practices exist, particularly in forecasting hazards, they are not yet embedded within a broader anticipatory planning framework. There is no overarching national strategy or trigger-based system that links early warnings to early financing or coordinated action. Several interviewees described efforts to inform farmers of upcoming risks but emphasized that responses typically occur after damage has already taken place, reflecting a compensatory approach rather than one grounded in anticipation and preparedness.

Early warning systems and forecasting infrastructure

Egypt's formal early warning framework for disaster response has historically been centralized through the Central Operations Room for Crises Management under the Egyptian Cabinet of Ministers, which coordinates cross-sector alerts during emergencies. In some cases, the Prime Minister personally oversees crisis management, which guarantees strong coordination and swift decision making across all relevant sectors. One respondent, affiliated with the Egyptian Cabinet Information and Decision Support Center, noted that the last comprehensive update to Egypt's national early warning system occurred in 2009. Since then, efforts have largely focused on expanding forecasting infrastructure and developing sector-specific tools.

Egypt has made notable investments in national forecasting capacity, particularly through the Egyptian Meteorological Authority, which serves as the country's primary source of weather and climate data. Improvements in radar coverage, mobile alert applications, and real-time monitoring systems were frequently cited by key informants. However, while these systems play a central role in national disaster preparedness, as experts in Egyptian Meteorological Authority say, alerts are not always tailored to agriculture and forecasts often reach regional authorities but not farmers directly.

In the agricultural sector, the CCIC under the Ministry of Agriculture now operates an SMS-based alert system that delivers risk advisories to over one million farmers. These messages provide tailored advisories on crops risks such as frost, wheat rust, and seasonal temperature fluctuations. In parallel, the Ministry of Agriculture's Locust and Pest Control Department uses real-time surveillance tools and predictive mapping systems to monitor and manage outbreaks of fall armyworm, red palm weevil, and other common crop pests.

Despite these advancements, several respondents noted that forecasting outputs in both national and sectoral systems are typically used in an advisory capacity rather than as action-triggering tools. Forecasts are rarely linked to operational protocols or coordinated early response measures. While these tools and initiatives have enabled more proactive responses, they remain largely unconnected and are not yet integrated into a unified national early warning framework.

Social protection and financial tools

Respondents offered a mixed assessment of Egypt's existing financial risk management mechanisms for farmers and rural communities. A few mentioned the Livestock Insurance Fund, which has been in operation since 1959 and includes proactive elements such as seasonal health monitoring and subsidized veterinary and livestock vaccination services. However, no comparable crop insurance programme is currently operational at scale.

Efforts are underway to improve this landscape. According to the Financial Regulatory Authority, work is ongoing in collaboration with the Egyptian Insurance Federation to design new agricultural insurance models tailored to farmers' needs. These initiatives aim to leverage satellite imagery and other technologies to assess crop damage and improve claims processing. The new Unified Insurance Law (Law 155/2024), which came into effect in July 2024, includes specific provisions for agricultural insurance and coverage for natural disasters. While adoption remains limited, stakeholders view this as a critical step toward expanding protection against climate-related risks in the agricultural sector. In the meantime, farmers continue to rely on informal coping strategies in the absence of accessible, anticipatory financial tools.

Several respondents mentioned that there is emergency compensation from the Ministry of Social Solidarity designed to provide financial assistance to affected households, including smallholders, in the aftermath of extreme weather events or other hazards. However, this support is reactive, becoming available only after a shock has occurred and once damage has been verified. Other programmes, such as subsidized pesticide distribution and input support to wheat growers, were also cited by key informants. While these programmes offer important post-crisis relief, respondents consistently emphasized that they are not structured to help farmers anticipate or prepare for climate-related risks and therefore remain limited in their contribution to long-term agricultural resilience.

Section 3. The landscape of anticipatory action in Egypt

Common understanding of anticipatory action

Across interviews, there was a consensus that the term "anticipatory action" is not widely used or institutionalized in Egypt's national disaster risk or agricultural planning frameworks. While some respondents, particularly those with exposure to international initiatives or training, were familiar with the concept, others were less certain about its definition or application. Several noted that AA is often pursued in practice, even if it is not framed explicitly as "anticipatory." In such cases, actions taken before the impact of a hazard, such as targeted pest control, frost alerts, or seed distribution, are implemented as routine or seasonal good practice rather than as part of a formal AA system. Therefore, it can be noted that the idea of AA is often present in function, but not in name.

Institutional and policy landscape for anticipatory action in agriculture

Egypt's institutional framework for risk reduction and climate adaptation includes a wide array of ministries, authorities, and research centres – among them the Ministry of Agriculture and Land Reclamation, the Egyptian Meteorological Authority, CCIC, ARC, Ministry of Water Resources and Irrigation, and the Information and Decision Support Center. While these institutions contribute to various aspects of disaster preparedness and climate adaptation, there are no formalized national protocols or frameworks specifically designed for AA in the agricultural sector.

