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Weather and Climate Information Services

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WISER Early Warnings for Southern Africa

Final Project Evaluation

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November 13, 2025 (with minor correction to Table 7 in June 2026)

The Weather and Climate Information Services (WISER) Programme is funded with UK International Development from the UK government and led by the Met Office in the UK.

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Acronyms

ARCAN	Africa Regional Climate and Nature programme
CAP	Common Alerting Protocol
DRR	Disaster Risk Reduction
EW	Earning Warnings
EWSA	Early Warnings for Southern Africa
FCDO	Foreign, Commonwealth and Development Office
GESI	Gender Equality and Social Inclusion
INAM	Instituto Nacional de Meteorologia (National Meteorology Institute)
KII	Key Informant Interview
MTG	Meteosat Third Generation
NMHS	National Meteorological and Hydrological Services
RCC	Regional Climate Centre
RSMC	Regional Specialised Meteorological Centre
SAWS	South African Weather Service
SEB	Socio-Economic Benefits
SOP	Standard Operating Procedure
ToC	Theory of Change
UK	United Kingdom
WCIS	Weather and Climate Information Services
WISER	Weather and Climate Information Services programme
WMO	World Meteorological Organization
WP	Work Programme
ZMD	Zambia Meteorological Department

Acknowledgements

Data for the evaluation was collected from May to July 2025. Data was collected in Zambia by a team led by Katharine Vincent and Willem Colenbrander, in Mozambique by Katharine Vincent, Gilda Monjane and Marita Monjane Saraiva, and in South Africa by Thato Masithela. We are grateful to WISER EWSA team members for availing themselves to inform data collection protocols and to provide project-specific reflections.

Executive Summary

The WISER Early Warnings for Southern Africa (EWSA), part of the Weather and Climate Information Services (WISER) programme managed by the United Kingdom Met Office, aimed to enhance the quality, accessibility and use of weather and climate information services (WCIS) in Mozambique, South Africa and Zambia. WISER EWSA was implemented from March 2023 to August 2025. It engaged a team of meteorologists, academics, economists, and user engagement specialists to work with national meteorological and hydrological services (NMHS), disaster risk management agencies and non-governmental organisations, to engage with communities—with a focus on women and people with disabilities— to reduce disaster risk and impact through the co-production of new weather information services and early warnings. The programme specifically focused on the production of "nowcasts"—short term forecasts of severe weather which incorporate impact-based forecasting and can be used to support actions to reduce negative impact associated with events like thunderstorms. The project focused on three urban communities (Boane in Mozambique, Katlehong in South Africa, and Kanyama in Zambia) but hoped to support replication by establishing forecaster capacity and developing business models for funding nowcast production and dissemination at a national level.

This WISER EWSA programme evaluation seeks to answer the following questions:

1. What was the impact of the programme?
2. Did the programme achieve its intended results?
3. What aspects of the programme theory of change were validated, and which require adaptation?
4. What are the lessons learned for future projects?

The evaluation uses a mixed methods approach. First, programme documents, including programme reports, Stories of Change, and the Socio-Economic Benefits analysis are reviewed. Second, key informant interviews, baseline and endline quantitative surveys, and focus group discussion data, were collected and analysed. The approach attempts to make use of all available evidence and learning and synthesize this evidence to answer the evaluation questions as comprehensively as possible.

The key findings are as follows:

Programme impact: Drawing on the full range of project data, there was strong evidence of some **sustainable innovations in weather information service delivery**, such as adoption of Common Alerting Protocol for alerts by Zambia and Mozambique, new links for disseminating dam discharge information to communities in Mozambique, **improved capacity among forecasters; increased interest, understanding, and trust in forecasts, and demand for them, among the three targeted communities** and some localities outside them, and **increased access to weather information among targeted communities.** There was somewhat limited evidence of increased avoided losses to date in the targeted communities, and very limited evidence of increased avoided losses to date at the national level. There was mixed evidence of increased capacity and engagement with intermediary organizations to support nowcast use and dissemination, as some organizations were highly involved, while others were less so. There was limited evidence for systemic changes that to establish national-level adoption of nowcasts**;** several key informant interview respondents expressed reservations that the service would be scaled.

Limited data, particularly for national-level impacts, was a limiting factor in drawing conclusions regarding impact with high confidence.

Achievement of Intended Results: The project was very successful at delivering its activities, outputs, and immediate outcomes. WISER EWSA met or exceeded its targets for nearly all output and outcome level indicators, including number engaging 795 people in co-production processes, against a target of 270. The only outcome target that was not achieved was the number of Regional Climate Centres (RCCs) and NMHSs with improved ability to generate and deliver enhanced weather and climate information; the target was six, but this was achieved only for the three NMHSs of Mozambique, South Africa and Zambia.

For impact indicators, the project supported an estimated 5.5 million people to have improved ability to reduce severe weather losses through access to nowcasts and related alert services, against a target of 5 million, and resulted in £1 million in avoided losses, of which £743,000 occurred among urban populations, against an ambitious target of £10 million. There is a high degree of uncertainty around these estimates, due to limited data.

The programme made good progress towards many of its markers of transformation, which indicate meaningful and sustainable impact. In the area of **innovation**, the project appears to have achieved its "expect to see", "like to see", and to some extent its "love to see" transformation goals. In the areas of **scale and replicability/sustainability,** the project appears to have achieved its "expect to see", and to some extent its "like to see" goals at community level but has not achieved its "love to see" transformation goals.

In the area of cost effectiveness, avoided losses to date due to the programme were estimated at about £1 million, against a programme budget of £2 million. However, much of the benefit is expected to accrue in the future, and the SEB Analysis indicates that further additional benefits are possible, depending on NHMSs implementation. However, these estimates include a large degree of uncertainty, particularly for South Africa, which accounts for by far largest share of the estimated avoided losses. This suggests the programme has potential to be good value for money if capacity improvements and nowcast services can be sustained by the NHMSs.

Validation of the Theory of Change: Many aspects of the theory of change appeared to hold up well, and key activities, outputs and immediate outcomes were largely achieved. However, a key weakness in the theory of change appears to be the assumption, explicitly identified at project start, that NMHSs would have sufficient capacity to continue producing and disseminating inclusive nowcast products. There was limited evidence of this occurring within the short life of the project; a project that wants to be sure this part of the theory of change can be achieved is likely to require a substantial run time and budget for consistent institution building.

An additional weakness in the theory of change was with respect to the role of intermediary organizations. While many organizations were strong participants in WISER EWSA activities, others were not, and this appeared to be an important factor in the sustainability of some approaches.

There were a couple of outcomes and observed mechanisms for change that were not in the original theory of change. The first was an unanticipated positive outcome for programme participants: members of marginalized groups, specifically people with disabilities, who participated in activities reported feeling they experienced increased social standing as a result of their role providing weather information in their communities. The second was the importance of understanding forecasts in creating greater trust in them, and subsequently greater use.

