

FLAGSHIP
REPORT

FUTURE

FIT

EARLY WARNING EARLY ACTION
IN A WORLD OF CHANGING RISK

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LEAD AUTHORS

Liz Stephens
Adele Young
Erin Coughlan de Perez
Irene Amuron
Dorothy Heinrich
Clemens Gros

CONTRIBUTING AUTHORS

Kiswendsida Guigma
Juliane Schillinger
Juan Bazo
Sojung Yoon
Madhab Uprety
Mary Anne Zeilstra
Sayanti Sengupta
Tesse de Boer

WORKSHOP FACILITATORS

Erin Coughlan de Perez
Dorothy Heinrich
Emmanuel Poan
Madhab Uprety
Hassan Ahmadul
Juan Bazo

INTERVIEWERS

Adele Young
Erin Coughlan de Perez
Liz Stephens
Mary Anne Zeilstra
Meghan Bailey
Irene Amuron

INTERNAL REVIEWERS

Aditya Bahadur, Christopher Jack, Meghan Bailey, Julie Arrighi, Roop Singh

COPY-EDITING

Sarah Tempest

DESIGN

Eszter Saródy

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For further information on this report, please contact:

anticipatoryaction@climatecentre.org and/or amuron@climatecentre.org

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Cover photo:
Ecuadorian Red
Cross dengue
prevention work
in Santa Elena
and Guayas, 2025.
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Red Cross)

KEY MESSAGES

1

Climate change is making extreme events more frequent and more severe. As populations shift and hazards compound, the risks we face have moved well beyond what history can tell us.

Alongside climate change, population changes and shifts in their vulnerability are combining to drive changes in risk. With the landmark 1.5°C global temperature threshold predicted to now be reached by 2029 [1], we are set for a future with more frequent and intense unprecedented events. The events of tomorrow will not look like the events of yesterday.

2

Even with climate adaptation, early warning systems and anticipatory action are not optional.

While major investments in disaster resilience and climate change adaptation will reduce risk, predictable extreme events will continue to have major effects on society. However, Anticipatory Action (AA), whether led by communities, governments or humanitarian organizations, is effective and transforms early warnings into lives and livelihoods saved. In fragile and conflict-affected settings, regional and international support may be needed to underpin local early warning and anticipatory action capacity.



Mozambique Red Cross Society volunteers unload shelter kits ahead of Cyclone Idai that hit central Mozambique on the night of 14/15 March 2019, killing hundreds of people and leaving some 2 million in need of humanitarian aid. (Photo: Denis Onyodi/Climate Centre)

Communities in Mozambique had long experienced cyclones, but Cyclone Idai in March 2019 caused devastating impacts, not because the hazard was new, but because its scale far exceeded what the systems were designed for. Twenty-one per cent of the flood damage was estimated as attributable to climate change. Globally, the population exposed to major flooding is projected to increase by 19 per cent by 2100, predominantly in low-GDP regions, with climate change driving nearly one-quarter of that change.

3

Anticipatory Action approaches must evolve faster than the risks they need to address.

The success of anticipatory action now does not guarantee success in the future. Anticipatory Action approaches need to be able to imagine and prepare for the events of tomorrow rather than what happened yesterday. The system is evolving in this direction; however, it is not yet business as usual: just eighteen per cent of Anticipatory Action plans assess or account for future changes in hazards.

In South Sudan, the complexities of an upward trend in flooding, large-scale displacement and outbreaks of cholera have led practitioners to redesign AA triggers and interventions. The rise in upstream water levels in Lake Victoria in 2020, which led to the flooding in South Sudan, was estimated as 1.8 times more likely as a result of climate change.

4

Only Anticipatory Action practice that uses forward-looking and flexible approaches will keep pace with changing risks.

FUTURE-FIT ANTICIPATORY ACTION refers to AA systems that remain effective under changing risk. Such systems move beyond simply acknowledging changing risk to systematically assessing and accounting for evolving climate, exposure and vulnerability across its design and implementation. We must urgently recognize existing examples of good practice to catalyse wider change, strengthen local capacity and bridge from early warning systems through to longer term adaptation.

We recommend four practical ways to make Anticipatory Action future fit:

- I. Consider changing, emerging and multi- risks in risk assessments rather than relying solely on historical data.
- II. Design forecast triggers that are dynamic and scalable to remain relevant as risks change.
- III. Plan actions with flexibility to match the severity of the event and align with longer term resilience-building efforts.
- IV. Run regular simulation exercises to test whether AA plans are 'fit' for changed risks.

In Ecuador, Anticipatory Action planning for dengue outbreaks is identifying new areas where transmission is emerging and prioritizing awareness-raising anticipatory actions in these locations. Globally, climate change and population growth together are estimated to drive increases in the number of people at risk of dengue by over 2 billion by 2080.

5

Government-led approaches which proactively strengthen engagement across ministries and actors are best placed to deliver future-fit anticipatory action which aligns with longer term risk management investments.

Anticipatory Action approaches cannot exist in siloes; identified best practices result from different government agencies collaborating regularly on reviewing, understanding and addressing changing risks. Anticipatory Action is one part of the wider disaster management toolbox, and continued collaboration across climate, development, security and humanitarian perspectives is required to ensure that all disaster risk management measures align.

6

Anticipatory Action financing must be flexible, scalable, and joined up.

As risks change, financing for Anticipatory Action should facilitate the flexibility for anticipatory action to remain relevant in contexts where vulnerability and exposure are changing rapidly, and scalability to reach larger populations as events become more extreme.

Anticipatory financing should work in tandem with other investments across the Disaster Risk Management continuum, with locally led and joined-up thinking on how best to manage changing risk. If increasing risk is not mitigated, anticipatory financing will be stretched and resources for acting on warnings may become quickly depleted.

7

Future-fit anticipatory action requires investment across different systems but delivers value across all those systems too.

From early warning to risk reduction timescales, future-fit Anticipatory Action supports the more efficient production and use of risk information, maintains the effectiveness of government and humanitarian systems and ensures limited resources are targeted where they are most needed in settings where risk is changing rapidly.

Investing in future-fit Anticipatory Action approaches doesn't just ensure that the delivery of early actions remains relevant and effective for the extreme events of tomorrow, it enables investment in early warning systems and disaster risk reduction measures to be more joined up and, therefore, deliver better value.

BEST PRACTICES & SOLUTION AREAS FOR PRACTITIONERS

FINANCING MECHANISMS

SOLUTIONS AREA 1: FUTURE-FIT RISK ASSESSMENTS



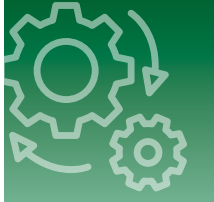
Consider changing frequency and intensity of hazards, including emerging and multi-risk

SOLUTIONS AREA 2: FUTURE-FIT TRIGGERS



Improve monitoring of exposure and vulnerability and develop dynamic and scalable triggers that remain relevant as risks change

SOLUTIONS AREA 3: FUTURE-FIT ACTIONS



Select and design actions with flexibility and long-term benefits

SOLUTIONS AREA 4: FUTURE-FIT READINESS



Test the design of AA plans with simulation exercises of plausible future events

SOLUTIONS AREA 5: FUTURE-FIT FINANCING



Design sustainable and flexible financing for AA to deliver impact amid rapidly changing risks



SCIENCE AND RESEARCH

Enhance science-practice partnerships to pull through the latest science into Anticipatory Action systems



POLICY

Support cross-government institutionalization to deliver sustainable, scalable and flexible AA for changing risks



PRACTICE

Strengthen readiness activities to identify and stress-test systems against changing risks

CROSS-CUTTING RECOMMENDATIONS

Solution Areas 1–5 and cross-cutting recommendations.

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LIST OF ABBREVIATIONS

AA	Anticipatory Action
ANAM	Agence Nationale de Météorologie
CAJ	Climate Action Journey
CERF	Central Emergency Response Fund
DREF	Disaster Response Emergency Fund
EAP	Early Action Protocol
EWSS	Early Warning Systems
FAO	Food and Agriculture Organization
FCS	Food Consumption Scores
FCV	Fragility, Conflict and Violence
GLOFs	Glacial Lake Outburst Floods
GCF	Green Climate Fund
GDP	Gross Domestic Product
HeiGIT	Heidelberg Institute for Geoinformation Technology
IbF	Impact-based Forecasting
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
KIs	Key Informants
PGI	Protection, Gender and Inclusion
UNHCR	United Nations High Commissioner for Refugees
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNDRR	United Nations Office for Disaster Risk Reduction
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme
WMO	World Meteorological Organization

INTRODUCTION

Globally, climate change is increasing the frequency and intensity of unprecedented weather events and exposing billions of people to its impacts [1]. In 2022, over 40 per cent of the global population (3.3-3.6 billion people) was considered highly vulnerable to these changes [2], and the number is only increasing. In addition, non-climatic drivers of vulnerability and exposure such as population growth and displacement are in constant flux, which complicates understanding of future risk.



Anticipatory Action (AA) is defined as “acting ahead of a predicted hazardous event to prevent or reduce impacts on lives and livelihoods and humanitarian needs before they fully unfold”. This works best when actions as well as triggers or decision-making rules are pre-agreed, and decisions are made to guarantee the fast release of pre-arranged funding [3]. AA is one operational component within the wider Disaster Risk Management continuum, building on adaptation, prevention, mitigation and preparedness efforts to increase the coping capacity of governments and people [4]. Since its conception within Red Cross Red Crescent pilot projects in 2015, AA systems have developed into multi-agency and government-led frameworks and humanitarian programming in 45 countries [5].

In 2022, G7 foreign ministers recognized the key contribution of AA for “averting, minimizing and addressing” the risks of climate change [6]. Alongside climate change, exposure and vulnerability are also changing; and, in many contexts, dramatically. Additionally, AA systems, including financing, should be embedded across the Disaster Risk Management framework to ensure a holistic approach towards addressing the evolving vulnerabilities. It is, therefore, critical in a world of changing risks that AA systems are fit for the future. For example, the short-term variability in risks that trigger AA will be influenced and shifted due to climate change and contextual factors even when underlying climate trends are emerging.

Within this report, we draw on best practice from across the AA community and beyond to identify how AA systems and practices can be strengthened to remain effective as risks change, including under climate change. Across four practice-focused solution areas related to risk information, triggers, actions, implementation, and one solution-area related to funding, we provide recommendations for practitioners, governments, scientists, policymakers and donors.

The report focuses on AA plans for single and multiple climate hazards, epidemics and multi-risk contexts. The operational and logistical challenges and barriers of implementing AA remain a focus of critical attention [7–9]. This report does not aim to cover all aspects of how AA should evolve in the future; it focuses only on how AA can be designed to address changing risks over time.

“Why is [addressing changing risk] important? [It affects] how we develop [our] protocols in terms of scale, in terms of scope, in terms of the trigger that we are looking at and historical data that is available.”

KI#4

BOX 1.

APPROACH USED TO CONDUCT THIS RESEARCH

OUR APPROACH

The content of this report is based on:

- Open session at the Global Dialogue Platform for Anticipatory Action, held in Berlin in December 2025.
- Review of 40 published AA plans across multiple hazards and organizations to determine whether and how they explicitly address changing risks.
- Interviews with 24 key informants (KIs) from 23 organizations across governments, UN agencies, INGOs, researchers and the Red Cross Red Crescent network.
- Tabletop simulation exercises in five countries in which existing AA plans were confronted with scenarios of future risk.

Our approach focuses on formalized AA systems that use forecast and risk analyses as well as committed pre-agreed plans and pre-arranged financing. However, the recommendations can be applied to other programmes that use unformalized early actions or early response.

WHERE ARE WE NOW? EFFECTIVENESS OF AA TO DATE

A growing body of research has sought to answer the question of whether AA is effective at reducing disaster risk, using a wide range of methods with varying analytical rigour. AA has been found to be effective and efficient across different sectors ranging from early warning and preparedness to livelihoods, health and social well-being. The following paragraphs provide an overview of what has been learned based on the existing literature.

EARLY WARNING AND PREPAREDNESS ACTION. Several studies indicate that AA increases people's access to early warning messages, in some instances also earlier, giving more households and institutions more time to prepare [10-13]. While the type of preparatory action does not necessarily differ, people benefiting from AA have been shown to prepare more extensively than non-beneficiary households, enabling them to, for example, evacuate a larger number of household members out of harm's way [11] [14-16] and to protect more livestock [16].

NUTRITION AND FOOD SECURITY. Anticipatory Action has consistently been shown to improve people's food security and access to a nutritious diet, ensuring households experience less hunger, skip fewer meals and are better able to meet their daily calorie and protein requirements [15] [16-19].