While climate change adaptation is addressed in national plans, interviewees noted that references to AA are either missing or implicit. The National Emergency System, the National disaster law and emergency protocols prioritize response and relief rather than pre-emptive preparedness or forecast-based interventions. Most respondents confirmed that Egypt does not currently operate under a trigger-based or AA system for agricultural hazards. Systems in place are not structured around predefined thresholds or timelines that would activate preventive interventions; instead, decisions tend to be driven by expert judgment, seasonal expectations, or historical patterns. In a few cases, respondents pointed to sector-specific practices, such as, wheat rust zoning or pest forecasting models, that function as early warning mechanisms within specific departments.

Several institutions were identified as technically capable of leading anticipatory efforts in agriculture, including the Ministry of Agriculture and Land Reclamation, the Egyptian Meteorological Authority, and CCIC. However, respondents emphasized that institutional roles remain siloed, and no single agency currently holds a cross-cutting mandate to manage pre-emptive actions.

Key actors and coordination mechanisms

Respondents frequently referenced a core set of institutions involved in disaster risk management, including the Ministry of Agriculture and Land Reclamation, Egyptian Meteorological Authority, CCIC, ARC, the Ministry of Water Resources and Irrigation, and the Information and Decision Support Center. In addition, international agencies and donors, including FAO, International Fund for Agricultural Development, UNDP, the World Bank, the Green Climate Fund, and the EU – were noted for their contributions in funding or technically supporting climate adaptation and risk monitoring initiatives. However, respondents described limited coordination during the preparedness phase, especially across sectors or between national institutions and local stakeholders.

Although emergency coordination protocols exist, they are focused on response and relief. When coordination occurs during emergency events, it is typically led by the central government and often facilitated through the national crisis management system and the Central Operations Room for Crises Management under the Egyptian Cabinet of Ministers. Beyond emergency response, interviewees pointed out that collaboration among institutions appears to be project-based or informal, with few formalized mechanisms for sustained planning or information sharing across sectors.

Sectoral mandates, such as those related to agriculture, water, or meteorology, often operate in parallel. In the absence of a dedicated AA mandate or coordination platform, many efforts rely on ad hoc

collaboration or the continuity of specific leadership or donor-driven initiatives. Several interviewees emphasized that progress in AA or early warning often depends on individual leadership or personal relationships across institutions, rather than being supported by institutionalized protocols for coordination or DRR. This was especially noted in cases where progress made through pilot projects did not continue once external funding or key personnel changed.

Engagement with farmers, NGOs, or local officials in anticipatory planning was described as limited. While outreach initiatives like CCIC's SMS alert system were noted as positive developments, these tools do not yet operate within broader participatory planning processes. Respondents stressed the need to strengthen vertical coordination, especially between national ministries and farmer organizations or cooperatives, to improve the relevance, delivery, and local interpretation of risk information

Financing for disaster preparedness or anticipatory action

Most respondents indicated that Egypt does not currently have a dedicated national budget line for AA or forecast-based financing. While disaster-related expenditures exist within broader contingency frameworks, funding is typically mobilized after a crisis occurs, rather than allocated in advance based on risk forecasts or seasonal triggers. This limits the ability of institutions to act early, even when credible early warnings are available.

In the agricultural sector, proactive efforts such as pest control, wheat rust zoning, or seasonal advisories are often implemented with support from technical departments. However, these initiatives are not underpinned by a formal anticipatory financing mechanism and frequently depend on donor-funded projects or external partnerships. Several respondents noted that forecast-based planning remains vulnerable to funding gaps, especially when external support is phased out or reallocated during emergencies.

Some institutions have sought to access international climate finance, including from the Green Climate Fund and other multilateral sources, to strengthen early warning and preparedness. However, accessing international climate finance remains a challenge for some institutions due to limited proposal-writing capacity, unclear ownership of climate-related portfolios, or delays in inter-agency coordination. These constraints, and possible entry points to address them, are explored further in sections 4 and 5.

Section 4. Barriers and challenges

Across all interviews, respondents identified a consistent set of structural and operational barriers that limit Egypt's ability to move from reactive disaster response toward more pre-emptive, risk-informed planning in the agricultural sector. While technical progress has been made, particularly in forecasting efforts, respondents emphasized that various challenges continue to constrain the institutionalization and scaling of an AA framework in Egypt. The challenges outlined below are ranked in order of frequency and perceived severity based on interview insights.