Lessons for future projects: Some of the key lessons included:

- Training approach matters: for engaging NMHS forecasters, online training was less effective than in-person training and the testbeds.
- The community engagement approach was very effective at including people with disabilities in co-production and increasing their engagement with weather information. However, there are questions about how to make this level of community engagement sustainable.
- Intermediary organizations could play a role in sustainable community engagement, but their involvement was uneven, with implications for impact especially at systems level. Incorporating intermediary organizations as full partners (for example funded through the consortium) could be considered in the future to ensure buy-in.
- The project appears to have encountered more constraints within the national meteorological and disaster risk management systems than expected, raising concerns about the likelihood that NHMSs would be able to institutionalize nowcasts at country level. There are opportunities for "low hanging fruit" improvements, such as ensuring all dissemination mechanisms are working at full potential, and ensuring the language in forecasts is accessible, but institutionalizing these changes at national level would likely require ongoing support over a longer time period.
- Related to the previous lesson, there appeared to be a mismatch between the targets for WISER EWSA, the context in which the programme was working, and the resources and strategies of the programme. The institution building needed to support many of these changes permanently and at scale likely requires more time, funding, and dedicated and persistent capacity building support than the project design allowed for.
- Impact indicators could be designed more broadly, to allow for flexibility and adaptation in programme approaches, and to ensure that the full range of benefits is captured in project reporting.
- For many outcomes, especially at the impact level, there was limited rigorous evidence, and confidence in findings was low. If higher quality estimates are desired for future programming, additional MEL resources should be considered.

Background, Programme Summary and Project Summary

About WISER

The Met Office has been commissioned by the UK Government's Foreign, Commonwealth and Development Office (FCDO) to manage the Weather and Climate Information Services (WISER) programme, leading on its design, management and coordination, and a range of technical assistance.

The Met Office is a global centre of excellence in weather and climate science, and the United Kingdom's national weather service. The Met Office is a trusted and long-term partner of the UK Government, development agencies, developing country governments, research institutions, UN bodies, academia, non-governmental organisations, and national meteorological and hydrological services (NMHS) worldwide. The Met Office works closely with the World Meteorological Organization (WMO) spanning a number of areas from governance and technical commissions to membership and representation on the Scientific Advisory Panel to WMO and the WMO Research Board. The Met Office's UK membership to WMO means that the Met Office is a trusted partner to NMHSs globally.

Since 2015, WISER has enhanced the quality, accessibility and use of weather and climate information services (WCIS) in East Africa and the Sahel through 17 projects over two phases of implementation. Working regionally, nationally and with communities, WISER has had significant impact. It has met the needs of a variety of users of WCIS from farmers and fisherfolk to journalists, government officials, the disaster risk sector, non-governmental organisations, and vital businesses such as energy providers and aviation services. In doing so, WISER has supported 3.3 million households to access enhanced WCIS, helping them to make decisions that strengthen their resilience, delivering at least £200 million of socioeconomic benefit. A third phase of WISER in Africa was launched to advance existing achievements and further innovate and expand geographically into new areas and partnerships which can continue to strengthen the development, delivery and use of WCIS across the continent. From 2022 to 2026, funded with UK aid from the British people under FCDO, WISER Africa will provide up to £15.7 million to continue its work in East and West Africa and expand into southern Africa.

The aim of WISER is to continue to strengthen the uptake and use of co-produced WCIS in decision-making from local to regional level, building resilience to the impacts of extreme weather, seasonal events and longer-term climate change. WISER aims to enhance WCIS by also putting greater focus on gender equality and inclusion, transformational change, and lesson learning both within the programme and across other FCDO Africa Regional Climate and Nature (ARCAN) programme pillars, and globally, seeking to maximise systemic effects through greater collaboration and learning.

WISER Africa is part of the ARCAN programme. Other pillars of ARCAN focus on transboundary water management, nature, energy transitions, and climate finance and policy. ARCAN's overarching aim is to increase the resilience of African economies and communities to climate change, tackle nature and biodiversity loss and catalyse energy transitions in Sub-Saharan Africa.

About WISER EWSA

Severe thunderstorms cause significant damage in southern Africa, threatening lives, damaging property, and destroying livelihoods. This is particularly the case in cities and urban areas.

Nowcasting techniques using satellite data enable weather forecasters to observe thunderstorms as they form, how intense they are and to provide **early warnings** of where they will move within the coming 2 hours. Working with urban populations, including disadvantaged groups (such as women and people with disabilities) we can help to ensure that people receive these early warnings in a timely manner (including through direct alerts to cell phones). It is vital that people know **what action to take**, to reduce the risk of negative impacts, once they have received a warning.

Complementing a growing range of weather and climate information services, nowcasting technology has recently been applied to early warning in other parts of Africa and beyond but this is the first project to do this in southern Africa.

From March 2023 – June 2025, the WISER Early Warnings for Southern Africa (EWSA) team of meteorologists, academics, economists, and user engagement specialists from South Africa, Zambia, Mozambique, the UK and Switzerland worked with disaster risk management agencies and non-governmental organisations, to engage with communities—with a focus on women and people with disabilities— **to reduce disaster risk and impact through the co-production of new weather information services and early warnings.**

Particular outputs included:

- Strengthening the capacity of national meteorological agencies in severe weather forecasting and nowcasting techniques, using current and new satellite data (Meteosat Third Generation, MTG) and working through the World Meteorological Organisation's Regional Specialised Meteorological Centre (RSMC) in southern Africa (South African Weather Service).

- Building strong links between the people who generate nowcast early warnings (National Meteorological Agencies in Mozambique-INAM, South Africa-SAWS and Zambia-ZMD) and the people who can use them, to reduce their risk (or communicate warnings to others);

- Generating user-focused early warning alerts for severe thunderstorms that are understood and can be acted upon by urban communities, including women and people with disabilities;

- Investigating business models to finance and sustain the process;

- Building on cost-benefit analysis to demonstrate the potential to scale up such an approach - to other countries in southern Africa, and to other sectors beyond cities and urban environments.

EWSA's approach is one of co-production of knowledge by all partners working collaboratively. This was be enabled through co-production processes that culminated in two **testbeds** (exercises to test the processes for issuing nowcasts) and one king-sized testbed (an extended testbed held over the rainy season in 2024/25).

The programme focused on three urban communities for the co-production process: Boane in Mozambique, Katlehong in South Africa, and Kanyama in Zambia. However, the intent was to develop nowcast procedures and co-produce the format of thunderstorm early warning alerts that could be

replicated at a national level within each country. This would be supported by developing business models for funding the required additional resources for providing these improved services.