LIVESTOCK AND LIVELIHOODS. Livestock is a key productive asset for many vulnerable pastoralists in hazard-prone areas. Several rigorous studies indicate that AA can reduce animal mortality [15][16] [21][22] and help herders safeguard livestock health and productivity [20,23], thereby protecting future income. Other papers have studied the effects of AA on other agricultural outcomes – they generally find a positive relationship between AA and the volume or value of crops harvested, though these studies do not consistently report on the robustness of their findings [24-27].

HEALTH AND PSYCHOSOCIAL WELL-BEING.

While over 20 studies have investigated various effects of AA on people's physical health and psychosocial well-being (for an overview see [28]), only a handful have tested and reported on the robustness of their findings. This means that their results cannot be distinguished from a 'no effect' finding with certainty. The more rigorous research with conclusive evidence – all from flood-related AA in Bangladesh and Nepal – shows that AA reduced the incidence of minor health issues but not diarrhoeal or other more severe diseases [15], and that it lowered stress and improved life satisfaction [17]. Other papers discuss various health-related outcomes, suggesting positive effects on limiting cholera outbreaks [29,30], malaria [31,32], and heat-related illnesses [33,34].

COST-BENEFIT ANALYSIS. Most of the few studies that have aimed to quantify the economic benefits of investing in AA versus conventional response assistance robustly have found a positive benefit-to-cost ratio. Conservative research approaches indicate that every 1 US dollar invested in AA yields 1.3–3 US dollars in avoided losses and added benefits, while other estimates arrive at 7 US dollars and more in benefits [26].

RISK-INFORMED EVIDENCE FOR FUTURE-FIT AA.

This short evidence review shows that AA has been proven to be effective in multiple humanitarian outcome areas, most convincingly regarding early warning and preparedness, nutrition and food security. However, there are still many unknowns. For example, more research is needed on how much assistance is optimal, based on a given hazard severity. Moreover, most efforts to generate evidence on the effectiveness of AA are funded from humanitarian budgets. They must strike a balance between academic rigour and operational feasibility. This research typically cannot afford the large sample sizes and randomized designs that would allow for producing more conclusive results. Therefore, AA design and research must become innovative, investigating a wider range of risks and potential outcomes to make AA truly fit for the future.

ANTICIPATORY ACTION IN THE CONTEXT OF CHANGING RISK

Risks generated by climate hazards, exposure and vulnerability have increased with impacts attributed to climate change, rising population growth and urbanization, with the most vulnerable people being affected disproportionately [2].

CLIMATIC HAZARDS

Since the early 20th century, the climate has already changed with resulting shifts in the magnitude, frequency, duration, seasonality and spatial extent of many hazards [35]:

Bangladesh Red Crescent Society volunteers distribute drinking water and advice on staying safe in hot weather to people working outdoors on Heat Action Day 2025. (Photo: Bangladesh Red Crescent Society via IFRC)



DROUGHTS. Many regions are experiencing changes in meteorological drought (rainfall deficit) frequency and intensity, with more regions showing drought increases than decreases [36]. Agricultural and ecological droughts, where high temperatures and evaporation contribute to impacts, are increasing in many regions ([36], p8). Increasing drought frequency means that communities often don't have time to recover from one event before the next occurs (KI#11). Multi-year droughts have caused significant impacts in recent years; several KIs referenced multi-season and multi-year droughts. Examples included the 2023 and 2024 drought in the Amazon [37,38], the five years of drought in the Islamic Republic of Iran [39–40] and the five consecutive failed rainy seasons in eastern Africa from 2020–2023 [41].

“For AA, you are anticipating further deterioration, [but] you are already intervening in an already bad crisis.” KI#14

HEAVY PRECIPITATION AND FLOODS. Extreme rainfall and pluvial flooding are becoming more frequent and intense in almost all land areas due to climate change [1]. At the global scale, extreme daily precipitation events are projected to intensify by about 7 per cent for each 1°C of global warming (high confidence) [36]. Increasing frequency of flooding in drought-prone regions like the Sahel has taken people by surprise, especially in places where infrastructure and preparedness activities were focused on drought (KI#15). In other regions with a long history of river floods, the increase in flash flooding has created new challenges. For example, in Bangladesh and Pakistan, existing plans are riverine flooding-focused, and practitioners have highlighted difficulties in including flash flooding in trigger systems with sufficient lead time, particularly where flash and riverine flooding occurs at the same time (KI#14). Beyond heavy rainfall, many river basins are also flooding more frequently under climate change [1]. Floods are also affected by land-use change and water management decisions.

TROPICAL CYCLONES. Globally, the overall frequency of tropical cyclones is projected to decrease, while the proportion of tropical cyclones reaching Category 3 or higher has increased over the past four decades, alongside an increase in the number of rapid intensification (RI) events [1], with this trend set to continue. This poses challenges for AA, as storms are becoming more intense, and return periods more difficult to forecast with sufficient skill to encourage early action.

“Cyclones caused devastating impacts, like unprecedented loss of life, not because these communities had never experienced cyclones, they actually had experienced cyclones, just not the scale of Cyclone Idai.” KI#18

DISEASE. Climate change is also reshaping the geographic distribution of climate-sensitive infectious diseases; more than half of all infectious diseases known to humanity have been aggravated by climate change at some point [42, 43]. For example, future warming is projected to raise dengue incidence by 49–76 per cent by 2050 [44] as changing temperatures and rainfall patterns affect the vector suitability. Critically, transmission is spreading into regions with no prior exposure or institutional preparedness, posing a distinct challenge for AA (KI#9).

HEATWAVES. Climate change has led to an increase in the frequency and intensity of heat extremes globally, and this trend is projected to continue [1] with high likelihood that the five-year average warming for 2025–2029 will exceed the 1.5°C threshold. For example, in Kyrgyzstan an obvious upward trend in extreme temperatures has seen more impacts among vulnerable people, but heatwaves were not previously recognized as an impactful disaster in the country [45]. This situation was similar in South Sudan, which experienced a heatwave in 2025 that was estimated to be 4°C hotter than in a pre-industrial climate [46].

“In the last two years, South Sudan has experienced heatwaves which have never been recorded in the history... if we were to plan for 2023–24, we should have included it. But there was no discussion about looking into the future.” KI#17

EMERGING AND COMPOUNDING HAZARDS. While existing hazards are changing, new hazards are emerging because of both climate change and environmental degradation (e.g., land-use practices, deforestation and overgrazing). In mountain environments, there is high confidence that as climate change leads to more heatwaves, glacial retreat and reduction in permafrost, it will drive hazards such as landslides and glacial lake outburst floods [1].

Researchers are also calling for preparedness for extreme dust storms which are increasing in severity due to climate change and land degradation [47]. Dust storms, sandstorms and dusty weather have so far remained largely overlooked by AA work, yet they have significant impacts on health, transport, agriculture and infrastructure in many arid/semi-arid regions and beyond. Furthermore, climate change will alter the occurrence of complex, interdependent and connected events, also known as compound events [48].

VULNERABILITY AND EXPOSURE CHANGES

WHILE CLIMATE HAZARDS ARE CHANGING, VULNERABILITY AND EXPOSURE ARE ALSO CHANGING IN RESPONSE TO SHIFTING SOCIOECONOMICS, DEMOGRAPHICS, ENVIRONMENTAL CHANGE AND CRISES SUCH AS CONFLICT AND DISPLACEMENT [49]. These changes can increase or decrease both vulnerability and exposure for different population groups, significantly altering their climate risk and potentially impacting the effectiveness of AA.

“From a community perspective ... you don’t live through the hazard; you actually live through the disaster.” KI#21

SOCIOECONOMIC CONDITIONS. Shifts in poverty, food access and prices, income sources and employment opportunities can all affect people’s vulnerability to extreme weather. While some AA plans use poverty, low socioeconomic status or worsening food access as part of their rationale for action [50–52], other protocols, for example, in Somalia, include market conditions or famine indicators alongside hazard information.

DEMOGRAPHICS. In 2015–2050, the proportion of the world’s population aged over 60 years will nearly double from 12–22 per cent [53]. Population age structures are constantly changing, and the roles of certain groups (e.g., women) change over time. In AA, these factors are often reflected in who is targeted for support; for example, through prioritization of older people for heatwaves in Kyrgyzstan [45] or female-headed households for floods in Bangladesh, Pakistan and Yemen [54–57].

URBANIZATION. The proportion of the world’s population living in urban areas is projected to continue to grow [58]. Where urbanization outpaces urban planning, informal settlements and insufficiently protected new developments place local populations at increased risk of hazards, for example, due to their location in flood- or landslide-prone areas [59].

“The area that is covered by floodwater for the last three years, there’s not any tree left... if this flood water recedes... the place basically turns into a desert. And that makes it very hard for the local population to use it for farming... It affects livelihoods.” KI#17

ENVIRONMENTAL DEGRADATION. Human activities such as agricultural intensification, deforestation and population growth can degrade ecosystems, as can natural hazards [60], (KI#17). In Unity State, South Sudan, there was feedback between the two.

IN CONTEXTS OF FRAGILITY, CONFLICT AND VIOLENCE (FCV) risks are increasing and rapidly evolving as even post-conflict societies often remain politically and economically fragile for a protracted period. As conflict persists, it undermines individual and community coping capacities, such as the loss of livelihoods, damage to critical infrastructure, weakened institutions and social cohesion, adverse impacts on public health and disruptions to humanitarian aid [61].

DISPLACEMENT. The year 2024 saw record numbers of people displaced by conflict, persecution and other forms of violence [62]. However, humanitarian mindsets remain short-term (KI #10); linking to longer term climate adaptation is often not a priority because the settings are seen as temporary, despite 67 per cent of refugees being in protracted settings [62]. [Population movement](#) more generally is responsible for changing risks all over the world in the short- and long-term.

“Communities don’t have time to recover from the previous crisis, so they enter another crisis already vulnerable.” KI#14

CASCADING¹ AND COMPOUNDING² EVENTS. As hazards happen more frequently, many regions see simultaneous events across space and time. The chance of compound extreme events has risen including increases in the frequency of concurrent heatwaves and droughts on the global scale (high confidence) [36]. The risk of cascading failures is also increasing as infrastructure systems become more interconnected [63]. The combined impact of repeated flooding, mudslides and landslides can lead to permanent changes in the topography of an area (KI#2), and disasters are layered on top of one another (KI#21), with outbreaks of cholera following floods and cyclones (KI#6) and droughts leading to food insecurity which may trigger displacement or local conflict (KI#18).

1 Cascading risk: One event or trend triggering others; interactions can be one way (e.g., domino or contagion effects) but can also have feedbacks; cascading risk is often associated with the vulnerability component of risk, such as critical infrastructure. (IPCC, 2018)

2 Compound risks arise from the interaction of hazards, which can be characterized by single extreme events or multiple coincident or sequential events that interact with exposed systems or sectors (IPCC, 2018)

FAILURE TO CONSIDER CHANGING RISK

Most AA plans were developed recently, so they do not explicitly account for changes in risks due to ongoing climate change as well as changes in vulnerability and exposure. Considering these changing risks will be critical for the effectiveness, relevance and sustainability of AA programming. Risks can change dramatically in the short-term, such as the construction of a new neighbourhood in a city, or in the long-term, such as climate changes that happen slowly over decades. Confronted with new risks, AA plans can have unexpected outcomes, rendering triggers, actions, implementation or financing mechanisms ineffective.

First, if AA plans only address historical risk levels, they might fail to be relevant for some of the largest disasters in the next few years. While historical risk analysis is an important starting point, informants highlighted that assessing changing risks is vital to ensure that AA approaches remain impactful and relevant for the risks that communities are facing (KI#21, KI#11, KI#14).