1. Lack of institutionalization and strategic mandate

The most frequently cited barrier was the absence of a clear national mandate or framework for coordinating pre-emptive or early warning-based action in agriculture. While several ministries and centres are engaged in elements of risk monitoring and response, their efforts are largely carried out in isolation. Respondents repeatedly noted that there are no national protocols or triggers that systematically connect forecasts to predefined AAs in agriculture. Moreover, efforts often lack sustainability. As one interviewee stated:

> *"In the end, its individual efforts, not an institutionalized system."*

When leadership changes, AA initiatives are at risk of disappearing or being deprioritized, highlighting a broader dependence on personal networks and informal collaboration rather than clear formal protocols.

2. Fragmented coordination across institutions and levels

Respondents described limited coordination beyond the emergency response phase, which is managed through the Cabinet's Central Operations Room. Pre-disaster planning and coordination across cross-cutting sectors (i.e. agriculture, water and meteorology) were seen as weak or dependent on ad hoc arrangements. Most collaboration takes place within project contexts and rarely outlives the funding cycle.

> *"Once a project ends, the data, equipment, and trained staff all vanish."*

Vertical coordination, between central government and local actors, is similarly constrained. Farmer organizations, local extension agents, and NGOs are often not systematically engaged in early warning dissemination or anticipatory (pre-season) planning.

3. Absence of dedicated financing for anticipatory action

Nearly all respondents confirmed that Egypt lacks dedicated budget allocations for AA or pre-disaster agricultural interventions. While several funds exist (e.g. the Agricultural Solidarity Fund and the General Disaster Loss Fund), these are typically used after crises have already occurred. Forecast-based financing mechanisms are not operational, and no AA protocols are linked to financial disbursement systems.

> *"We know where the pests will hit. The pheromone traps tell us.*
> *But response funding comes too late."*

Respondents also highlighted a lack of capacity to access international climate finance, despite growing needs and increasing climate risks. One respondent emphasized that accessing instruments such as the Green Climate Fund remains a major challenge. This was attributed to a combination of complex proposal

procedures, limited technical capacity, and weak inter-ministerial coordination. As one interviewee explained:

> *"While Egypt has many qualified professionals, those responsible for lobbying and applying for funding often lack the capacity to draft compelling proposals or conduct the risk assessments needed to build a strong case for support."*

This capacity gap makes it difficult for Egypt to compete effectively and lobby for donor funding or to build a sustainable pipeline of climate finance for agriculture or AA.

4. Technical gaps in forecasting and data integration

While national institutions like the Egyptian Meteorological Authority and CCIC have invested in improved radar, mobile apps, and crop-specific advisories, forecasting systems remain underutilized for anticipatory planning. Respondents described a disconnect between data collection, analysis and informed decision making at the farmer level.

> *"Farmers get the forecast, but they don't know what to do with it."*

Meteorological staffing shortages further constrain the system, leading to data gaps and reduced modelling capacity.

> *"We have a wide network of meteorological stations, but many are currently closed due to a lack of staff to operate them."*

This reduces coverage and undermines Egypt's ability to model localized risk or deliver timely information to farmers. In addition, respondents noted that there is no unified data-sharing platform across ministries, and risk information often fails to inform operational decision making. Although several agencies generate forecasts or risk advisories, these outputs rarely trigger specific AAs.

5. Awareness and cultural constraints

Respondents highlighted a low level of awareness of AA as a concept among many technical and administrative staff members. Several noted that anticipatory planning and forecast-based decision-making remain unfamiliar concepts. In many cases, risk communication remains limited to weather bulletins and general warnings, and there are few pathways to translate forecasts into clear agricultural advice and farmer action. Institutional staff often require training in anticipatory approaches and greater awareness of the value of acting early rather than reactively.

At the local level, barriers include farmer digital illiteracy, limited access to mobile technologies, making dissemination of early warnings through SMS or apps ineffective without complementary outreach. The

fragmentation of land ownership, especially in the Delta and Upper Egypt, was also cited as a constraint. Land fragmentation limits the feasibility of collective action or unified planning during crisis, particularly for water or pest management.

6. Policy and political prioritization gaps

Finally, while climate adaptation is gaining traction, particularly following Egypt's COP27 commitments, AA remains a low priority in national agricultural policy and planning. Respondents explained that political attention and public discourse continue to favour reactive responses and visible infrastructure investments, rather than investing in pre-disaster systems that may appear "costly" or difficult to justify without a crisis at hand. Various respondents highlighted that pre-disaster systems often struggle for visibility and support, as their benefits are preventative and therefore harder to quantify or communicate to the public.

Meanwhile, this visibility issue and policy gap is compounded by limited representation of AA in national strategy documents, budgets, and implementation plans. Even where sector-specific good practices exist, they have not yet been scaled up or embedded into a cross-cutting anticipatory system.