Programme and Project Theory of Change

The WISER Programme Theory of Change

The WISER Africa programme attempts to improve the availability, access and use of WCIS that meets the decision needs of different users, from a farmer or fisher(wo)man to a policy maker. Substantial progress has been made by WISER since 2015, using co-production to enhance the quality and encourage better use of WCIS in a range of decisions across sectors and actors, predominantly in East Africa. Yet the capacity of the population in Africa to effectively anticipate, prepare for and act ahead of impacts from changes in weather and climate, and stay safe and thrive, still poses challenges in practice with more to be done. Levels of co-production and interaction and trust between WCIS providers, intermediaries and users across Africa differs. Too often lack of resources and knowledge can also inhibit the effective use and application of WCIS. Driving further improvements to better tailor WCIS to different needs and help inform the decisions users make around livelihoods, protecting lives and property, policy, plans or development investments is needed.

WISER's activities are designed to address the above needs. The WISER Africa Theory of Change (ToC) shows how the programme expects to contribute to the changes it aims to influence to do so. The ToC for WISER Africa demonstrates how WISER expects to drive better decisions that integrate co-produced WCIS, to ultimately strengthen people's resilience to the impacts of changing weather and climate across East, West and southern Africa. (The WISER ToC is summarized in Figure 1.)

In summary, WISER maintains that delivering the following five outputs:

1. Strengthened co-production between producers, intermediaries and users to improve the uptake and use of WCIS across weather to climate timescales

2. Strengthened global, regional and national networks, partnerships and coordination mechanisms to support the improved generation, uptake and use of WCIS

3. Strengthened designated producers' capacity to deliver WCIS

4. Strengthened enabling and policy environment for better delivery, use and sustainability of WCIS

5. Better evidence and learning, continually strengthening WCIS and programme decision-making

will contribute to two intermediate outcomes:

1. Greater and better access to WCIS by regional, national and community users

2. Improved awareness of the value of using WCIS in the decisions users make

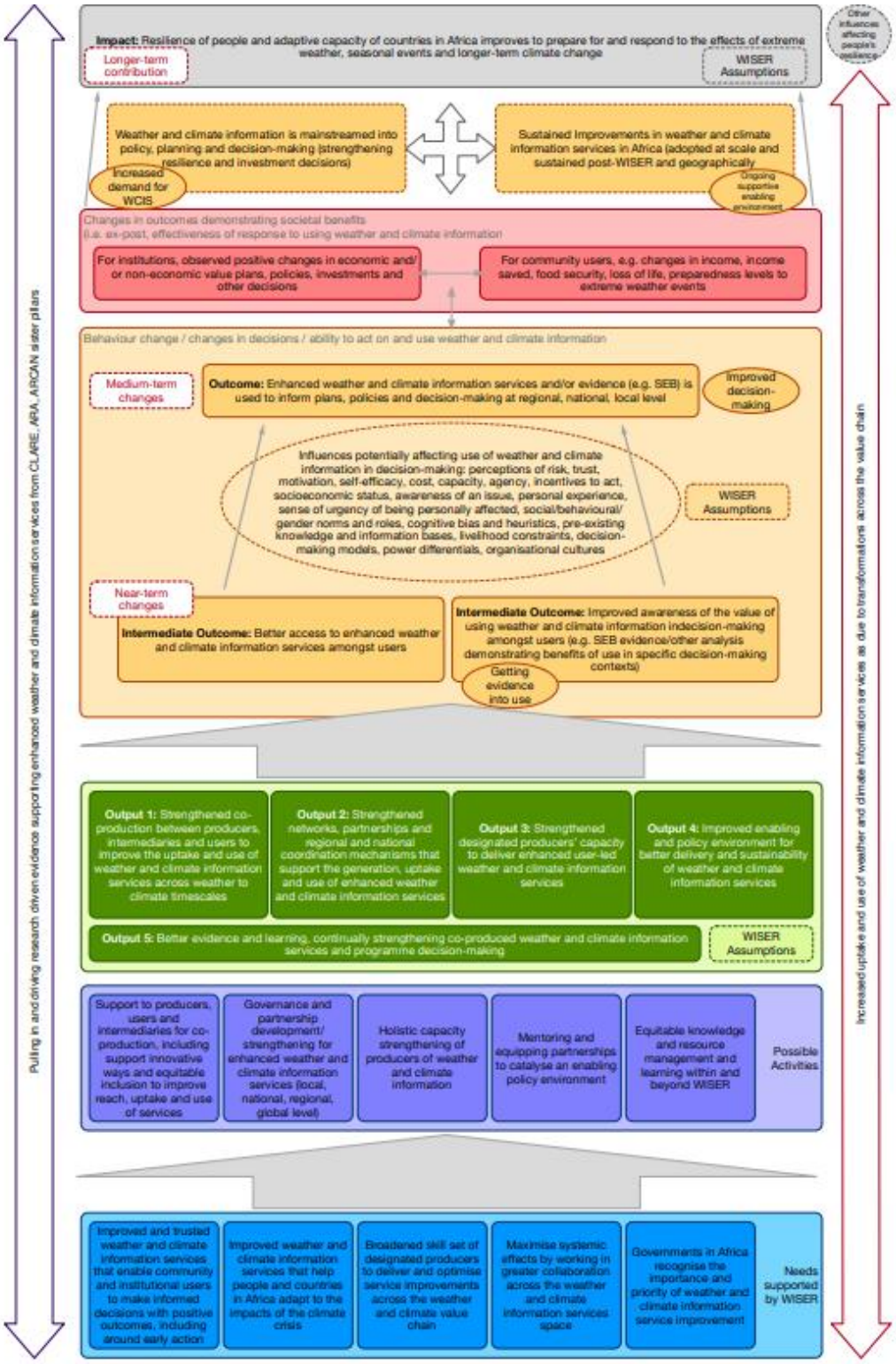
The two intermediary outcomes above will together contribute to better and more use of WCIS and related evidence or analysis, which will strengthen policy, planning, resource allocation and other

resilience or livelihood decisions by users from regional and national to community level (WISER's outcome). Alongside these anticipated changes, WISER's outputs and outcomes will also contribute to WCIS being scaled, replicated and sustained, through innovation where possible, contributing to the potential for transformation under WISER through the ways in which the uptake and use of WCIS can be further enhanced and evidence of effectiveness shared.

The initiatives or interventions which WISER supports will contribute to change at the outcome and impact level by supporting activities within one or more outputs. WISER by design aims to achieve a series of results that contribute to achieving the final intended impact by working in partnership with a range of stakeholders and organisations across the weather and climate value chain.

WISER's ToC also acknowledges that the programme is not the only initiative working on enhancing WCIS to strengthen people's resilience to weather and climate impacts. WISER Africa is located within a wider set of international, regional and national development and research actions on climate change, disaster risk management, governance and other issues. The programme therefore aims to strengthen evidence on how to keep improving the generation, use and uptake of WCIS, and feed in and pull through this learning into and from other initiatives. The aim is to foster greater collaboration and maximise impact across the WCIS space, and support understanding of what needs to be known to adapt, iterate and continually improve.