“We really risk losing the real value and the real impact of AA.” KI#14

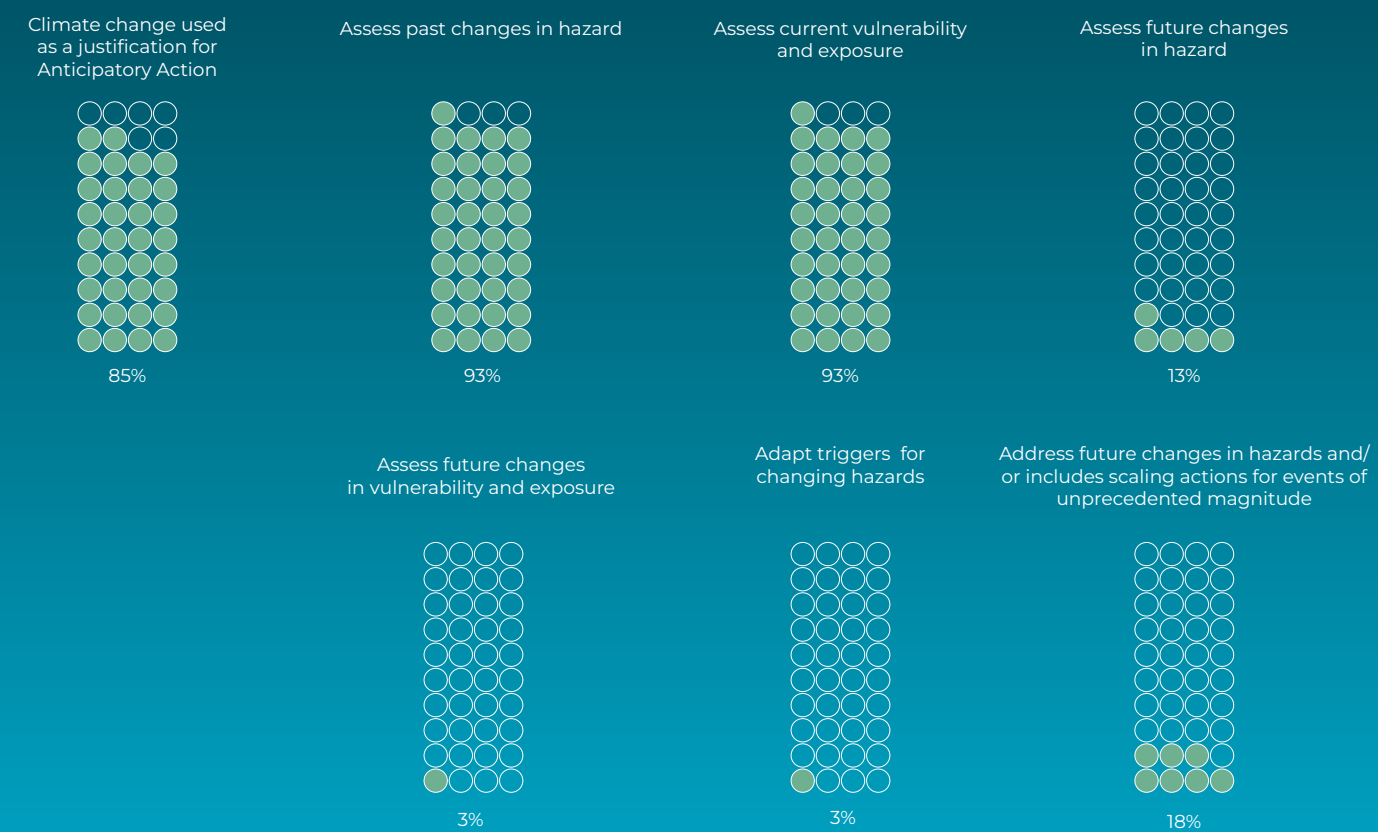
Compound and cascading risks are driving disaster impacts, but most triggers often only reflect a single hazard. Alongside that, with an increasing frequency of extreme weather events, trigger conditions might occur more frequently than expected. Triggers which reflect changing risk are required to ensure early actions are appropriate for the community context at the time of triggering, and triggers need to be designed so that they are not too frequent for sustainable financing (KI#3, KI#14, KI#15).

“Do you trigger every year, do you increase the trigger to a level that is much more extreme or do you combine AA with other types of support?” KI#14

In a changing climate, longer term climate adaptation and resilience efforts are reducing vulnerability to extreme weather, therefore AA plans should align with these programmes to maximize relevance and impact (KI#10). The implementation of AAs should be able to reflect the pace of change of risk (KI#14) while the financing of AA work should also reflect the challenges and complexities of compound and cascading risks, and recurrent shocks.

While 85 per cent of AA plans reviewed (34/40) are using climate change as a justification for Anticipatory Action, only 18 per cent explicitly assess and/or account for future changes in that hazard and scale actions to events of unprecedented magnitude. However, the review of AA work identified examples of good practice for addressing changing risk, even if informants were often unaware of these examples. Many of the AA plans also noted the need to refine and update plans.

FIGURE 2. Summary of how AA plans incorporate past, present and future climate risk considerations across hazard, vulnerability, exposure, trigger design and actions






BEST PRACTICES AND SOLUTION AREAS FOR FUTURE-FIT AA

The previous section highlights how increasing hazard characteristics, shifting risk patterns, changing vulnerabilities and compound crises challenge existing approaches to AA. If AA does not adapt, it risks losing its distinct value, relevance and long-term effectiveness. Being ‘future fit’ includes being ‘climate smart’ by adapting to changing climate risks, but it also includes changes to remain effective under other changing risk factors, such as changing population patterns.

Our five Solution Areas describe new and existing approaches that can be used in AA plans and frameworks to make AA more fit for the future. The best practices and Solution Areas 1–3 have been outlined for practitioners, which should be supported by so-called ‘build’ funding to develop Early Warning Early Action and AA systems. We also propose that the build funding should strengthen efforts to maintain and update systems and capacities as risks change and emerge, whether during ‘readiness’ activities within the operational lifecycle of AA systems, or as these AA systems are renewed ([Solution Area 4](#)). Finally, we make recommendations related to the ‘fuel’ finance that enables institutions to reallocate resources (e.g., move personnel to new locations) or allocate new resources (e.g., funding for evacuation centre staff and food supplies) based on an early warning ([Solution Area 5](#)).

“We need to adapt the protocols more often... we can’t just... design the programme and leave it for the following three years, because things are changing too fast.” KI#14



Practitioner solution areas



SOLUTIONS AREA

1

FUTURE-FIT
RISK

Develop risk assessments that include changing, emerging and compounding risks



SOLUTIONS AREA

2

FUTURE-FIT
TRIGGERS

Monitor triggers and develop dynamic and scalable triggers that remain relevant as risks change



SOLUTIONS AREA

3

FUTURE-FIT
ACTIONS

Select flexible actions and actions with long-term benefits



SOLUTIONS AREA

4

FUTURE-FIT
READINESS

Test Anticipatory Action plans through simulation exercises of plausible future events

Financing Mechanisms



SOLUTIONS AREA

5

FUTURE-FIT
FINANCING

Design sustainable and flexible financing mechanisms

SOLUTION AREA 1 FUTURE- FIT RISK ASSESSMENT

FUTURE-FIT RISK ASSESSMENTS CONSIDER THE CHANGING FREQUENCY AND INTENSITY OF HAZARDS, INCLUDING EMERGING AND MULTI RISKS³

Ninety-three per cent of AA plans reviewed selected hazards and areas of intervention based on a historical analysis of the hazard, exposure and socioeconomic vulnerability. Assessing changing risk requires developing new partnerships, investing in science, integrating local knowledge and engaging with local actors at the community level.

3 Multi-risk: Risk generated from multiple hazards and the interrelationships between these hazards (and considering interrelationships on the vulnerability level) (Zschau, 2017)



Vietnam Red Cross Society volunteers survey people on their attitudes towards extreme heat to inform early action. (photo: Vietnam Red Cross Society)

SAI.1. ASSESS THE BASICS: THE CHANGING FREQUENCY AND INTENSITY OF HAZARDS

In places where hazards are becoming more/less frequent or intense, the frequency of triggering AA plans might be different in the coming years than it would have been in the past. We recommend assessing changing trends in the hazards, exposure and vulnerability that inform AA plans. Based on this assessment, AA plans can determine whether and how to adjust triggers, actions or financing (see later solution areas). For example, the Vietnam Red Cross Society incorporated climate projections of the changing number of days of extreme heat into its heatwave AA plan [64].

In many cases, a lack of historical data makes it challenging to assess current and future risks, and creative approaches are recommended to do the best possible with imperfect information. Online tools and [collaborations with hydro-meteorological services](#) and climate researchers can support the assessment of how risks are changing and shifting over time and across locations. A range of publicly available platforms provide accessible, science-based data and projections that can be used to inform future-aware risk assessments ([Box 2](#)).

BOX 2.

WEB-BASED INTERACTIVE TOOLS THAT ALLOW SPATIAL AND TEMPORAL ANALYSES OF PROJECTED CLIMATE CHANGE INFORMATION THAT CAN BE USED IN FUTURE-AWARE RISK ASSESSMENTS

[Climate Analytics – Climate Impact Explorer](#)

A specialized, web-based tool offering detailed, science-based information on climate impacts across continents and countries, down to the provincial level.

[IPCC – Interactive Atlas](#)

Provides authoritative, up to date, scientific information on climate change projections and risk scenarios to help guide policy and action.

[WHO – Health and Climate Change Country Profiles](#)

Profiles summarize evidence of the climate hazards and health risks facing countries by tracking national progress in addressing the health threats from climate change and highlighting opportunities for gaining health benefits from climate mitigation action.

[World Bank – Climate Change Knowledge Portal](#)

Developed for practitioners and policymakers. It uses the latest climate data and scientific research available to explore, evaluate, synthesize and learn about future climate scenarios, projected risks and climate-related vulnerabilities at subnational level.

SAI.2. ASSESS CHANGING MULTI-HAZARD AND COMPOUND RISKS

A vast majority of existing AA plans are single-hazard specific [65] which creates a gap when risks or impacts overlap or compound. Though cascading impacts are more regularly addressed by AA plans, for example, with provisions for disease prevention or landslide risks from floods, or floods from tropical cyclones, only a small number consider compounding dynamics, such as *dzud* in Mongolia linking drought and cold extremes. Consecutive hurricanes Eta and Iota in Central America in 2020, or compound events such as conflict, cholera and flooding in South Sudan ([Case Study 3](#)) demonstrate the need to look beyond changing magnitude and frequency when undertaking risk assessments for AA.

Where hazards are independent (e.g., the Covid-19 pandemic and the occurrence of tropical cyclones), qualitative methodologies are often the best practice for considering multi-risk [66]. For example, Médecins Sans Frontières has adopted foresight approaches to future-proof its activities [67]. In East Africa, it developed two

plausible future scenarios and used them in participatory cross-disciplinary workshops to explore system stressors and compounding risks. The scenarios were based on expert elicitation and evidence-based data, one presented on malaria in Addis Ababa (Ethiopia) and the second presented a severe heatwave affecting communities on the move because of protracted drought and the collapse of humanitarian support [68].

Quantitative approaches can also be used to quantify interrelations between hazards and are often used to assess cascading hazards [66]. For example, dengue modelling can incorporate projections of both changing climate and social variables into estimations of the distribution of the mosquito vector (e.g., [69]). In Ecuador and Nepal collaboration between government health agencies and weather / climate scientists enabled more detailed prediction of the cascading impacts of weather events on health [[Case Study 2](#)]. Our simulation workshops also highlighted the need to develop

“We should not only look at the historical record, but we should look at both... [and] start forecasting what could happen most likely in the next coming years.” KI#17



partnerships beyond meteorological services to assess compound and cascading risks. For example, during unprecedented glacial lake outburst flooding the condition of critical infrastructure and access roads and supply routes can hinder AA and create new forms of vulnerability at very local levels ([Case Study 1](#)).

Participatory methods that involve communities can strengthen risk assessments by grounding scientific analysis in lived experience, helping to identify locally specific drivers of risk (e.g., soil degradation, water quality or land-use change) or social economic factors and community migrations (KI#2) to interpret how broader trends manifest in practice, as well as improving trust in the resulting decisions. For instance, in Malawi, communities have reported an increase in dangerously strong wind speeds, attributed locally to deforestation rather than climate change [70]. The IFRC's Climate Action Journey (CAJ) supports Red Cross Red Crescent National Societies to integrate climate risk projections into their programming [71]. Again, in Malawi,

the CAJ's Enhanced Vulnerability and Capacity Assessment process [72] is a participatory approach in which communities discuss how hazards and vulnerability are evolving in their local context, contributing to decision-making that is more robust and more trusted at the local level [73].

Vulnerable and marginalized groups have valuable insights into how risks are changing and the best ways for risks to be managed. When engaging with communities to discuss changing risks and vulnerabilities, we recommend engaging specifically with people with disabilities, women and youth networks to ensure their meaningful participation and contribution. Participatory methods can ensure that AA builds on existing community-based and last-mile early warning systems. We recommend that systematic Protection, Gender and Inclusion (PGI) analysis should be incorporated into the assessment of vulnerability and exposure. Without this lens, AA risks reinforcing existing inequalities and failing to reach those facing the highest predictable protection risks.

“It is super difficult to predict and act in anticipation [of wildfires and urban flash floods]. This requires much stronger integration of local knowledge and real experiences from the ground. We need people to participate in seasonal forecast and risk scenarios. We need communities to inform local insight into risk monitoring and the verification of triggers.” KI#14

SAI.3. ASSESS, ADVOCATE AND RAISE AWARENESS FOR NEW OR EMERGING RISKS

Risks can emerge in new geographies as hazards, vulnerability and exposure change and interact. For example, in Europe, heat-related mortality risk will continue to increase due to both the effects of climate change and an ageing population [74]. However, very few AA plans cover these emerging risks, and this is partly because a lack of data on past impacts makes their prioritization difficult to justify. We recommend ringfencing funding to support the partnership-building, science and awareness-raising actions that are required to develop AA for these emerging risks.