Section 5. The way forward

While AA is not yet embedded in Egypt's disaster preparedness system, respondents identified a range of practical, actionable steps to support earlier, more proactive planning in the agricultural sector. This section outlines untapped opportunities, practical recommendations, and suggestions for how FAO could best support anticipatory efforts in Egypt's agricultural sector.

Untapped opportunities

Several promising entry points and areas of progress were identified by respondents where Egypt could strengthen its anticipatory capabilities:

- Encourage data sharing and use across ministries: data integration across ministries was seen as a major opportunity. While many institutions collect and store climate, pest, and crop data, this information is not routinely shared or translated into AA triggers.
- Subnational engagement remains underdeveloped. Respondents noted that extension agents, cooperatives, and local officials could play a much stronger role in translating national forecasts into localized guidance – if empowered with the right tools and training.
- Digital solutions such as mobile apps, satellite data, and farm-level sensors were seen as underutilized. Several interviewees suggested expanding CCIC's SMS model into two-way platforms that allow farmers to report conditions, improving real-time risk tracking.
- Egypt's growing focus on climate-smart agriculture and digital transformation (as part of Vision 2030) provides a natural policy entry point for linking DRR and anticipatory planning with ongoing national priorities.

Recommendations and way forward

The below recommendations are grouped into five themes: governance, financing, data and forecasting, farmer communication, and local systems.

1. Strengthening governance and institutional systems

- Establish a national framework for AA

  Respondents emphasized that existing institutions are technically capable but operate without a unifying mandate or coordination structure. Respondents emphasized the need for a formal framework to define AA in Egypt's risk management structure. This would include the development of a national strategy for AA in agriculture, clear inter-agency roles, and pre-approved AAs linked to hazard-specific triggers (e.g. heatwaves, drought, pest outbreaks).

- Establish a permanent inter-ministerial coordination platform

  Coordination across agencies is currently project-based and inconsistent. Interviewees proposed establishing a standing platform that includes the Ministry of Agriculture and Land Reclamation, Egyptian Meteorological Authority, CCIC, ARC, Ministry of Water Resources and Irrigation, and the Information and Decision Support Center to jointly oversee climate risk planning, AA protocols, and seasonal preparedness. This platform could also support the integration of disaster risk reduction and AA into national planning instruments, including agricultural strategy documents and annual budgets.

- Mainstream successful pilot initiatives into national systems

  Some effective programmes like CCIC's SMS alerts and pest monitoring systems are partly donor reliant. Respondents stressed the need to institutionalize these tools within public budgets and national operating plans to ensure continuity.

- Strengthen vertical coordination with cooperatives and local officials

  Farmer cooperatives, local officials, and extension staff are not typically included in national-level seasonal planning. Interviewees recommended involving these actors earlier in the planning process to help localize alerts and coordinate local-level responses.

  "Anticipatory action is still something we do for farmers, not with them."

  Scenario planning workshops, response drills, and cross-ministerial trainings were identified as practical entry points for improving coordination and preparedness at the subnational level.

2. Enabling funding for anticipatory action

- Develop forecast-based financing mechanisms

  Many interviewees proposed the development of forecast-based financing and action protocols, where specific weather thresholds would trigger early interventions in agriculture (e.g. seed distribution, input support, advisory rollouts). Respondents widely supported the idea of setting aside funds that can be released in advance – when reliable forecasts signal risks like heatwaves or pest outbreaks.

- Develop and expand agricultural insurance schemes

  Recent collaboration between Egypt's Financial Regulatory Authority and the Insurance Federation on new insurance models is promising. However, interviewees emphasized the need to rapidly expand crop insurance coverage, integrate satellite-based assessments, and ensure that these schemes are accessible to smallholders.

- Build capacity to access and manage climate finance

  Many respondents noted limited experience and capacity within national institutions to access international funds (e.g. Green Climate Fund). Barriers included proposal design, vulnerability assessments, and inter-agency collaboration. Suggested actions include training ministries in climate finance preparation, donor engagement, and building cross-agency proposal teams.

3. Improving forecasting and data use

- Develop a unified digital risk platform across ministries

  Interviewees noted that risk and forecasting data are collected by various ministries but not shared systematically. A central digital platform, that connects forecasts, agricultural models, and pest alerts, was identified as a key opportunity.

  "We have the data. But not the systems or staff to use it properly."

  This system should support data exchange, visualization, and allow for customized, localized outputs usable by both government and field staff.

- Link forecasts to clear AA steps

  Forecasting capacity has improved in Egypt, but its integration into actionable frameworks remains weak. Forecasts are rarely connected to operational responses. Respondents called for developing clear plans: who should act, when, and how, once specific risks are forecasted.