Figure 1. WISER Theory of Change



The WISER EWSA Project Theory of Change

The WISER EWSA project will contribute to WISER's objectives by addressing the need for better availability, access and use of short-term WCIS among urban populations in southern Africa, particularly disadvantaged populations such as women and people with disabilities who have typically been excluded from discussions around the generation, presentation and communication of such information.

Currently, multiple barriers prevent effective WCIS use. On the supply side, NMHS have technological and capacity barriers that constrain their ability to produce and disseminate high quality short term "nowcasts". On the demand side, potential users are not aware of what nowcasts are, and how they could use them, so they do not demand them. This is particularly the case for women and people with disabilities who are more disconnected from accessing and using WCIS and early warnings on other timescales. On a systems level, there is a lack of systems for communicating weather warnings to people, particularly given that different social groups have different needs and preferences for such communication. Altogether, these issues result in barriers to information about weather among urban communities. These barriers mean that many extreme weather events give rise to negative impacts, in terms of loss of lives, livelihoods and assets; and these negative effects are typically particularly severe for certain groups, such as women and people with disabilities.

WISER EWSA aims to address these barriers to reducing negative effects of severe weather events through activities, or Work Packages (WPs), aimed at building capacity for production, dissemination and use of severe weather nowcasts targeted to urban populations. The WISER EWSA WPs encompass all five of WISER's output areas:

- WP 1a: User engagement for coproduction (aligned with WISER output area 1)
- WP 1b: Institutionalisation (aligned with WISER output areas 2, 3 and 5)
- WP 2: Nowcast and Emergency Weather Services (EWS) production and communication (aligned with WISER output areas 1, 2, and 3)
- WP 3: Capacity building and regional governance (aligned with WISER output area 4)
- WP 4: Co-production through testbeds and operationalization (aligned with WISER output areas 1, 2, and 3)

The WISER EWSA ToC is that if these activities are carried out, and if the targeted institutions—including NMHS, DRR intermediary users, and end users—have the interest and capacity to fully participate in these activities, then this will lead to intermediate outputs including:

a) urban populations with better knowledge of how to access and use early warnings (EWs);
b) better awareness of how EWs can feed into DRR, especially among intermediary organizations;
c) the development of business models for how EWs can be produced sustainably; and
d) improved capacity to co-produce and generate EWs in 3 countries.

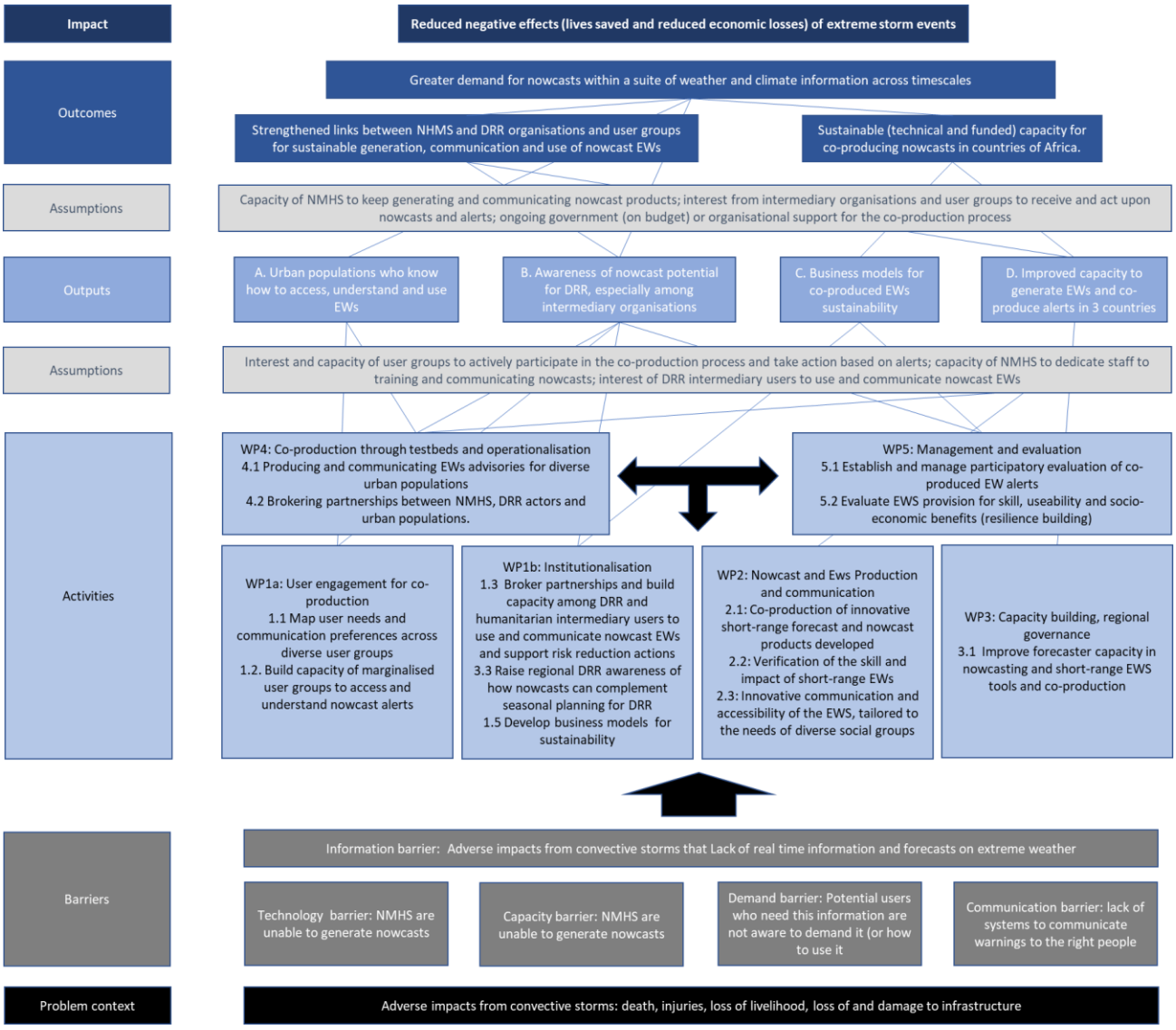
In order for these outputs to translate into sustainable outcomes, NMHS will need sufficient capacity to continue producing and disseminating inclusive nowcast products, and intermediary organizations and end users will need to have an interest in receiving them and building them into procedures and decision-making; EWSA will seek to achieve this through capacity building activities. At the level of

NMHS and DRR intermediary organizations, this will require sufficient institutional support, including budgeting, to build co-production and other nowcast development activities into organization programming. While EWSA will work with these organisations to identify and demonstrate the viability of business models to support these investments, they will also require financing outside the scope of EWSA's work. If this takes place, it is expected to lead to three key outcomes:

1) Strengthened links between NMHS, DRR organisations and end user groups for the sustainable generation, communication and use of nowcast EWs
2) Sustainable capacity for co-producing nowcasts in countries in Africa
3) Greater demand for nowcasts within a suite of weather and climate information across timescales.