Strong partnerships across local and national government ministries are a feature of examples of good practice for emerging risks of glacial lake outburst floods, dengue, heat and emerging pests ([Case Study 1](#), [Case Study 2](#) and [Case Study 5](#)). However, emerging risks pose a challenge for coordination and partnerships; in Kyrgyzstan, the combination of an ageing population and increasing temperatures has led to heatwaves becoming a rapidly growing risk, but

they were historically not thought of as a disaster by the government [75]. This creates the need for additional advocacy to develop the partnerships needed for AA work.

Where risks are new or emerging, communities are unlikely to have developed the coping capacities required to manage these risks. For example, in Ecuador, practitioners emphasized a need for increased awareness-raising activities in communities that have only recently begun to see dengue outbreaks (see [Case Study 2](#)).

These emerging risks pose challenges for science and risk assessment. For example, for an emerging health threat such as chikungunya, researchers have to rely on dengue suitability models as a proxy [76], even though chikungunya's thermal suitability range is itself shifting [77]. This makes even borrowed projections unreliable and, therefore, limited for such risks. One solution is to ensure that AA plans are anchored in strong epidemiological surveillance systems.

CASE STUDY 1.

AN EXAMPLE OF AN EMERGING RISK: GLACIAL LAKE OUTBURST FLOODS

Rising temperatures in high-altitude areas of Nepal are accelerating glacier melt, increasing the risk of glacial lake outburst floods (GLOFs) in downstream catchments. A GLOF happens when meltwater from glaciers builds up behind rocks or another natural dam, building up pressure until the natural blockage bursts and releases all the accumulated water.

In August 2024, a GLOF from Thyanbo Lake severely impacted Thame village and downstream areas of the Bhote Koshi basin in Solukhumbu District, Nepal [78], whereas the 2025 supraglacial lake burst in Tibet resulted in flooding in the downstream catchments in Tibet as well as in the Bhote Koshi basin of Nepal [79].

Because this is an emerging risk, past records of discharge and temperature or lake flooding cannot be used as an indicator of today's risk or for future trends. A study by Nepal's Department of Hydrology and Meteorology found that Nepal is seeing an average increase in temperature of 0.56°C per decade and the upper parts of the country is experiencing a higher temperature increase of 0.86°C per decade. KI#1 indicated Nepal had seen a decrease of 24 per cent in its glaciers from 1977–2010, which has led to an increase in glacier lakes.

A glacial lake inventory report has identified 47 potentially dangerous glacial lakes within the Gandaki, Karnali and Koshi river basins of Nepal, the Tibet Autonomous Region of China, and India [80].



CASE STUDY 2.

INCORPORATING PROJECTIONS OF THE CHANGING SPREAD OF DENGUE INTO AA WORK IN ECUADOR

Dengue is transmitted by the *Aedes* species of mosquitoes, which thrive in warm climates and urban centres globally [81]. The interannual variation of dengue incidence can be forecast successfully using El Niño–Southern Oscillation (ENSO) indices as predictors [82], therefore showing potential for AA. However, climate change (rising temperatures and altered rainfall patterns) and urban expansion are projected to increase the risk of dengue transmission to new areas [81], and cases have already been observed for the first time in new locations [83].

The National Institute for Public Health Research of Ecuador (Instituto Nacional de Investigación en Salud Pública – INSPI) has produced modelling on the potential distribution of *Aedes aegypti* under climate-change scenarios, identifying areas where the environmental suitability for dengue transmission is likely to increase, such as at higher latitude ([84,85]; KI#9).

The Ecuadorian Red Cross is using this modelling to define the intervention areas of their dengue Early Action Protocol (EAP) currently under development, rather than the historic incidences. This emphasizes supplementing a community-needs assessment with scientific information for emerging risks:

“If you talk to the community in this area, and they’ve never had [dengue] before, it may not be a priority.”

(KI#9)



SOLUTION AREA 2 FUTURE-FIT TRIGGERS

IMPROVE MONITORING OF EXPOSURE AND VULNERABILITY AND DEVELOP DYNAMIC AND SCALABLE TRIGGERS THAT REMAIN RELEVANT AS RISKS CHANGE

With risks evolving rapidly in many operational contexts (KI#14), existing triggers must move away from strict rigidity to inform effective and timely action in increasingly complex multi-risk environments. Anticipatory Action systems must be able to adjust when conditions change, evidence improves, and/or operational realities shift. Pre-agreed systems should not be weakened but rather strengthened by this flexibility.



The Afghan Red Crescent Society, supported by the IFRC and Turkish Red Crescent Society, provides food relief to families through a persistent drought in Afghanistan in 2025. (Photo: Meer Abdullah/IFRC)

This section sets out recommendations for developing future-fit triggers, while recognizing practical considerations. Flexible trigger systems that better capture multiple dimensions of changing risk may bring increasing complexity for practitioners who require clear and easy-to-monitor sources of information and thresholds. In addition, incorporating greater flexibility or judgement into trigger design can have implications for financing, particularly in terms of understanding and managing the financial exposure of funds (KI#16) (more detail in [SA5: Flexible financing](#)). Rising to this challenge, practitioners will need to strike a balance between these considerations and be open to reflecting and adjusting systems whilst sharing learning and explanations for different trigger design decisions they may make.

“If you have a trigger system that is too sophisticated that no one understands. People don’t trust it and the trigger, and the system is the first thing that gets blamed.” KI#16

SA2.1. IMPROVE SURVEILLANCE AND REGULAR MONITORING OF EXPOSURE AND VULNERABILITY TO ENSURE THAT RAPID CHANGES IN ANY COMPONENTS ARE CONSIDERED

Anticipatory Action programmes often cover places where vulnerability and exposure data may be sparse and incomplete, which can pose limits to the inclusiveness and accuracy of AA risk analysis and interventions. In a rapidly changing world, not only do these gaps need to be filled, but the data needs to be even more regularly monitored and updated. Here, an emphasis on localized validation is critical. For example, static population density metrics may become out of date in places that see high levels of population movement. Current global data sources such as the INFORM Risk Index updates on an annual basis only [86]. Data gaps and access limitations make it difficult to monitor these rapidly evolving vulnerabilities and exposure trends, constraining risk

analysis and the design of timely AA [87]. For example, population exposure estimates for flooding in South Sudan became rapidly outdated as a result of people escaping conflict in neighbouring Sudan and practitioners will need as recent information as possible to plan interventions (see [Case Study 3](#)). Similarly, other indicators for vulnerability such as market conditions, household economic vulnerability and access to essential services may change rapidly – especially during compounding crises (e.g., as seen during Covid-19 [82] and during escalations of armed conflict. For example, potential interruptions to humanitarian access were looked at using OpenStreetMap in Sudan as an approach that could be replicated in other FCV settings [88].

Improvements on surveillance and monitoring depends critically on strengthening local capacity to collect, store and share data. In many countries, national and subnational governments hold the role of monitoring risk information, and in particular vulnerability and exposure data. Organizations and agencies also collect complementary or more specific information for their interventions. Annual readiness activities should include reviewing and updating risk and contextual analysis and requests for changes in the monitoring period in the AA plan. For example, displacement data from the Displacement Tracking Matrix of the International Organization for Migration as well as Camp Coordination and Camp Management are used to guide AA practice in Somalia along with dynamic market monitoring data covering food prices, market

functionality, supply flows and access constraints (Simulation Workshop #3). Data is compiled in a dashboard from the country's Food Security and Nutrition Analysis Unit [89].

Where up to date data does not exist, local resilience management committees play a key role in monitoring real-time changes in vulnerability and exposure. For instance, heatwave AA plans from the Nepal Red Cross Society account for the limitations of out of date beneficiary lists for capturing vulnerable migrant workers by including pre-activation assessments within their triggering process (see [Case Study 4](#)). Triangulation using community inputs, field data and with technical working groups is also used to address outdated vulnerability mapping (Simulation Workshop #3).

“Vulnerability mapping that was done by SoDMA was about four years ago, so I don’t think the situation is still the same. But we normally triangulate them with the immediate information that is emerging from the field.” (Simulation Workshop #3 participant)

The combination of satellite data sources and artificial intelligence techniques shows potential for monitoring the real-time condition of roads and housing and access to critical services like education and healthcare facilities (e.g., OpenStreetMap) [90] and current and future projections of population e.g., Worldpop [91]. Data sources,

like the risk assessment indicators from the Heidelberg Institute for Geoinformation Technology (HeiGIT) that are available on the Humanitarian Data Exchange (HDX), integrates some of these open data sources to provide information on exposure vulnerability and coping capacities [92] which can support [SA2.3](#).

SA2.2. MOVE AWAY FROM STATIC EXPOSURE AND VULNERABILITY ASSESSMENTS AND SINGLE-HAZARD APPROACHES WITHIN IMPACT-BASED FORECASTING AND TRIGGERING

From improved surveillance and monitoring of vulnerability and exposure comes an opportunity to move towards Impact-based Forecasting. While Impact-based Forecasting has made great improvements, most systems still rely on static exposure and vulnerability assessments and for a single hazard. In the FCV context, impacts to hydrometeorological infrastructure and the sudden loss of data used in trigger design can also impact the system's reliability. Examples of good practice can be found within the health community, where case counts are used as inputs into epidemiological models, for example, for dengue ([Case Study 2](#)) and by Médecins Sans Frontières in South Sudan [89]. Similarly, the triggers used in Bangladesh's National Tropical Cyclone EAP uses multi-hazard triggers accounting for wind, rainfall and storm surge [92].

Impact-based triggers are used more commonly within the AA community, which align hazard thresholds with the impacts expected at that threshold. The use of dynamic vulnerability and exposure indicators within these trigger thresholds can account for changing risks. For example, the Honduran Red Cross' AA plan on population movement includes a dual trigger that considers both expected

arrivals in the country and the available capacity within the National Society to assist people on the move, which can be driven by a range of hazards. Additional early actions are only triggered if the former is expected to surpass the latter [93].

Allowing for the adjustment of triggers (different hazard severity levels) based on dynamic changes in vulnerability and exposure is increasingly explored. For example, FAO has developed a dynamic trigger for drought-related AA, whereby trigger thresholds are adjusted by developing an index that includes regularly updated vulnerability indicators and the local context [94].

More qualitatively, triggers can integrate scenarios for different potentially compounding risks that could augment impacts or operational capacity based on existing contingency plans – for example, for different types of armed conflict or food security levels – as these factors can influence the feasibility and impact of early actions. Such scenarios may justify lowering thresholds for established triggers, such as in the case of repeated cyclones in the Philippines or conflict-affected Syria (KI#10), where cascading events and compounding risks increased community exposure and vulnerability. It may also mean that different types of early actions would be more appropriate.

“We need to look into these multi-hazard scenarios and figure out how we combine setting up different triggers... Some kind of activation of them depending on each other.” KI#6

CASE STUDY 3. DEVELOPING FORECAST TRIGGERS THAT TAKE INTO ACCOUNT THE CHANGING FLOOD HAZARD IN SOUTH SUDAN

A step-change in the extent of the flooding in the Sudd wetlands in South Sudan has affected over one million people in the country since 2020 (e.g., [95]). Refugees fleeing the crisis in Sudan have increased population exposure to the flooding, and a cholera epidemic and internal conflict have compounded to increase the humanitarian crisis.

This recent episode of flooding was driven by record lake levels upstream in Lake Victoria following a strong positive Indian Ocean Dipole event in 2019 [96]. Climate attribution research has pointed to the role of climate change in these record lake levels [97], which is consistent with observed increases in the frequency, magnitude and rainfall of positive Indian Ocean Dipole events [98].

The development of AA triggers has had to consider the trend in flood extent, because setting a threshold based on a static return period would lead to triggering every year. The adopted solution to this problem by the South Sudan Red Cross was based on the definition of a 'shock', defined by an extreme increase in flood extent from the seasonal minimum [99].

However, challenges remain in terms of the long-term picture. Will floods recede to pre-2020 levels, or increase further? With expensive maintenance to dykes around large displacement camps, there is a need to have better knowledge of the long-term picture and align AA plans with the longer term planning for communities.



SA2.3. SCALE AND STAGGER TRIGGERS AND THRESHOLDS TO ACCOMMODATE EVENTS OF INCREASING MAGNITUDE, AND TO DEAL WITH CHANGING UNCERTAINTY

Single-trigger designs consist of a binary go/no-go implementation of early actions. However, in cases where risks of greater intensity, extent and duration are becoming increasingly more likely, trigger systems might need to support layers of actions (see [Section SA3](#)).