4. Expand use of technology and digital tools in agricultural risk management

- Promote wide use of digital solutions

  Interviewees were optimistic about the potential of digital solutions in risk dissemination, coordination, and precision agriculture. Several mentioned mobile apps, SMS platforms, and AI-powered forecasting as key areas for investment. However, concerns remain around digital access and literacy among smallholder farmers, reinforcing the need for blended approaches.

- Expand on farmer outreach and advisory services

  Many respondents highlighted the disconnect between forecasts and farmer decisions. Several interviewees stressed that even when farmers receive forecasts, they often don't know how to respond. Building on existing SMS systems, suggestions included adding voice messages, visuals for low-literacy users, and mobile apps with tailored, location-based advice. Other respondents suggested developing communication links or tools that enable farmers to report their conditions (e.g. pest sightings, drought stress) to improve the system's responsiveness and collect real-time data from the field.

Annex 4.
Case study: Jordan (key informant interview insights)

Section 1. Main hazards

Jordan's agricultural sector is increasingly exposed to a complex mix of environmental and climate-related hazards, with drought emerging as the most pressing and persistent risk. All key informants emphasized that drought is no longer an occasional challenge, but a structural stressor that affects rainfed agriculture and livestock.

The impacts of drought are especially severe in the Jordan Valley and eastern governorates, where prolonged rainfall deficits have degraded pasture, reduced crop yields, and deepened food and income insecurity for smallholder producers. The country's rainfall patterns have become increasingly erratic, with delayed or shortened wet seasons limiting the planning window for farmers. In some cases, respondents noted that farmers have abandoned traditional planting calendars altogether, shifting toward crops that require less water or rely more heavily on irrigation. However, this shift has come with trade-offs, as reliance on groundwater increases stress on already limited water resources.

In addition to drought, frost was mentioned by multiple respondents as a hazard affecting highland areas and cold-season crops. Several informants also pointed to rising temperatures and the intensification of heatwaves, which are disrupting planting and harvest cycles and causing crop damage during sensitive growth periods.

Dust storms and land degradation were also raised in the interviews, though less frequently. Some respondents described worsening soil quality due to repeated drought cycles and inadequate water management. There was also recognition that these environmental risks often interact with broader social and economic stressors, particularly in rural areas where input access, infrastructure, and institutional support remain limited. As one interviewee observed,

> *"The risks are seasonal, but their effects are permanent, our farming systems haven't recovered from the last few years."* (Key informant interview 33)

Section 2. Evaluation of crisis management and disaster risk reduction systems

Jordan has built a relatively structured emergency response system over the past decade, anchored by national crisis management institutions. However, AA is not yet embedded into the country's agricultural risk governance. Most respondents characterized the system as reactive, with strong institutional capabilities during crises, but weak integration of early warning data, financial planning, or farmer engagement before disasters occur.

Coordination and institutional structure: A system built for response, not readiness

Emergency coordination is centrally led by the NCSCM, which organizes relevant ministries and actors during major events. In some emergencies, crisis response in Jordan can be mobilized quickly when directed by the Royal Court, with His Majesty the King intervening to form high-level committees or taskforces to oversee inter-ministerial coordination. This top-down authority facilitates rapid institutional alignment and enables swift decision making when crises emerge. Several informants pointed to the government's ability to respond quickly during the COVID-19 pandemic and the 2022 drought.

While the system functions well under severe pressure, it remains largely reactive. Pre-season planning remains limited, and ministries activate support measures such as water trucking, livestock feed distribution, or relief payments only after damage assessments are complete.

> *"We have good emergency coordination, but no structure for acting ahead of time based on forecasts."* (Key informant interview 17)

AA is not yet institutionalized in Jordan's agricultural risk management system. Most respondents were unfamiliar with the terminology itself, and there is no national framework linking early warnings to pre-emptive operational plans. While Jordan's centralized coordination model can mobilize multisectoral responses, the formation of emergency committees is triggered during crises not in anticipation of them.

Local inclusion in planning is also limited. Smallholder farmers, cooperatives, and rural institutions are not formally involved in preparedness or AA. While some outreach is conducted during crises, through SMS alerts or awareness campaigns, there is no mechanism to involve local actors in planning or in activating early measures based on forecasts.

> *"Even when the warning comes, there is no clear guidance on what farmers should do."* (Key informant interview 02)

Early warning systems and forecasting infrastructure

Forecasting and early warning systems in Jordan are technically advanced but remain fragmented across institutions. Respondents cited the role of the Jordan Meteorological Department, as well as contributions from water authorities, research centres, and regional monitoring networks. Seasonal rainfall forecasts and drought alerts are available, and several interviewees confirmed that technical agencies share updates regularly with central planning bodies. However, there was consensus that these forecasts are not linked to any formal agricultural action protocols. Ministries receive early signals but typically act only after conditions deteriorate. While national drought assessments are carried out, there is no standard procedure for triggering early interventions, such as input distribution or credit access, based on forecast thresholds.