These outcomes are in turn expected to address the key weather information barrier faced by urban populations, with a particular consideration to the social differentiation of this barrier, empowering them to take actions to reduce the negative effect of severe weather events on their lives, resulting in lives saved and lower economic losses from extreme storm events. For the WISER EWSA logframe, see Annex A.

Figure 2. EWSA Theory of Change



Evaluation Objectives

The final evaluation of the WISER EWSA project sought to answer the following evaluation questions:

1. What was the impact of the programme among the targeted communities in Mozambique, South Africa, and Zambia, particularly for those with disabilities?
2. Did the programme achieve its goals with respect to targets, transformational change, sustainability, and cost effectiveness?
3. What aspects of the theory of change were validated, and which require adaptation? What are the lessons learned for future projects?

Evaluation Methods

The evaluation employed mixed methods, including synthesis of evidence generated in the course of project implementation, and primary data collection using both quantitative and qualitative methods.

Review of project reporting and learning documents

Project Reporting Results

The WISER EWSA project produced two six-month reports, in October 2023 and April 2024, and one annual report, in April 2025. In addition, the project also produced a final report. These reports include updates on project implementation activities, assessments of project timeline and spending status, results for project performance indicators, and reflections on challenges, adaptations, and lessons learned. The reports were reviewed to understand the project's implementation and management, and its achievements against goals over time. Key lessons learned and evidence of impact included in the reports were reviewed and highlighted.

Stories of Change

As part of regular project reporting, and consistent with WISER Africa's standard methodology for monitoring, evaluation and learning, the WISER EWSA team collected "Stories of Change"—short narratives that illustrate changes in knowledge, behaviour, attitude or practice that cannot be easily captured in quantitative indicators. They also serve as part of the evidence base for assessing project progress towards its markers for its targeted dimensions of transformation. The Stories of Change created by the project were reviewed as part of the qualitative evidence for the programme evaluation. For each Story of Change, this evaluation identified the dimension of transformation to which it relates, and the marker of progress to which it corresponds (see Table 1). For more information on the transformation progress markers, see Annex B.

Table 1. Dimensions of Transformation and Progress Markets for WISER EWSA

	Progress Markers		
Dimension of Change	Expect to See (most immediate and within project control)	Like to See (intermediate)	Love to See (most downstream and outside project control)
Innovation	NMHS and DRR will engage in inclusive, participatory processes supported by WISER EWSA	Engagement in inclusive, participatory processes under WISER EWSA will result in innovations in how nowcasts are produced and shared	Innovations resulting from inclusive, participatory processes will address barriers to accessing and using weather information, especially for vulnerable groups NMWS and DRR will make innovations in

			the processes for developing products and services that sustainably improve inclusive participation in weather services design
Scale	Participatory processes supported by WISER EWSA will reach the targeted number of direct beneficiaries.	Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services for existing audiences for these partners.	Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services that reach and attract new, inclusive audiences for these partners.
Replicability/Sustainability	Weather information services designed to be inclusive will become more available, and urban populations in the three countries will become more aware of their existence, how to access them, and how to use them to make choices that reduce negative impact of severe weather	Targeted populations will take actions based on access to inclusive weather services that reduce the negative impact of severe weather NMHS and DRR will take steps to institutionalize provision of inclusive weather information services	Urban populations benefitting from inclusive weather information services will increase their engagement with NMHS and DRR to advocate for and support inclusive weather information services NMHS and DRR intermediaries will apply co-production and other inclusive approaches to development of other products and services, or other MNHS and DRR intermediaries will replicate approaches

SEB Analysis

As one of its project deliverables, WISER EWSA produced a Socio-Economic Benefit (SEB) Analysis (D.1.4.2). Its outputs included information on current losses related to extreme weather in the three

communities, estimates of avoided losses under different scenarios of forecast and early warning improvement, and some indicative costs associated with making these improvements. This analysis provided the basis for a business case for investing in nowcasts and other improvements in forecasting and delivery, which was presented to the NMHSs and other government ministry officials. It also provided the basis for reporting on the value of avoided losses from extreme storm events to urban populations, and value for money reporting.

Primary data collection

Key Informant Interviews

Key information interviews were conducted with the EWSA WISER staff, including those involved in both community engagement and engagement with the meteorological services in each country, to provide additional context for the evaluation, and as input for the design of the quantitative and focus group survey questionnaires. Questions included what range of impacts the staff perceived their project as having at the level of community members and weather information systems, as well as the challenges faced during implementation. The input from the key information interviews was used to ensure that the quantitative and focus group survey questionnaires collected indicators that could be used to triangulate the findings related to impact at community member level.

Quantitative Household Survey

To assess the impact of EWSA WISER activities on individuals' attitudes and behaviours related to accessing and using weather information to reduce losses caused by severe weather events, the project surveyed members of the targeted communities in Mozambique, South Africa, and Zambia. An effort was made to include women and people with disabilities. Baseline data were collected October through December 2023, while endline data were collected in May to July 2025. For the endline survey, see Annex C.

The baseline sample was selected by instructing community engagement staff to select individuals through their outreach networks, with the goal of sampling equal numbers of men and women, and oversampling people with disabilities relative to their proportion of the population. For the endline survey, the project first sought to survey those who had participated in the baseline. However, since contact information such as phone numbers were not available or collected for all individuals included in the baseline, a number of the baseline participants could not be located. To complete the endline sample, community engagement staff were instructed to replace unfound participants with individuals of the same gender and disability status, to attempt to create baseline and endline survey samples that were comparable, based on these key observable characteristics.

The quantitative survey questionnaire included questions on basic demographic information, perceptions of the frequency and impact of severe weather events, attitudes towards and perceptions of weather forecasts, and behaviours with respect to accessing, taking note of, and acting on weather information.

To assess impact of the project, two main evaluation approaches were used: 1) before-and-after comparison, in which endline results were compared to those at baseline for key indicators, and 2)

comparison between groups with different levels of engagement in the programme; for example, those who reported participated in EWSA-specific activities versus those who did not.

Focus Group Discussions

To collect further information about the costs and benefits of accessing and using weather information, and the barriers to doing so, the project also conducted five focus group interviews with men and women in the targeted communities—two in Zambia, and in Mozambique. The focus groups were intended to be targeted to community members; however, the Mozambique focus group discussions were attended by community mobilizers and media representatives, and one group appeared to consist of employees of the district local government. No focus group discussions were conducted in South Africa, due to the short timeline for data collection and limited staff capacity in that location. The focus group discussions included questions about the costs associated with taking actions to reduce the impact of severe weather events, and the benefits of those actions. For the focus group discussion protocol, see Annex D.