Scaled triggers (e.g., a trigger matrix, rather than a single trigger statement) should be used to scale early actions depending on the magnitude of disaster predicted and the context of vulnerability and exposure. For example, the Zambia Red Cross Society's Drought EAP has a second trigger later in the seasonal calendar where unconditional cash transfers are distributed when severe drought conditions are already affecting crops and threatening livelihoods [100]. In Kenya, the government's hunger social safety net programme uses thresholds which expand the

number of households reached during severe (50 per cent) and extreme (75 per cent) droughts [101]. In the 2021–23 drought, this social safety net expanded horizontally to reach an additional 270,000 beneficiaries [102].

Staggering or phased triggers at different lead times could allow recognition of forecast uncertainty as well as providing escalation or deescalation rules to cope with sudden changes in the intensity and location of the unprecedented events. This includes the standard practice of having a 'stop mechanism' that can also be thought of as an adjustment tool, i.e., a clause in the trigger statement that allows actions to be paused when updated risk monitoring signals a weakening of the initially forecast severity. Attention will be required related to how these layered trigger monitoring systems are communicated to the public.

“What we do more often these days is to try to have the multi-layers of triggers, so having like seasonal forecasts as a trigger and then another trigger for the specific event. With these layered trigger mechanisms we built in something that deals with a ... very immediate changing risk.” KI#20

For example, in 2025 in Madagascar, tropical cyclone forecast triggers were stress-tested against different scenarios for forecasts in the days before cyclone landfall. This exercise identified how the Malagasy Red Cross Society could move beyond a simple stop/go but link across to contingency planning [103]. This would help facilitate earlier response activities should an inaccurate forecast not provide enough lead-time for early

actions. Similarly, AA frameworks and multi-layered triggers for tropical cyclones from the UN's Office for the Coordination of Humanitarian Affairs (OCHA) shows a possible approach to trigger layering ([Figure 3](#)). It includes an observational trigger as a 'fail safe', which facilitates earlier response, even if the event was not sufficiently well forecast for early action to be taken [7,104,105].

TROPICAL CYCLONE TRIGGER MECHANISM FOR HAITI

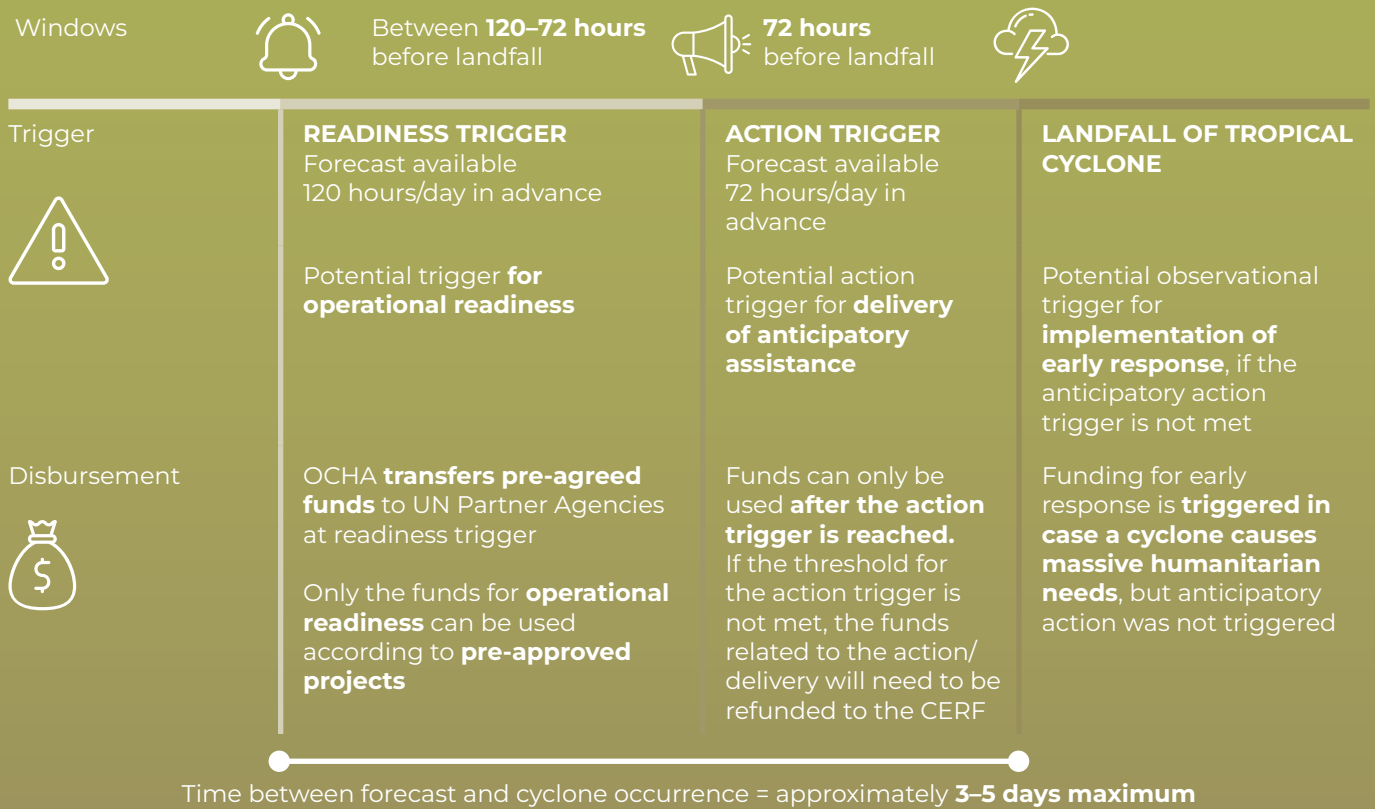


FIGURE 3. CERF Haiti tropical cyclone trigger mechanism for monitoring, triggers and activation. Source: [104]

SA2.4. PREPARE FOR THE UNEXPECTED MONITOR TRIGGERS OUTSIDE OF USUAL SEASONS AND IN NEW LOCATIONS AND ENSURE NATIONWIDE CAPACITY AND COORDINATION TO ACT OUTSIDE OF THE USUAL TIME WINDOWS

Beyond the frequency, triggers might also occur at unusual times due to changing risks. For example, hazards might happen out of season such as in Bangladesh and Kyrgyzstan which have experienced prolonged heatwaves beyond the normal duration. Additionally, extreme weather that occurs outside of its usual season poses many logistical challenges, e.g., the Nepal Red Cross Society's

case study of the October 2022 floods [106,107]. Workshop participants from Bangladesh recommended assessing the changing seasonality of the hazards and extending the trigger monitoring to shoulder seasons and regularly updating monitoring plans. (For a practical list of ways that events could be surprising, see [Tables 2](#) and [3](#) in [Sections 4.2.](#) and [4.3.](#)).

“There’s still a need in my view to connect better AA to climate and in the sense of climate science, climate information and making sure that in the plans and in the triggers... they are considering climate information and not just past information and current hazards. So, I think there’s a need to still strengthen that link.” KI#7

SOLUTION AREA 3 FUTURE-FIT EARLY ACTIONS

“The two approaches are seen as complementary due to differing timescales and aligning them helps to ensure that short-term preparedness contributes to longer term resilience.” [108]

SELECT AND DESIGN ACTIONS WITH FLEXIBILITY AND LONG-TERM BENEFITS

Early actions occur within the short window of opportunity between a forecast and an impact. Ninety-three per cent of AA plans reviewed incorporated actions which focus on current risk and capacity; but, at the moment, in many cases, there is no obvious alignment with long-term resilience building.

We propose the following recommendations to make sure that anticipatory actions, climate adaptation and resilience building efforts are “all part of a toolbox that can be used at the right time” (KI#20).

Malagasy Red Cross Society volunteers help villagers to prepare for the landfall of Tropical Cyclone Freddy in February 2023 – the longest-lasting tropical cyclone on record. (Photo: Caren Ramanantoanina/IFRC)



SA3.1. STRESS-TEST EARLY ACTIONS TO ASSESS EFFECTIVENESS UNDER DIFFERENT HAZARD SCENARIOS

Where AA plans are designed around predefined triggers and actions, they often do not reflect shifting socioeconomic needs, particularly in rapidly evolving vulnerability contexts (See [SA2](#) for triggers). For example, in one location where AA was activated, the need for food supplies in the community had become a higher priority in the intervening years since the plan was developed, making the pre-planned actions inappropriate (KI#5).

Although plans are regularly updated, we recommend that practitioners screen early actions against changing risks to assess whether these actions would still be useful/viable under changing, compounding or more

extreme future risk. In FCV settings, plans should include changes in conflict and violence that may emerge. These screenings can be done using simulation exercises (See Section [SA4: Future-fit readiness](#)) and will also require that systems be flexible to allow updates to existing plans ([SA3.2](#)). Also, new risks may require different actions (see [Case Study 2](#)).

As evidence grows, ([SA1.1](#)), practitioners can look at examples to prioritize or modify their action design for unprecedented events. For example, shelter-strengthening kits that are used to secure roofs before tropical cyclones may be ineffective or even a maladaptation for the most intense tropical cyclones.

SA3.2 BUILD FLEXIBILITY INTO ACTIVATIONS TO ENABLE LOCAL ACTORS AND AUTHORITIES TO MAKE THE BEST DECISIONS POSSIBLE WHEN PRESENTED WITH NEW INFORMATION

Only 18 per cent of AA plans that were reviewed proposed alternative plans or actions if the forecast event was bigger in magnitude or duration or occurred during a period of heightened vulnerability. In general, most AA plans follow a similar structure of a predefined trigger threshold or combination of forecast indicators linked to a fixed set of readiness or activation actions [109].

Scenario workshop participants and KIs note improvements, but also expressed concern that overly rigid AA plans due to funding constraints can risk locking people into actions that are pre-planned and might not be effective when risk has changed. They recommended flexibility in the implementation of AA plans, to enable local actors to make the best

decisions possible when presented with new information. For example, the Zimbabwe Red Cross Society adopts scalable trigger-based AA ([SA2.4](#)) to address cholera in densely populated urban hotspots in areas of unplanned urban growth by implementing actions in three phases, based on community transmission [110].

Flexibility in early actions also enables acting during compound and cascading events which otherwise risks amplifying gender, social and structural inequalities [111]. Therefore, flexibility in early actions is not only a technical and operational requirement but also an equity measure that safeguards against exclusion [112]. Connecting early actions with response capacity is also key, as highlighted by a future-fit workshop participant who

expressed concern that they do not have the flexibility to do Anticipatory Action if they are already doing disaster response for another hazard elsewhere in the country.

Flexibility could be built into early action choice and design in a variety of ways (see [Table 1](#) for examples). Notably, systems could enable the scalability of reach for larger events. Currently, most AA plans do not have this ability, but calls are being made to change this (KI#4, KI#11, KI#14). In addition, practitioners should consider layering actions (in a similar way as described in [SA2.3](#)) to scale and stagger triggers and thresholds to accommodate events of increasing magnitude, and to deal with changing uncertainty for trigger systems. However, scalability is limited by operational constraints, therefore systems need to be built to

enable acting quickly at scale, e.g., by preparing large-scale rapid cash delivery mechanisms through social protection systems.

Finally, many KIs and workshop participants highlighted the need for AA to seamlessly pivot to response operations – this means that there needs to be coherence in the content of the interventions themselves along with the funding mechanisms to enable this connection. For example, recent developments in the Central Emergency Response Fund (CERF) for cyclones/hurricanes AA frameworks in Cuba, Haiti, Madagascar, Mozambique and the Philippines now include observational response triggers and preidentified subsets of activities that can automatically shift AA setups into rapid response mode if storms intensify quickly or AA cannot be triggered in time.

“If the organization feels like these actions are impactful actions for the communities, it’s okay to let them change them, even at the last minute.” **KI #2**

TABLE 1. Examples of how actions in different sectors could offer increased flexibility given changing risks

SECTOR	Flexibility: SCALE	Flexibility: LAYERS	Flexibility: POTENTIAL TO TRANSITION TO RESPONSE
Health	Stock cholera treatment in all clinics in potentially affected region. Increase number of people to be supported.	Distribute mosquito nets for small floods. Evacuate and prepare first aid for large floods.	Deploy more health workers. Set up quarantine camps that repurpose AA supplies for response activities.
Food security	Expand cash distributions vertically (larger payments) and horizontally (more beneficiaries) for more severe droughts.	Provide feed for livestock for a short drought. Provide supplementary feeding for children for a long drought.	Lengthen the timeline of interventions to move into response – quantity of support and number of people.
Water, Sanitation and Hygiene (WASH)	Rehabilitate boreholes across larger geographic area. Connect to urban water providers to plan sustainable joint actions in preparedness and response.	Protect small water sources such as springs for small floods. Provide large water storage tanks for big floods.	Transition infrastructure projects to cash-for-work programmes and provide water trucking.