> *"We see the early signs, but we wait for the crisis before moving. It's not about data, it's about how we use it."* (Key informant interview 33)

One respondent described emerging efforts to integrate early warning tools at the farmer level, including the use of text message alerts and field training. These activities aim to raise awareness and support AA among vulnerable farming communities. For example, farmers receive SMS notifications about expected rainfall events or frost risks, and in some cases, extension officers conduct site visits to explain the implications for planting or irrigation timing. However, these tools are still in pilot stages and not yet connected to a broader anticipatory planning framework. Several limitations remain, including coverage gaps, digital accessibility, and limited integration with institutional response systems.

Social protection and financial tools

Jordan's social protection system has expanded in recent years, particularly through national targeting programmes and donor-supported safety nets. Respondents highlighted the role of the Ministry of Social Development, which oversees the National Aid Fund and administers the Takaful cash transfer programme. These programmes are central to delivering assistance to vulnerable populations, including cash transfers and livelihood protection during crises. However, they remain largely reactive in nature and are not designed to disburse assistance in advance of climate-related shocks.

Several informants noted that the National Aid Fund's existing targeting infrastructure could, in theory, be used to deliver early assistance if linked to seasonal forecasts or drought risk models. Yet no structure for forecast-based disbursement exists, and smallholder farmers often fall outside the reach of formal safety net programmes.

The Ministry has implemented digital technologies to improve the efficiency and transparency of Takaful, including online registration, automated eligibility assessments, and disbursement via e-wallets. While these tools have significantly improved the delivery of assistance, they are not yet integrated with early warning systems or anticipatory triggers.

> *"There's capacity to do more, but right now the safety net is only activated after we can quantify what people have already lost."* (Key informant interview 11)

Indeed, the technical foundation represents a promising entry point, however, respondents agreed that the national system still lacks the structure, coordination, and mandate needed to activate agricultural measures based on forecast thresholds.

Section 3. The way forward

While AA is not yet established in Jordan, respondents pointed to several practical entry points that could support a shift from reactive to proactive risk management. Several components of a potential AA system, such as forecasting infrastructure, digital targeting systems, and emergency response protocols, are already in place and could serve as entry points for future anticipatory efforts. In addition, Jordan's

centralized coordination model and established meteorological capacities form a solid foundation on which a national AA system could be built.

> *"There's technical capacity and institutional will, but we need structure, funding, and a shift in mindset to act early."* (Key informant interview)

Proposed priorities for strengthening anticipatory action in Jordan

- Raise awareness among decision makers about AA as a strategic approach to disaster risk reduction. Efforts should include government workshops, dissemination of cost–benefit case studies from other countries, and integration of AA concepts into crisis management training for civil servants.
- Develop formal AA protocols that define clear roles, timelines, and trigger thresholds for early response to drought and climate risks. These protocols should link seasonal forecasts to pre-emptive actions, such as input distribution, livestock support, or risk communication.
- Strengthen data sharing between agencies, particularly between meteorological departments, Ministry of Agriculture, and crisis coordination bodies. A centralized digital dashboard could consolidate weather forecasts, drought indices, and agricultural risk data into a single accessible platform for decision makers.
- Leverage the existing social protection infrastructure to explore pilot initiatives for early assistance when a forecast is clear.
- Explore risk financing mechanisms that allow for early disbursement of funds before impact. This could include designing a contingency financing facility under the Ministry of Agriculture, or piloting drought-indexed payout schemes in high-risk regions.
- Invest in community-level preparedness efforts, such as through expanding existing SMS advisories and field-level training for farmers. These efforts should be scaled through agricultural extension networks and local cooperatives to ensure timely action at the farm level.
    - Include farmers and cooperatives in pre-crisis planning by establishing participatory planning mechanisms. Local actors should have a role not just in receiving information, but in shaping the response strategy for their regions.

Annex 5.
Case study: Saudi Arabia (key informant interview insights)

Section 1. Dual exposure to risk

Saudi Arabia's agricultural sector faces a unique risk landscape characterized by dual exposure. On the one hand, the country is impacted by domestic climate hazards such as drought, desertification, and increasingly severe sandstorms; on the other, it is highly vulnerable to external shocks in the global food system due to its dependence on agricultural imports.

Key informants emphasized that while Saudi Arabia is less vulnerable to frequent natural disasters compared to other MENA countries, it remains highly exposed to a narrower but intensifying set of natural hazards that impact its agricultural sector. Respondents consistently identified extreme heat and prolonged droughts as the primary hazards facing domestic agriculture. Rising temperatures are affecting both productivity and seasonal planting patterns. Several informants highlighted the increasing challenge of water scarcity, noting that agriculture in Saudi Arabia consumes a significant portion of the country's non-renewable groundwater reserves. As climate variability intensifies, maintaining even limited domestic production becomes more precarious, with risks of crop failure increasing in high-temperature zones.