Focus group data were analysed by coding the feedback according to a limited number of simple categories, including the impact of weather events in communities and particularly for those with disabilities, actions they take to reduce the impact of weather events and the costs and benefits of these actions, and feedback on weather information services. Within the latter category, negative feedback, positive feedback, and suggestions for improvements were identified. Within each category, key themes were identified.

Results

Review of project reporting and learning documents

Project Reporting Results

Project Process

The project reporting shows that WISER EWSA generally remained on track in terms of its activities and outputs over the life of the project.

The project experienced typical delays around contracting and finance in its first reporting period but was able to remain on pace and deliver its first nowcast testbed on time, and before its second six-month report. A cybersecurity breach at one of its national meteorological services partners was the major unanticipated challenge during the project in early 2025, which disrupted activities, but ultimately did not prevent the project from delivering its intended outputs. Other challenges included early challenges with attendance leading to switching to more in-person approaches, the need to adjust budget after the inclusion of a new partner, and the need to work around political unrest in Mozambique.

The project reporting documented a highly iterative process for many of the project work streams, particularly those related to NMHS capacity building, and inclusive community engagement. In the case of NMHS capacity building, nowcasting was confirmed as a capacity gap in the first reporting period, as

engagement with the NMHSs took place. The project reporting shows a process of conducting trainings and testbeds and learning from experiences to design subsequent activities. For example, learning from the first testbed (2024) identified the need for longer engagement over the span of the rainy season to support nowcast generation for storm events; this led to the design and implementation of the "king sized" testbed for the entire length of the rainy season from 2024/25. In the area of community engagement, reporting shows adaptations in the intermediaries and institutions that the project leveraged to reach communities, and improvements in how the project managed logistics to make activities more inclusive, such as renting a ramp and/or accessible toilets at activity venues to ensure people with disabilities could participate.

Results

WISER EWSA achieved or exceeded nearly all of its output and immediate outcome targets (see Annex A). The project supported 68 organizations and institutions to achieve improved access to weather and climate information, against a target of 40. It engaged 1094 individuals from producer, intermediary and user organizations in trainings that were overwhelmingly rated as useful, against a target of 270, and engaged 795 people in co-production processes, also against a target of 270. The project also worked to improve weather systems through twice as many forums and mechanisms as targeted and produced 16 evidence products against a target of six. The only output target that it did not achieve was the number of Regional Climate Centres (RCCs) and NMHSs with improved ability to generate and deliver enhanced weather and climate information; the target was 6, but only the three NMHSs of Mozambique, South Africa and Zambia were successfully supported. Overall, these results show that the project was effective at implementing activities, delivering outputs, and achieving outcomes largely within project control.

The project's first two impact indicators are: Number of people with improved ability to avoid or reduce damage caused by extreme weather conditions through access to co-produce nowcast alerts, reported for Direct Beneficiaries, and Indirect Beneficiaries. Results for these indicators are summarized in Table 2.

The project reported 795 individuals participating in co-production processes, representing direct beneficiaries. These individuals had direct access to nowcasts, and results from the user surveys, focus groups, key informant interviews, and Stories of Change provide strong evidence that direct participants in project activities perceived improvements in their ability to access, understand, and use weather information.

The project reported reaching an estimated 5.4 million indirect beneficiaries, against a target of 5 million. Of this, nearly 400,000 people were estimated to have accessed nowcasts in the three target communities. This was estimated by extrapolating the share of user survey respondents did not participate in WISER EWSA specific activities that reported accessing nowcasts to the population of each of the three targeted communities. An additional 25,000 individuals were estimated to have benefitted from nowcast information received through social network connections. This estimate was based on the ratio of the number of people in the user survey who reported receiving information through social networks, but not through direct means such as radio, television, or social media to the number of people who reported receiving weather information through direct means. The accuracy of this estimate depends on the degree to which the user survey sample is representative of the community as a whole;

although the estimate is based on results only for those who did not report participating in WISER EWSA specific activities, the sampling was not designed to be population representative for the three communities.

An additional 4.5 million individuals were reported to have received improved early warning forecasts via radio and television media disseminated in South Africa, based on estimates from SAWS. SAWS documented improvements in the forecasting attributable to WISER EWSA including issuing impact-based warnings followed by updates, rather than the previous practice of issuing a single warning and introducing the use of satellite data resources to complement radar data and offset some of its weaknesses. However, it should be noted that SAWS confirmed that it was not yet issuing nowcasts through these mechanisms, though it plans to begin testing new nowcast standard operating procedures (SOPs). The estimates are based on SAWS' estimated listenership and assume that these numbers reflect specific listenership for the improved weather forecasts, rather than general listenership, and that listeners generally pay attention to, and understand, the forecasts. An additional 400,000 people were estimated to have benefitted from improved early warning forecast information through social network connections, based on the same assumptions as for the community social network spillover estimates. It is important to note that due to limited data availability, including limited documentation of forecast and early warning dissemination by various media channels, and lack of user survey data outside of the three target communities, there is a high degree of uncertainty around the estimates related to SAWS reach. As these numbers represent the majority of the total results, the degree to which the project met its target for this indicator is highly sensitive to the reliability of the SAWS estimate, and whether the improvements in forecasts and early warnings described by SAWS can be legitimately counted towards the target for access to nowcast alerts.

The third impact indicator was the value of avoided losses from extreme storm events to urban populations. This value was estimated based on the results of the SEB Analysis, and project results for documented reach. (For more information see SEB Analysis, below). First, the average annual impact per individual reached was estimated using the SEB results for annual avoided losses, the SEB assumptions regarding reach, and country population data. SEB Estimates of avoided losses for Scenario 1 were used, which represents the lowest level of implementation by the NMHSs. Because Scenario 1 includes some additional actions by the NMHSs that have not been documented to date, including investment in additional staffing, the low-end estimate for avoided losses is used for all scenarios and locations. For the targeted communities, in Zambia and Mozambique, increased responsiveness is assumed, on the basis of the targeted engagement carried out there and increased access, understanding and use of forecasts reported in the user surveys. For national level results, no increased responsiveness is assumed. For South Africa, no estimate for increased responsiveness under Scenario 1 was produced for South Africa, so no separate estimated including improved responsiveness is included for Katlehong. Results for average impact per person reached are reported in Table 3.