SA3.3. SHORT-TERM ANTICIPATORY ACTION AND LONG-TERM CLIMATE ADAPTATION AND RESILIENCE BUILDING SHOULD BE SEEN AS PART OF THE SAME RISK MANAGEMENT TOOLKIT, WITH LOCALLY LED APPROACHES GUIDING HOW THAT TOOLKIT IS APPLIED

Traditionally, AA focuses on short-term ways to reduce immediate impacts. However, employing a resilience lens in the design of these actions could strengthen community capacity and bring longer term risk reduction benefits as well as resilience building (KI#10, KI#11, KI#18). Therefore, this also requires ensuring short-term preparedness contributes to longer term resilience by aligning with broader development and risk reduction goals (KI#11, KI#23, [108]).

AA can be seen as a climate adaptation toolkit when it focuses on building systems of AA that will have longer term benefits. This could include interventions that protect livelihoods, reduce underlying vulnerabilities, reinforce shelters or use durable and reuseable materials in camps and water systems that serve beyond one season (see section [SA3.1. Stress-test early actions to assess effectiveness under different hazard scenarios](#)).

For example, the construction and rehabilitation of water points prior to the 2020–22 Somali drought increased

the proportion of respondents with access to functioning water points from 22–89 per cent [24]. In Bangladesh, vulnerable households used cash grants to fortify household roofs and walls, improving safety during imminent floods and bolstering long-term structural resilience [113,114].

In sectors such as WASH, integrating resilience considerations into anticipatory actions such as protecting and reinforcing water points, sanitation infrastructure and treatment systems ahead of floods or droughts can reduce immediate harm, while lowering the risk of disease outbreaks during and after extreme events. Chosen actions should also contribute to longer term community preparedness that strengthen local knowledge and build communities' capacity to support locally led actions that better prepare communities for the next shock [115]. In particular, AA has the potential to contribute to resilience building, when rooted in existing community social structures through strengthening social cohesion, embedding local leadership and empowering marginalized voices [116].

“In anticipation of these dry conditions ... we provide piping that addresses livestock need for water and household water needs for that anticipated dry condition. In the process, we are helping this community in a more resilient way as well.” KI#18

Connecting anticipatory actions with long-term climate change adaptation and resilience building is an ongoing topic of debate within the humanitarian and development

communities [8, 117], exemplifying many discussions about the role and complementarity of humanitarian aid and development funding⁴:

“You shouldn’t be prepared to provide food aid perpetually, but rather you address the underlying factors, you address the underdevelopment, you address the inequality and inequity.” KI #11

While AA emerged within the humanitarian sector to address residual risk⁵, there is growing recognition that early actions are more effective when root causes are also being addressed (KI#10 KI,#3) and that there is a need to work more closely with institutions thinking about long-term resilience [108]. Indeed, aligning AA with climate adaptation strategies can transform AA from short-term intervention into part of a continuous resilience building system [118] In Nepal, AA was just one part

of a wider heat action plan which was co-produced at the municipality level ([Case Study 4](#)). Similarly, introducing an AA framing to resilience building can help increase its reach and effectiveness. This has been highlighted as a particular priority in FCV settings, where risks are predominantly driven by individual and community-level vulnerabilities and protection risks, and AA needs to be embedded with broader resilience strengthening to be fully effective [119].

“Most AA actors right now are humanitarian actors whose mandate and actions are very short-term. So, I think really looking ahead much further, we really need to work with the development side because it’s actually them who could say, five years from now, if the floods are going to be now 1-in-50 year events and maybe we need to redesign the bridges.” KI #23

⁴ For more reflection on this critical discussion, please see <https://www.anticipation-hub.org/news/making-sense-of-synergies-how-anticipatory-action-connects-to-other-approaches-and-sectors>

⁵ Residual risk: The level of risk that persists despite existing risk reduction measures (UNDRR, 2017)

CASE STUDY 4.

CO-PRODUCED CLIMATE ADAPTATION AND ANTICIPATORY ACTIONS TO ADDRESS THE RISING RISK OF HEATWAVES IN NEPAL

The frequency and intensity of heatwaves globally have increased and are projected to increase in future as a result of climate change [1]. The World Health Organization (WHO) has estimated that under a high-emissions scenario, annual heat-related mortality among people aged over 65 in Nepal could rise from roughly four deaths per 100,000 people historically to about 53 deaths per 100,000 people by the 2080s ([120], based on the modelling approach of [121]). Adding to this, analysis by the Nepalese Ministry of Health and Population has found that heat stress has already increased, particularly in lowland areas of the Terai [122]. Critically, future projections do not take into account rapid urbanization intensifying the urban heat island effect, an increasing proportion of the population living in urban environments, or changes to housing type or improvements in healthcare.

The Nepal Red Cross Society (NRCS) is working at the municipal level to co-produce heat action plans. These provide guidance on when and where to act before and during a heatwave, as well as defining long-term urban adaptation measures for investment, such as greening urban infrastructure [123]. In setting up the project in this way, it is agnostic to the choice of intervention type (AA or climate adaptation), enabling the local community, rather than project donors, to guide its design.

The heat action plans have subsequently informed the development of a simplified EAP for heatwaves in four cities in lowland Nepal [124]. The prioritization of heat risk is justified using both climate projections and data on how rapid urbanization is intensifying the urban heat island effect. Undocumented migrants are identified as particularly vulnerable to heat, including outdoor daily wage workers, and the NRCS is reaching this changing demographic through pre-activation assessments to ensure their inclusion.

SA3.4. TO BE FIT FOR THE FUTURE, EARLY ACTIONS NEED TO AVOID ACCIDENTALLY INCREASING RISKS RATHER THAN DECREASING THEM – A PROBLEM KNOWN AS MALADAPTATION

Maladaptation risks reinforcing, redistributing or creating new vulnerabilities [125]. To avoid

increasing risks, we recommend asking the following guiding questions (adapted from [126]).

1. Does this action cause negative impacts on ecosystems and ecosystem services? E.g., putting sandbags on a river before a flood, disrupting floodplain dynamics.
2. Does this action cause substantial additional greenhouse gas emissions? E.g., the use of non-local materials for shelter strengthening.
3. Does this action discourage people from implementing systemic changes to reduce risks? E.g., knowing that a siren system was installed might encourage people to live in a risky place.
4. Does this action have negative consequences for neighbouring communities? E.g., forecast-based irrigation reducing water availability downstream.
5. Does this action cause unintended harm to low-income groups, women/girls or marginalized ethnic groups? E.g., early warning messages in the dominant language that don't reach marginalized populations.

In a joint workshop, the Ethiopian Red Cross Society and the Climate Centre screened local community actions to ascertain how climate and hydrometeorological conditions (now and in future) are and could be considered locally in the Water at the Heart of Climate Action programme. For droughts, communities are already thinking about the impacts on water infrastructure as well as about extraction from aquifers and its effects on the water table and how to avoid over-extracting and depleting water reservoirs [127]. In this way, drought management is being linked to water monitoring, environmental protection and ecosystem management, especially during long dry periods. When water infrastructure and

extraction is defined as an early action within AA plans, these also need to link to environmental and ecosystem management so as not to overexploit and deplete resources.

Practitioners are also designing AA with the goal of supporting peacebuilding efforts in FCV-affected areas, thus avoiding maladaptation in the form of aggravating underlying conflict and violence-related tensions. For example, the Danish Refugee Council engages the peacebuilding sector in its AA work, promoting the use of early warning information and foresight in peacebuilding efforts [128], which can be further extended to selecting early actions that avoid unintentionally intensifying existing conflicts [87].

SOLUTION AREA 4 FUTURE-FIT READINESSS

FUTURE-FIT IMPLEMENTATION SYSTEMS USE SIMULATION EXERCISES TO STRESS-TEST AA PLANS AND FRAMEWORKS AGAINST PLAUSIBLE FUTURE EVENTS

Until now, the growth of AA practice has focused on developing AA plans in more countries and funding them when their triggers are activated [5]. However, preparedness or readiness activities are used to maintain the ability to coordinate and implement early actions. Various organizations account for these activities differently – for example, both the IFRC Disaster Response Emergency Fund (DREF) and the Start Ready Fund from the Start Network call these ‘readiness costs’ [129]. Readiness activities also provide an opportunity to test, review and adapt plans over time – when thinking about changing risk, this is even more essential.

The Tanzania Red Cross distributes shelter materials, food, WASH supplies and health support to some 1,500 people displaced in Tanzania in late 2025 to early 2026 due to heavy flooding across south-east Africa. (Photo: Tanzania Red Cross Society via X)



Readiness encompasses maintenance of the whole AA system, including triggers, actions, finance, coordination, communication, institutional arrangements and decision-making processes, and [guidance is available](#) on assessing and improving organizational readiness for AA. Other resources for assessing readiness include [value-chain assessments](#) that examine whether there could be breakdowns in any component of the early warning system.

“It would be interesting to know when [plans] are revalidated, how often they actually change in a substantive way and in which ways, because my feeling is that they don’t change... in any way, like triggers, actions, whatever.” KI#5

Simulation exercises (see [Case Study 6](#)), foresight approaches [67, 68] in which other similar tools are used to test readiness for disasters. These common emergency management practices can also ensure AA systems are adapted for changing risk. In this section, we provide recommendations to harness and adapt simulation exercises as a tool to future-fit the design and implementation plan of AA systems.

SA4.1. USE SIMULATION EXERCISES AS PART OF REGULAR PRACTICE OF TESTING ANTICIPATORY ACTION PLANS

[Simulation exercises](#) are well-established practices to test existing Anticipatory Action and disaster response procedures, either as table-top exercises (i.e., discussion-based) or large-scale live drills. Evidenced outcomes include improved collaboration, learning, development of new skills and improvements to plans / protocols / manuals that better equip organizations to deal with a future event [130–133].

“I feel that we could test, especially those ones that have not been activated over five years... I think it needs a bit of analysis, and we do a bit of random checks, for example, those ones.” KI#2

Simulation exercises are formed of one or several event scenarios that provide the hazard and risk context upon which to test plans. Testing AA plans against potential scenarios that are consistent with changing risk can help reveal gaps and highlight necessary improvements to ensure AA plans are future fit.

To facilitate simulation exercise, we recommend the following best practices:

- Create room for detailed discussion. Setting participants in a mindset of imagining what could happen is key to having them think more proactively about the future and what might happen.
- Have the right people in the room.
- Know what plan you are testing. Participants should be familiar with the AA systems and plans that are being tested.
- Develop contextual injects. ‘Injects’ or planned additions to the event scenarios can provide surprising twists and turns, such as power failures or conflict dynamics, that increase the complexity of the situation.
- Include a variety of stressors in the scenario exercise that test communication and logistics. Examine the different ways an extreme event could play out to ensure that early warning system components are tested from multiple angles.

CASE STUDY 5.

FAO SIMULATION EXERCISES FOR EMERGING AND CHANGING PESTS AND DISEASES

AA programming by the Food and Agriculture Organization (FAO) makes frequent use of simulation exercises designed to test operational readiness, including early warning interpretation, trigger activation and coordination among national and local actors prior to hazard events [34,134–137].

For hydrometeorological hazards, these exercises are primarily designed to test operational readiness and coordination rather than to stress-test systems against future risk. In the FAO simulation exercise toolkit, SimEx teams are encouraged to design possible scenarios for the hazard of focus [138], but without guidance on considering how the hazard (or risks) is changing.

However, FAO's work on emerging agricultural pests and diseases incorporates simulation exercises and contingency planning which more explicitly incorporate information on emerging and changing risks [139-140]. For example, FAO-supported simulations for banana pest outbreaks have helped plan for emerging fungal disease [139]. Similarly, FAO's contingency planning for Rift Valley fever recognizes the need to update plans (e.g., due to changes in the epidemiological situation, scientific advances, livestock production systems and experience on the ground) [140], with the spread of Rift Valley fever known to be facilitated by climate change [43]. These approaches have supported improved preparedness for transboundary threats, including earlier detection, coordinated surveillance and targeted pest management interventions [141].

SA4.2. FOR SIMULATION EXERCISES, DESIGN DIVERSE EVENT SCENARIOS REPRESENTATIVE OF FUTURE TRENDS BY WORKING WITH CLIMATE AND SOCIAL SCIENTISTS

When used in simulations, event scenarios can help participants to envision and analyse the future through detailed narratives on what might be in store. However, current practice in emergency management is to use scenarios with hazard events that are more like disasters experienced in the past ([Case Study 5](#)).

We recommend that practitioners work with the best available information about future risk to select and design an event scenario that is consistent with future trends on a medium-range time horizon and considered plausible by scientists and practitioners. Indeed, future-fit workshops highlighted that participants will not engage if they find the scenario too outlandish; but equally, a scenario that is not different enough from what has been experienced in the past will not be useful.