Dust and sandstorms were also cited as disruptive hazards, particularly in central and eastern regions. These events reduce visibility, damage crops, and complicate logistics during planting and harvesting periods. Respondents noted that while sandstorms are not new, their frequency and severity appear to be increasing, likely due to changing wind patterns and desertification processes.

Since Saudi Arabia has a unique agricultural model, which includes substantial overseas land investments, these risks are compounded by the country's heavy reliance on food imports, which creates exposure to climate hazards in external supplier countries. The country imports over 80 percent of its food supply, including key staples such as wheat, rice, and animal feed. Several informants stressed that disruptions to agricultural production in exporting countries – such as prolonged droughts in the Sudan or Egypt, or geopolitical shocks like the war in Ukraine – have immediate consequences for domestic food prices and availability. As one interviewee put it:

> *"The real risks to our food supply lie outside our borders."* (Key informant interview 29)

Section 2. Evaluation of crisis management and disaster risk reduction systems

Saudi Arabia's DRM system is centrally coordinated and highly responsive, with clear chains of command during emergency events. Crisis response is typically led by Civil Defense under the Ministry of Interior, supported by technical agencies such as the NCM, the Ministry of Environment, Water and Agriculture, and other line ministries depending on the sector affected. Respondents described the government's response mechanisms as fast and well-resourced, especially for extreme weather events and natural

hazards. However, most interviewees emphasized that the country's overall approach remains reactive – oriented toward mitigation and recovery rather than anticipatory or preventive action.

Early warning systems and forecasting infrastructure

Saudi Arabia has invested heavily in meteorological forecasting, hazard monitoring, and remote sensing systems. The NCM produces short- and medium-range forecasts, rainfall models, and dust storm alerts, which are routinely disseminated to public authorities. These systems provide a strong foundation for risk anticipation and are used across sectors for preparedness and response, such as issuing alerts to schools, ports, or transportation hubs.

Respondents noted that elements of anticipatory planning are emerging. Climate modelling and drought monitoring are already integrated into some agricultural decision-making processes. While Saudi Arabia's strong digital infrastructure and mobile communication tools provide a promising foundation for expanding early warning outreach to farmers. NCM and the Ministry of Environment, Water and Agriculture maintain early warning systems for drought and pest outbreaks. In some cases, early warnings prompt infrastructure preparations, such as reinforcing drainage systems or deploying locust surveillance teams.

Despite these advances, there are no formal protocols linking forecast information to predefined AAs in agriculture. Forecasts are disseminated, but agricultural responses remain discretionary and vary by region or agency. One expert summarized the gap:

> *"We act when the threat is confirmed, not when it's predicted."* (Key informant interview 35)

Coordination and institutional response

Saudi Arabia's disaster risk coordination system is centrally managed through a well-defined national emergency structure. Crisis response is typically led by the Civil Defense under the Ministry of Interior, with active support from the Ministry of Environment, Water and Agriculture, NCM, and other technical agencies. Respondents emphasized that Saudi Arabia has a clear chain of command for escalating emergencies and deploying resources during extreme weather events.

At the core of this structure is the National Emergency Committee, which includes representatives from all relevant ministries. Each ministry retains its sector-specific mandate for risk response but participates in joint committees activated under defined protocols when hazards escalate. This allows for synchronized action across agriculture, health, infrastructure, and environmental sectors.

> *"Every ministry has its own mandate, but they are assembled into specialized committees when risk escalates."* (Key informant interview 38)

The coordination model is supported by Saudi Arabia's tiered alert system, including yellow, orange, and red warnings, which are issued based on forecast severity. These alerts are grounded in WMO standards and are shared across government systems to inform ministerial actions during crisis.

Social protection and financial tools

Several financial instruments exist to support domestic agriculture but remain limited in scope. Compensation tends to be offered post-crisis, following assessments conducted by the Ministry of Environment, Water and Agriculture or local authorities. Emergency compensation schemes are available through government channels such as the Agricultural Development Fund, which provides recovery loans and aid following major shocks.

The Reef Program, a government initiative supporting rural livelihoods, offers targeted assistance to climate-vulnerable farming communities, especially in the southwest. However, support under both schemes is accessed only after losses occur, and disbursement timelines can be slow.

Several informants noted that the constraint is not a lack of resources, but a lack of structured systems to mobilize them before crises hit. As one expert noted,

> *"We don't lack funding – we lack the systems to deploy it proactively."*
> (Key informant interview 39)

A pilot agricultural insurance scheme is currently being tested to cover risks such as frost damage and pest outbreaks. The model is being designed in partnership with the private sector and may eventually extend to cover a broader range of climate-related risks. While promising, it is not yet scaled nationally.