Table 2. Results for Number of people (disaggregated by gender, age and disability) with improved ability to avoid or reduce damage caused by extreme weather conditions through access to co-produce nowcast alerts

Number of people with improved ability to avoid or reduce damage caused by extreme weather conditions through access to co-produce nowcast alerts		**Of which, estimated women**	**Of which, estimated with disability**
TOTAL	**5,351,168**	**2,729,327**	**440,639**
Direct beneficiaries	**795**	**381**	**95**
Indirect beneficiaries	**5,350,373**	**2,728,946**	**440,544**
People Reached with Nowcasts, 3 Target Communities	396,599	197,873	46,937
Boane	*79,308*	*40,844*	*4,600*
Kanyama	*172,895*	*86,275*	*13,313*
Katlehong	*144,396*	*70,754*	*29,024*
People Benefitting through Social Networks, 3 Target Communities	25,315	12,630	2,997
Boane	*5,062*	*2,607*	*294*
Kanyama	*11,036*	*5,507*	*850*
Katlehong	*9,217*	*4,516*	*1,853*
People Reached with Nowcasts, National via Radio, Excluding 3 Target Communities	4,523,904	2,311,715	359,459
Mozambique			
Zambia		-	-
South Africa	*4,523,904*	*2,311,715*	*359,459*
People Benefitting through Social Networks, National, Excluding 3 Target Communities	404,555	206,738	31,151
Mozambique	-	-	-
Zambia	-	-	-
South Africa	*404,555*	*206,728*	*31,151*

The total avoided losses are then calculated by multiplying the average avoided loss estimate by the number of people the project was documented as reaching. Avoided losses are calculated for 1.5 years, representing the period from which nowcasting began in January 2024. Disaggregated results for women and people with disabilities are estimated based on their share of the population. There is reason to believe that people with disabilities may benefit more from improved weather and alert services—results from the focus groups suggest that people with disabilities may bear a disproportionate amount of the costs of severe weather events, and could benefit most from making the services more accessible—but there was not sufficient quantitative data to estimate their comparative benefit.

Overall, estimated avoided losses for the project to date are around £1,000,000, of which around 70% are estimated to be urban. This was against a target of £10 million. However, the assumptions in this

estimate are fairly conservative, and include only avoided losses to date for documented reach, while much of the project impact is expected to accrue in coming years, and through potential replication of innovations within the larger national weather information services systems. The estimated avoided losses are also highly dependent on a number of assumptions, due to lack of data needed to produce a full, robust SEB Analysis using weather value chain analysis approaches. The results are particularly sensitive to assumptions for South Africa, which represents a large share of the avoided losses—and which had the most data challenges, including lack of data on the full range of different types of losses, resulting in reliance primarily on estimated avoided losses related to reduced traffic accidents. It should also be noted, as discussed in the SEB Analysis results section and in the deliverable itself, that the costs included in the SEB do not represent the full range of reduced losses or other benefits from improved access to high quality forecasts. For example, benefits like improved comfort and convenience from being able to plan for weather, are not included due to the difficulty in putting a value on them.

Table 3. Annual Avoided Losses and Annual Avoided Losses Per Person, Calculated from SEB

Annual Avoided Losses, GBP							
	High/Low Estimate	Zambia		Mozambique		South Africa (cell, radio and TV)	
		Urban	Rural	Urban	Rural	Urban	Rural
Scenario 1 - Cell phone and Radio, Low Responsiveness	Low	£151,484	£203,057	£81,229	£116,390	£5,626,223	£2,713,988
	High	£178,381	£239,110	£95,652	£137,055	£7,171,375	£3,459,341
Scenario 1 - Cell phone and Radio, High Responsiveness	Low	£236,166	£316,568	£126,638	£181,453	not calculated in SEB	not calculated in SEB
	High	£278,098	£372,777	£149,123	£213,671	not calculated in SEB	not calculated in SEB

Annual Avoided Losses Per Person Reached, GBP							
	High/Low Estimate	Zambia		Mozambique		South Africa (cell, radio and TV)	
		Urban	Rural	Urban	Rural	Urban	Rural
Scenario 1 - Cell phone and Radio, Low Responsiveness	Low	£0.018	£0.024	£0.007	£0.020	£0.133	£0.148
	High	£0.021	£0.028	£0.008	£0.024	£0.169	£0.188
Scenario 1 - Cell phone and Radio, High Responsiveness	Low	£0.028	£0.037	£0.011	£0.032	not calculated in SEB	not calculated in SEB
	High	£0.033	£0.044	£0.013	£0.037	not calculated in SEB	not calculated in SEB

Table 4. Results for Project avoided losses (disaggregated by gender, age and disability) under Scenario 1

SEB Avoided Loss Estimate Category	**Annual Avoided Losses Per Person Reached**	**Total Avoided Losses, 1.5 years**	**Of which, estimated women**	**Of which, estimated with disability**

TOTAL			£1,055,219	£538,487	£87,313
Direct beneficiaries			£41	£20	£5
Boane	Urban, High Responsiveness, Low Estimate	£0.01	£6		
Kanyama	Urban, High Responsiveness, Low Estimate	£0.03	£13		
Katlehong	Urban, Low Estimate (Only 1 responsiveness rate calculated)	£0.13	£22		
People Reached with Nowcasts, 3 Target Communities			£37,265	£18,357	£6,412
Boane	Urban, High Responsiveness, Low Estimate	£0.01	£1,307	£673	£76
Kanyama	Urban, High Responsiveness, Low Estimate	£0.03	£7,193	£3,589	£554
Katlehong	Urban, Low Estimate (Only 1 responsiveness rate calculated)	£0.13	£28,766	£14,095	£5,782
People Benefitting through Social Networks, 3 Target Communities			£2,379	£1,172	£409
Boane	Urban, High Responsiveness, Low Estimate	£0.01	£83	£43	£5
Kanyama	Urban, High Responsiveness, Low Estimate	£0.03	£459	£229	£35
Katlehong	Urban, Low Estimate (Only 1 responsiveness rate calculated)	£0.13	£1,836	£900	£369
People Reached with Nowcasts, National via Radio, Excluding 3 Target Communities			£932,173	£476,341	£74,068
Mozambique	Weighted Average Urban and Rural, Low Responsiveness, Low Estimate	£0.02	£0	£0	£0
Zambia	Weighted Average Urban and Rural, Low Responsiveness, Low Estimate	£0.02	£0	£0	£0
South Africa	Weighted Average Urban and Rural, Low Estimate (Only 1 responsiveness rate calculated)	£0.14	£932,173	£476,341	£74,068
People Benefitting through Social Networks, 3 Target Communities			£83,361	£42,597	£6,419
Mozambique	Weighted Average Urban and Rural, Low Responsiveness, Low Estimate	£0.02	£0	£0	£0
Zambia	Weighted Average Urban and Rural, Low Responsiveness, Low Estimate	£0.02	£0	£0	£0
South Africa	Weighted Average Urban and Rural, Low Estimate (Only 1 responsiveness rate calculated)	£0.14	£83,361	£42,597	£6,419
Of Which, Urban			£743,450		
Of Which, Rural			£311,769		