“[We] have experience in running simulations... but capacity [is] needed on designing the scenarios. There would be added value on having that extra person with that skill and expertise.” KI#2

A major barrier is that most climate projections are provided as averages or long-term trends, and it is not possible to identify discrete events from this information. Climate projections often fail to provide information on certain dimensions of hazards (e.g., changing spatial extent of storms) or compound or cascading events. While simple extrapolation of an individual event scenario from a larger regional trend is a reasonable starting point, this is imprecise and can overlook local weather dynamics. However, recent advances in climate research have demonstrated how to identify

unprecedented events using weather and climate models [107,142]. Further analysis using these methods is needed, and science-based scenarios need to be made available [143, 144] for humanitarian organizations to use in simulation exercises.

To develop diverse event scenarios representative of future trends, practitioners could make use of the following categories adapted from [145], which was co-developed between climate scientists and humanitarian practitioners specifically for this purpose ([Table 2](#)).

TABLE 2. Different dimensions of unprecedented weather adapted from [145] which could be used to create salient scenarios for AA testing

Event type	Description	Example scenario
Magnitude and intensity	The hazard conditions are stronger	The hottest temperatures ever experienced
Duration	The hazard lasts longer	A heatwave that lasts many more days than the previous record
Timing	The hazard occurs at a different time of the year	Out of season flooding
Frequency	There is a higher frequency of occurrence of the same type of hazard	Consecutive flash flooding episodes
Speed	The speed of onset or intensification of the hazard is faster	Very rapidly intensifying tropical cyclone
Location	The type of hazard occurs in a new location	A glacial lake outburst flood in region previously thought safe
Extent	The hazard is larger and/or occurs over a larger geographic scale	Widespread flooding
Pattern	The hazard occurs with a different geographic combination	Clustering of high precipitation events

For example, in the Southeast Asia region, climate projections show that heavy rainfall events are likely to become heavier in magnitude in Viet Nam ([36] p8). This would cut-off roads and isolate many communities (KI#10).

A simulation exercise could include how long internal resources would last when roads are blocked by flooding and landslides and if there is a need to preposition more emergency supplies in these areas before communities become isolated.

“It’s likely to get people to think a bit out-of-the-box in terms of what actions could be implemented. Because I think, right now, we are just thinking within the remit of what we know, what we have done, but we have not necessarily thought about what if it was an El Niño, like 1997, but two times bigger?” KI#23

SA4.3. IN EVENT SCENARIOS, INTEGRATE DETAILED DESCRIPTIONS OF COMPOUND AND CASCADING RISKS

To get a comprehensive picture of changing risk, simulation exercises should also test plausible compound and cascading event scenarios. We recommend exploring four different types of events: preconditioned, multivariate, temporally compounding and spatially compounding, as

explained in [Table 3](#) [146]. One common problem for AA systems is a breakdown of warning communication in contexts of compound events. Readiness should include ensuring that warnings are understood, trusted and acted on.

TABLE 3.
Types of compound and cascading events, and scenario example

Event type	Description	Example scenario
Preconditioned event	A pre-existing climate/ weather condition means that a hazard has an amplified impact	Drought in Somalia creates cracked ground, which cannot absorb water and causes huge runoff and major floods when heavy rains fall
Multivariate event	One weather driver causes many sub-hazards in the same place	A hurricane in the Dominican Republic causes strong winds, storm surge flooding, and flooding from heavy rainfall
Temporally compounding event	Hazards that follow each other, one after the other, in a single location	In Nepal, heavy rainfall causes a glacial lake outburst flood, then flash flooding downstream, then river flooding
Spatially compounding event	Several connected locations are affected by hazards at the same time	A heatwave in northern Bangladesh happens at the same time as a landfalling cyclone

Event scenarios should also include detailed vulnerability and exposure contexts that are representative of trends. This can help test the effectiveness of early actions in the short- and long-term. Various types of event scenarios could be designed to this end. For example, child-sensitive event scenarios could consider how actions need to be adapted for different groups (KI#8). Future-fit readiness should include

testing whether systems are inclusive, participatory and able to avoid reinforcing existing inequalities in situations of changing socioeconomic conditions. Scenario exercises should assess institutional readiness, including whether organizations have the structures, authority, coordination mechanisms, decision-making processes, resources and partnerships needed to act before a crisis.

SOLUTION AREA 5 FUTURE-FIT FINANCING FOR ANTICIPATORY ACTION

FUTURE-FIT FINANCING FOR ANTICIPATORY ACTION IS SUSTAINABLE AND FLEXIBLE FOR AA TO DELIVER IMPACT AMID RAPIDLY CHANGING RISKS

To act on an early warning, institutions need to reallocate resources (e.g., move personnel to new locations) or allocate new resources (e.g., funding for evacuation centre staff and food supplies). Here, we will refer to these resources that are reallocated or released to fund action as ‘fuel’ finance. This Solution Area focuses on fuel finance, including both government-led AA (e.g., shock-responsive social protection systems) and humanitarian AA.



The Red Crescent Society of Kyrgyzstan helped nearly 14,000 people facing extreme heat in Kyrgyzstan in 2022. This was the first activation anywhere in the world of an IFRC–DREF Early Action Protocol for heatwave. (Photo: Red Crescent Society of Kyrgyzstan–German Red Cross)

SA5.1. SUSTAINABLE FUEL FUNDING FOR CHANGING RISKS

Behind every AA plan or shock responsive social protection system is some kind of guarantee that funding will be released or reallocated should a pre-agreed trigger be met. As a result, most AA plans state the probability or frequency at which triggers would be reached (e.g., Fiji, [141]), as this enables an estimation of the depletion risk of the overall fund.

However, if the intensity and frequency of a hazard is increasing, this can increase the rate of depletion of funding mechanisms to an unsustainable level. For example, a heatwave that was previously estimated (based on historical data) to occur once every five years and used as the basis for a trigger, may, in practice, become a once-in-three year event. (For assessment of trigger frequency, see [SA2.1](#): Improve surveillance and regular monitoring of exposure and vulnerability to ensure that rapid changes in any components are considered).

Within government departments, decision-makers need to determine whether an increased trigger frequency could cause problems for their proposed actions, e.g., cancelling train services in response to increasingly frequent heat events. For those who oversee pooled AA funds or donor allocations to humanitarian AA, decisions need to be made on whether to adjust the trigger threshold so that it is reached with the same frequency, or whether to allow triggering for the same level of impact but accept that this will mean more frequent payouts. There is no standard recipe for making this decision and we recommend consulting existing resources, such

as the [Forecast-based Financing Manual](#) for guidance on coordination and trigger selection using updated frequency values.

Reserve mechanisms or recapitalization rules can help replenish funding in times of frequent activations, so that funds do not need to be limited by static budget envelopes. Planning for the frequency of activation can be challenging when using impact-based triggering approaches, especially with dynamic or flexible triggers, because the trigger frequency is harder to model. Therefore, we urge caution when implementing Impact-based Forecasting methods to ensure that trigger frequencies can be modelled and uncertainties are assessed (see section [SA2.3](#): Scale and stagger triggers and thresholds to accommodate events of increasing magnitude, and to deal with changing uncertainty).

If and when trigger frequencies reach a level at which AA is being activated more often than is financially or operationally feasible, this should be treated as a signal that a given hazard is transitioning from an anticipable shock to a chronic stress, requiring a shift towards longer term investments that build resilience or social protection programming that assists in migration/relocation in places where adaptation limits are reached. In the example of too-frequent train cancellations, government agencies might opt to invest in long-term resilience upgrades to the train tracks. The AA system would then have a higher trigger, and train cancellations would become less frequent in a warmer climate.

SA5.2. FINANCING SCALABLE ANTICIPATORY ACTION APPROACHES TO EXTEND THE REACH OF AA FOR LARGER EVENTS

In record-breaking events, Early Warning Early Action systems need to be able to scale action beyond what has been done in the past, which requires flexible and scalable financial allocations. There is a need for a better harmonization of investments being made in Early Warning Systems (EWSs) and Anticipatory Action – many of the ongoing large EWS investments to government agencies are disconnected from humanitarian AA investments. While humanitarian AA systems have been developed in more than 50 countries around the world, the ability of these systems to scale up when events are predicted to have greater impact is relatively limited. For example, in Somalia, future-fit workshop participants from the humanitarian sector reported that larger scale flooding would require more resources from different actors.

National institutions need dedicated mandates, budget lines and technical capacity to be able to execute on a whole-of-government response for large and unprecedented events [147]. The [Coalition of Finance Ministers for Climate Action](#) supports innovation among government leaders worldwide on how to finance climate action. More details on Anticipatory Action in government systems are available in this report on [National Disaster Risk Management Systems](#). For example, the Kenyan government's hunger social safety net programme can reach a greater number of people when drought is expected to be 'severe' rather than 'extreme' [102]. Social protection systems can be one of the most cost-effective pathways to deliver scalable AA. Many national governments are increasingly recognizing this logic and leveraging their social protection platforms for AA delivery, for droughts, floods and cyclones [148,149]

SA5.3. ALLOW FLEXIBILITY IN SPENDING FUEL FUNDING TO ACCOMMODATE RAPIDLY CHANGING POPULATION VULNERABILITY AND EXPOSURE

To manage the interaction of multiple and novel hazards, AA plans require operational flexibility on how funding is allocated and activities are adjusted, when forecasts change or when impacts are different than expected (KI#4, KI#5, KI#14). For example,

humanitarians might require the ability to transition from pre-agreed AA actions to response operations in the case of an unusually large flood ([SA3.2](#)) or take new actions for unprecedented events ([Case Studies 1, 3 and 5](#)).

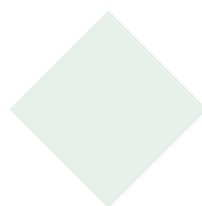
“I do think it’s a real challenge thinking about trying to have systems that are rigorous enough to reassure donors, but then making sure that they are flexible with the evolving climate science.” KI#8

SA5.4. STRENGTHEN INNOVATIVE FINANCING SOLUTIONS TO BRIDGE SHORT AND LONG TIMESCALES

In a world of changing risks, AA will not succeed as a single solution; countries will require a mosaic of disaster risk financing instruments to be used before, during and after extreme events. Many risks will not be able to be reduced, and funding for disaster response and recovery must also be a key priority. Insurance and risk transfer mechanisms already exist to finance AA, including parametric insurance products to provide payouts against predefined triggers [150], catastrophe bonds and crisis modifiers, as well as indemnity insurance for absorbing the risk of drawdown from pooled funds like DREF [151]. Successful ‘bridging’ across timescales requires financial instruments to be coherent. The Risk-informed Early Action Partnership (REAP) defines successful coherence as a group of financial mechanisms that have conceptual agreement on the risk assessment, institutional coordination, cross-sectoral action planning, joint monitoring and evaluation, and dedicated budgets that acknowledge both disaster risk reduction and climate change adaptation. We recommend this report on [Charting a Path towards Resilient Futures](#) for guidance on how to assess and improve coherence of risk management solutions across scales. There is also an ongoing conversation on how AA can be a


funded and incorporated into the work plan at both the programming and financing levels of the Santiago Network on Loss and Damage to scale up Anticipatory Action [152, 153], especially as both are focused on minimizing loss and damage for climate risks of the most vulnerable.

New financing solutions are emerging to provide support across these time horizons. For example, in Malawi, parametric insurance products are being developed to finance the anticipation, response and recovery phases of support to communities (see [Case Study 6](#)). The recovery phase perhaps provides the most obvious opportunity to link with climate adaptation work and ‘building back better’. For example, in the Philippines, a mangrove insurance facility currently in development will pay out whenever a super-typhoon makes landfall to support both mangrove rehabilitation and humanitarian response [154,155]. The current status of the mangroves could then be used as a vulnerability indicator within an Anticipatory Action protocol, given their proven ability to mitigate the risk of a cyclone’s dangerous storm surge.



CASE STUDY 6.

DEVELOPING INSURANCE SOLUTIONS THAT BRIDGE ANTICIPATION, RESPONSE AND RECOVERY PHASES FOR FLOODS IN MALAWI



In January 2022, Tropical Storm Ana brought flooding to many parts of southern Africa, with the government reporting an estimated 221,127 households affected in Malawi [71]. There is medium-to-high confidence that tropical cyclone rainfall will increase in intensity as a result of climate change [156], with the potential for tropical cyclones that can more frequently travel further inland [157]. As a result, climate change, alongside recent population increases leading to a rise in deforestation for firewood [158], threaten Malawi with more impactful storms with cascading hazards including floods, debris flows and landslides [159].