Beyond borders: The hidden risks in Saudi Arabia's food security strategy

Saudi Arabia's food security strategy is defined by its heavy reliance on global agricultural markets and its growing portfolio of farmland investments abroad. Through entities such as the Saudi Agricultural and Livestock Investment Company, Saudi Arabia has invested in agricultural production across countries like the Sudan, Egypt, Ukraine, and Argentina. These investments are intended to hedge against shocks by ensuring access to the food supply even during global crises. However, respondents noted that the approach remains largely reactive. When disruptions occur, whether due to conflict, drought, or trade restrictions, the default response is to switch suppliers, rather than engage in anticipatory planning or resilience-building in key partner countries. One interviewee summarized this:

> *"Diversifying investments abroad is our strategy to ensure food security when export countries face crises."* (Key informant interview 36)

Despite the scale of these investments, no structured mechanisms exist to anticipate or mitigate risks in supply countries. There are no regional early warning partnerships, insurance arrangements, or joint preparedness protocols with host governments or local producers. This creates a major challenge in Saudi

Arabia's agricultural risk management strategy. Several informants emphasized the need to shift from short-term trade adjustments to more proactive engagement:

> *"Food security isn't just about trade. We need to support the farmers we depend on – in Egypt, Somalia, Morocco – before the crisis hits."* (Key informant interview 37)

A key barrier identified by respondents is the fragile institutional environment in many of the countries where Saudi Arabia invests. Political volatility, weak governance, and recurrent disruptions make it difficult to establish long-term risk partnerships or implement early warning systems jointly with host governments. As one informant explained:

> *"One of the barriers to proactive investment abroad is political instability in partner countries."* (Key informant interview 35)

This import-centric model has helped buffer domestic production shocks, but respondents agreed it cannot insulate Saudi Arabia from external climate or geopolitical crises. As one expert put it,

> *"Saudi Arabia may be shielded at home, but any crisis in Sudan or Ukraine hits our food supply chain."* (Key informant interview 39)

Without mechanisms to assess and manage transboundary agricultural risks, Saudi Arabia's food security remains vulnerable to disruptions beyond its borders. AA planning will need to extend beyond domestic hazards to include structured risk monitoring and early response systems in key import regions, especially as climate volatility and political instability increase.

Section 3. The way forward

Institutional infrastructure and opportunities

While AA is not yet embedded in Saudi Arabia's agricultural risk management system, the government's centralized structure enables rapid crisis response and inter-agency coordination. The Ministry of Environment, Water and Agriculture oversees a network of research centres, data units, and technical departments, and is well-positioned to serve as a coordinating authority for AA.

Respondents saw clear potential to build on the existing institutional base to strengthen anticipatory capacity and shift from its current reactive model to a more proactive approach to agricultural risk management.

Section 4. Proposed priorities included:

- Formalizing AA protocols that connect forecast thresholds with agricultural interventions such as seed distribution or input subsidies.
- Integrating anticipatory functions into the Saudi Green Initiative, which already serves as a long-term resilience strategy for ecosystems and land management. With appropriate adjustments, the Saudi Green Initiative could serve as an umbrella platform to scale localized AA planning.
- Establishing a unified digital platform for agricultural risk data that integrates real-time weather forecasts, pest and disease surveillance, and soil and water metrics into a single advisory system. The platform would help address a critical gap raised by several key informants – one of whom noted that:

  "Data exists in silos, and some agencies need formal requests to access key information." (Key informant interview, 35)

- Expanding anticipatory planning to Saudi Arabia's external food security strategy, particularly by investing in risk monitoring and preparedness in key supplier countries.
  - Investing in risk monitoring and early warning partnerships in key supplier countries (e.g. the Sudan, Egypt, Somalia), particularly where the Saudi Agricultural and Livestock Investment Company and other Saudi-backed ventures operate.
  - Supporting regional data sharing platforms or engaging in bilateral arrangements to anticipate shocks in food-exporting countries and coordinate responses in advance.
  - Embedding anticipatory components into future Saudi Agricultural and Livestock Investment Company investment strategies, including funding for drought-resilient infrastructure or local insurance schemes.

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Contact

FAO Regional Office for Near East and North Africa
FAO-RNE@fao.org
fao.org/neareast
Cairo, Egypt

Office of Emergencies and Resilience
Anticipatory-Action@fao.org | OER-Director@fao.org
fao.org/emergencies/our-focus/anticipatory-action
Rome, Italy

Food and Agriculture Organization of the United Nations

ISBN 978-92-5-140178-1

9 789251 401781

CD7181EN/1/10.25