In response to this increasing risk, the Malawi Red Cross Society in partnership with the insurance sector is piloting parametric flood insurance products designed to support vulnerable households in flood-prone areas [160]. This was supported by the Danish government and the InsuResilience Initiative. A parametric design is central to the approach's future-fit credentials: payouts are triggered by objective, forecast-based indices rather than post-event assessments, enabling anticipatory disbursement within the narrow window of opportunity before a hazard peaks. This initiative seeks to develop financing options that can bridge timescales, funding anticipatory response and recovery activities [161], allowing support to reach communities before, during and after disasters.



Philippine Red Cross volunteers rescue people trapped by rising floodwater following Tropical Storm Trami in October 2024 – one of six typhoons that struck the Philippines in October and November of that year. (Photo: Philippine Red Cross via IFRC)

CROSS-CUTTING RECOMMENDATIONS

In this section, we pull out recommendations for science, policy and practice that cut-across the different solution areas.



ENHANCE SCIENCE-PRACTICE PARTNERSHIPS TO USE THE LATEST SCIENCE IN ANTICIPATORY ACTION SYSTEMS

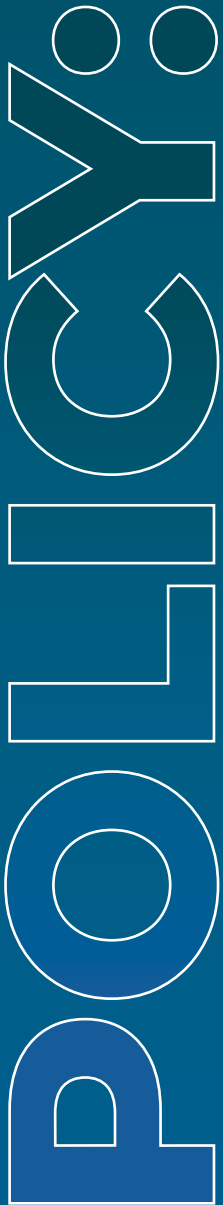


Historically, climate science has only provided general statements about likely large-scale changes in the frequency or intensity of a hazard. However, collaborations between practitioners and different types of scientists can now provide localized assessments of emerging and changing risk ([SA1: Future-fit risk assessment](#)), demonstrating how these risks might be changing in terms of frequency, magnitude, duration, location and seasonality. Combined with the growth of vulnerability and exposure data sources, science can inform our prioritization of risks, the actions we take ([SA3: Future-fit early actions](#)) and the funds to allocate ([SA5: Future-fit financing for Anticipatory Action](#)) as well as the locations in which we prepare to act. To assess these risks, we require collaborations across different areas of expertise

(e.g., health, climate, urban planning) and these collaborations should centre the voices of local actors.

In addition, through advances in weather and climate science (convection-permitting climate modelling, pseudo-climate counterfactuals and use of ensembles) we can extract individual plausible future events from which to stress-test our Anticipatory Action plans through simulation, scenario and foresight exercises ([SA4: Future-fit readiness](#)) so that they are resilient to what the future may hold. We recommend developing partnerships between government hydrometeorological services, other government agencies (e.g., health, agriculture), researchers and practitioners to use these scientific breakthroughs.

SUPPORT CROSS-GOVERNMENT INSTITUTIONALIZATION TO DELIVER AA THAT IS SUSTAINABLE, SCALABLE AND FLEXIBLE



In contexts in which government institutionalization is possible, the allocation of domestic funding for Anticipatory Action often requires legislation and policies that support EWSs and AA, and we recommend that government agencies collaborate with humanitarian partners to develop and institutionalize such policies that are sustainable considering future changing risks. Both governments and civil society institutions should have access to a variety of financing instruments for early actions as well as a mosaic of coordinated funding mechanisms to cover the rest of the Disaster Risk Management cycle.

Strengthening cross-sectoral government engagement in AA will support risk assessment ([SA1: Future-fit risk assessment](#)), triggering ([SA2: Future-fit triggers](#)) and readiness ([SA4: Future-fit readiness](#)) and enable AA to address future risks. This should include collaboration and leadership with national hydrometeorological services wherever possible.

The integration of AA into adaptive social protection systems ([SA5.2 Financing scalable Anticipatory Action](#) approaches to extend the reach of AA for larger events) can deliver scaled AA for events with bigger impact because of climate change and other changing risks. These government support systems should enable locally led action.

The institutionalization of AA also goes beyond government-led delivery of anticipatory actions. Hazards such as infectious diseases, population movements, supply chain disruptions and tropical cyclones can propagate across boundaries; therefore, the institutionalization of AA should extend to transboundary cooperation and strengthening linkages between international and domestic risk management systems. In FCV settings, these institutional coordination mechanisms may be more complex. Detailed guidance exists to help, including the Toolkit for Anticipatory Action in Fragile, Conflict and Violence-affected settings [162].

STRENGTHEN READINESS ACTIVITIES TO IDENTIFY AND STRESS-TEST SYSTEMS AGAINST CHANGING RISKS

PRACTICE

While Early Warning Early Action requires funding to be reallocated or newly assigned when there is a forecast of an extreme weather event, it also requires long-term maintenance to ensure that people are ready to act when the event arrives. In some cases, government departments or humanitarian organizations have personnel who are assigned the task of running annual drills and reviewing emergency plans. In other cases, agencies have 'readiness' funding for the ongoing maintenance and improvement of both emergency and AA plans. In all cases, AA plans require regular cycles of testing and review to capture changing risks and learning. Donors and practitioners should recognize preparedness as a core enabler of effective AA, rather than a residual or optional cost, and ensure that learning from activations and simulation exercises is translated into concrete improvements in preparedness over time. We recommend bundling planning processes with routine training and simulation within the same financing structures, and we also recommend using recovery financing to review and improve AA plans, strengthening operational readiness for future risks while leveraging periods of increased political attention and resource availability.

Simulation exercises are a key component of many readiness activities and should be seen

as entry points for making AA future fit. Many organizations are already familiar with these approaches as pre-season activities between meteorological services, disaster management agencies and humanitarian partners, used usually for testing AA logistics and coordination. Technical support will be required for embedding the latest information on changing hazards, exposure and vulnerability as well as salient and realistic event scenarios into these simulation exercises, rather than relying on 'testing' using past events. Through these exercises, it will be possible to identify where there might be need for more flexibility in terms of early actions ([SA3.3](#). Short-term anticipatory action and long-term climate adaptation and resilience building should be seen as part of the same risk management toolkit, with locally led approaches guiding how that toolkit is applied), trigger systems ([SA2.1](#). Improve surveillance and regular monitoring of exposure and vulnerability to ensure that rapid changes in any components are considered.) and financing ([SA5: Future-fit financing for Anticipatory Action](#)). It is critical to have local actors as co-designers and participants in these simulation exercises. Finally, simulation exercises and readiness activities should explicitly test whether anticipatory actions help preserve critical services – particularly water, sanitation and health systems – that determine epidemic risk and recovery trajectories.

CONCLUSION AND REFLECTION

Through the Climate Centre's involvement and leadership in the AA community for over a decade, Anticipatory Action has expanded from pilot projects to become an integral part of the humanitarian system [142]. But as unprecedented flood after cyclone after drought has hit the headlines and have been attributed to climate change, we have pondered how AA can play a better role in the effort to improve the outcomes of vulnerable communities who are faced with these extreme events. We recognize that the recommendations in this report are, in many ways, aspirational, particularly as the funding landscape for climate, development and humanitarian interventions is under pressure. However, we hope they go some way to reshaping how climate adaptation and AA work alongside each other over the decades to come.

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APPENDICES

APPENDIX A: PARTICIPANT INFORMATION SHEET

ADDITIONAL PROJECT BACKGROUND AND OBJECTIVES

Several recent reports demonstrate that Anticipatory Action (AA) has become an important tool for helping vulnerable communities withstand shocks and stresses. However, the same research also indicates that AA initiatives often design triggers and actions based on historical disaster impacts, overlooking future risks. As most AA protocols rely on historical data, they are limited in their ability to address current and future climate risks.

The research will examine how AA can remain effective in a changing climate, identify emerging models and examples that account for evolving

climate risks, and explore how organizations are currently considering future risks in their AA programming. The aim is to develop tools and guidance to support the creation of 'future fit' anticipatory approaches.

The project is funded by the UK's Foreign, Commonwealth and Development Office (FCDO) and the British Red Cross and carried out by the Red Cross Red Crescent Climate Centre and the University of Reading. The outcomes of these interviews will be used to prepare a report and publication on Future Fit Anticipatory Action, which will be released in mid-2026.

CONSENT INFORMATION AND DATA PROTECTION

We request your permission to record this interview. Participation is entirely voluntary and anonymous. Organizations taking part will be acknowledged, but no specific quotation will be attributed to any individual or organization. The information collected will be summarized and used to prepare a report and publication on Future-Fit Anticipatory Action.

We kindly request that you inform your employer of this interview and obtain their consent prior to your participation. By providing your consent to participate, you authorize the use of your responses in the resulting documentation and agree that the data may be

stored in a non-identifiable format after use. All identifiable material will be deleted at the end of the project. You may stop the interview at any time if you feel uncomfortable, and you may also choose to withdraw at the end of the interview. In the event that you choose to withdraw, all data provided will be deleted.

All data will be anonymized and stored securely in password-protected online databases of the Red Cross Red Crescent Climate Centre. Following the interview, a transcript will be shared with you via Microsoft Teams or email, allowing you to review and, if necessary, withdraw any statements you have made.

WHO HAS REVIEWED THE STUDY?

This project has been reviewed by the University of Reading Research Ethics Committee and has been given a favourable opinion for conduct.

If you have any questions about the project, your participation or complaints, please feel free to contact any of the researchers:

Adele Young: young@climatecentre.org; Erin Coughlan de Perez: Erin.Coughlan@tufts.edu; Irene Amuron: amuron@climatecentre.org; Dorothy Heinrich: heinrich@climatecentre.org; Mary Anne Zeilstra: zeilstra@climatecentre.org; Meghan Bailey: bailey@climatecentre.org; or the Principal Investigator: Liz Stephens: elisabeth.stephens@reading.ac.uk

INFORMED CONSENT STATEMENT

The following consent statement will be read on the recording.

- Do you understand the accompanying information, the purposes of the project, and what will be required of you?
- Have all your questions about the interview been answered to your satisfaction?
- Do you agree to the arrangements described in the information provided so far as they relate to your participation?
- Do you understand that all your responses will be anonymized when collected and stored?
- Do you confirm that your employer is aware of the conversation and gives its consent for your participation?
- Do you voluntarily give your consent for the information being collected and its use for the purposes specified only?
- Do you understand that you have the right to withdraw from the interview at any time and after the interview?
- By proceeding with the interview, you agree to the above and give your informed consent to participate.

INTERVIEW QUESTIONS

This is a semi-structured guide. The interviewer will follow up with many detailed questions based on the responses to these general questions.

1. Risks change over time (for example, the current risk of heatwaves might be higher than the risk was 20 years ago, and future risk might be even higher). In your Anticipatory Action (AA) work, are there any changing risks that you are concerned about? Please explain why or why not.
2. Have you made any decisions in AA plans or programmes to manage changing risks? Please explain.
3. Do you think that AA programming is sufficiently addressing changing risk? Please explain why or why not.
4. What might happen if AA programming does not address changing risk?
5. What do you think could be improved in AA programming to better account for changing risks?
6. Have you ever done a simulation exercise or 'stress test' of your Anticipatory Action work with a new event that has never happened before? Do you think this would help identify areas for improvement in the AA plans to be ready for changing risks? Why or why not?

NOTE: We are primarily interested in how hazards are changing over time with climate change, but these questions can also apply to how vulnerability and exposure are changing over time and how this also needs to be accounted for.

APPENDIX B:

SCENARIO WORKSHOP DETAILS

We conducted five workshops (three online, one hybrid and one in-person) to test AA protocols against plausible scenarios that are consistent with climate change trends and projections in five countries and for different hazards (Table B1). In each workshop, representatives from civil society and government discussed how their Anticipatory Action plans would operate under each future scenario.

TABLE B1. Scenario workshops used to test AA plans

Workshop country	Scenario event
Nepal (online)	Spatially compounding and multivariate flooding event of high magnitude
Bangladesh (online)	Spatially compounding heatwave and cyclone events; out-of-season flood with high forecast error
Somalia (online)	Drought event that preconditions the soil for high magnitude extreme rainfall: a flooding event of magnitude above previous record
Dominican Republic (hybrid)	Rapidly intensifying tropical cyclone of record-breaking windspeeds at landfall
Burkina Faso (in person)	Heatwave of record-breaking magnitude and duration

FIGURE B1. A snapshot of the Honduras tropical cyclone scenario



FIGURE B2. The Red Cross Red Crescent Climate Centre's facilitation of the future-fit scenario workshop in Ouagadougou, Burkina Faso, hosted by the Agence Nationale de Météorologie (ANAM), 12 March 2026



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