Evidence of Impact

The April 2025 Annual Report included a number of examples illustrating some of the impact of the programme. In the area of innovations within the NMHSs, the Annual Report states: "The integration of

nowcasting procedures at NMHS's operationally, requires an investment in resources (human as well as infrastructure), but for the most basic enhanced nowcasting services these resources can be met from existing commitments." The Annual Report quotes Pedro Joao Mutumane, Forecaster at the Mozambican National Institute of Meteorology (INAM), "We get the knowledge about the Common Alerting Protocol (CAP), about the nowcasting; it is very important, it is increasing our capacity. We continue to make nowcasting in Mozambique and we want to extend into other provinces." Examples of changes that have occurred, or that are expected to occur with no further support, cited in the report include:

- Changes in the workflow, structures of the forecasting operations to accommodate nowcasting and early warnings have taken place.
- Standard Operating Procedures (SOP) and instructions for early warning using nowcasting have been produced.
- Materials such as Frequently Asked Questions documents have been provided for each NMHS's resource bank. This included illustrative icons to make advisory information more visual and accessible; INAM has already started to use these icons in its nowcasts.
- INAM (Mozambique) will continue to deliver short-range forecasting and nowcasting in WhatsApp messages and voice messages for Boane. After normal office hours, INAM will transmit these messages from the airport forecast office which is staffed 24-hours, therefore no additional staff costs will be needed.
- SAWS (South Africa) will continue WhatsApp short-range and nowcasting messages to the project-partnering community in Katlehong. Additional plans are in hand to collaborate with the insurance industry to roll out WISER-EWSA's short-range and nowcasting EWS to more urban areas.
- An increase in Common Alerting Protocol messages from SADC countries on global monitoring platforms has been observed.

In addition, the three NMHSs are seeking funding to build on the WISER EWSA approach. The three NMS are collectively writing a proposal to be submitted to international programmes to expand and extend the work of WISER-EWSA to new geographic regions, and to new sectors including agriculture and the marine sector. A proposed "SAFE-SA" project with UK Met Office has been written, with the aim of expanding on the communication aspects of WISER-EWSA's progress, including 3 new rural areas.

The examples in the Annual Report also highlight the role of community mobilization in sharing weather information. Peggy Thole, Senior Meteorologist and Forecaster at Zambia Meteorological Department, is quoted: "We have community observers who have been trained. So even when I send a meteorological information, I know that somebody will be able to interpret that correctly and give it to the communities."

In the area of collaboration with intermediary organizations, the report describes several impacts with good potential for sustainability, including engagement with the local non-profit organization Wings of Change, which supports the elderly in South Africa. The organization adopted the EWSA community observers and established a sub-group focused on weather, climate, and environmental issues in Ekurhuleni. In Mozambique, the integration of community members into INGD (Instituto Nacional de

Gestão e Redução do Risco de Desastres) was a highlight as this ensures that local knowledge and community participation are embedded within national disaster risk reduction strategies beyond the lifespan of WISER EWSA.

Finally, the report documents quotes from community members participating in programme activities, describing the impact it has had for them and their neighbors. Changes they describe including increased interest in forecasts, greater trust and understanding of them, and increased use of weather information, mostly to make decisions about what activities to do each day, including livelihood activities. Three illustrative quotations are listed below:

"I have learnt more and I am able to give that information which I've learned to vulnerable people who cannot afford to have that information. It has even changed the lives of some people, they are able to prepare themselves before the rain starts, they're able to protect themselves, … and they are able to maintain their houses." Female, Kanyama, community observer and now member of the SDMC.

"My mother is a business lady who sells maize. I look at the forecast and I sometimes tell her 'don't go to the market today, don't go for business because it's going to rain' and then it rains and she says, 'thank you for letting me know'" (female)

"I have a neighbour who had a stroke, so when I receive a weather update, I'll go first to tell her. Now she likes to ask me a lot how the weather is going to be, and to receive information on what will happen. She asks what will happen at certain times when she is planning to go somewhere, to know if it is likely to rain or not" (female)

Lessons Learned

Project reporting also documented lesson learned. While many of these concerned operational details, many also have potential applicability for future programme design and implementation. Two lessons learned are described below.

The first is was how to structure engagement and training of NMHS and other government bodies to promote active participation. The project documented the challenge of involving busy government officials: *"though engagement with intermediary organisations was positive and widespread interest was shown in WISER EWSA's aims, everyone is busy and this was shown when, for example, we failed to have local DMMU representation in Zambia meetings*". This lesson emphasizes the need to design engagements to be considerate of partner time, and design engagement strategies that take into account the risk of no-shows at some events.

Another lesson that was mentioned in feedback in project reporting was the need to address all elements of systems for creating and sharing weather alerts, and the gap that resulted from mixed results with respect to DRR partners: *"DRR agencies are not consortium partners in WISER EWSA. They have been involved to varying degrees across all three countries, for example through partnering in awareness raising and events (South Africa with Ekurhuleni Disaster Management, Mozambique with INGD at local level, and in Zambia through the integration of community observers in SDMCs, and training of those SDMCs). However, at community level as awareness of weather information grows, so*

does realisation of the need for effective DRR to reduce risk. If future projects want to build effective early warning systems, the four pillars of EWS need to be addressed."

Stories of Change

Stories of Change are documented by the project to illustrate examples of changes supported by the project. They provide important qualitative evidence for the mechanisms through which impact is being achieved, and the degree of transformation that can be seen due to these changes. This includes evidence of whether the project is achieving its markers of success for different targeted dimensions of transformational change. For each dimension, markers are defined for "Expect to see" (most proximate and easily achieved), "Like to See", and "Love to See" (farthest down the results chain and most outside project control).

Over the course of WISER EWSA, the project reported on six Stories of Change, covering all three countries, and different aspects of weather information systems. The six Stories of Change are summarized below, along with an assessment of the marker of success that the story illustrates for each dimension of transformation targeted by the project.

Title	Date	Summary	Dimension of Change (Innovation, Scale and Replicability/Sustainability) and Marker
Inclusion of People with Disabilities in DRR Committees in Mozambique	April 2024	Before the project, 20 local disaster management committees existed in Boane but none had representation of people with disabilities. As a result of relationship brokered through involvement in the co-production process, people with disabilities are being recognised as active agents of disaster risk reduction and are being actively integrated into the committee composition of local disaster management committees in Boane in Mozambique, whose committees are now increasing in size from 18 to 20 or 21 persons (with 2 or 3 people with disabilities)	Innovation - Expect to see: NMHS and DRR will engage in inclusive, participatory processes supported by WISER EWSA Scale - Expect to see: Participatory processes supported by WISER EWSA will reach the targeted number of direct beneficiaries.
Increased Interest in, and Demand for, Weather Information	March 2025	Increased demand for weather information has been created in Kanyama, enabled by a sustained co-production process with selected community members who have begun to trust weather information themselves, and then actively acted as ambassadors for the information by sharing in their broader	Innovation - Love to see: Innovations resulting from inclusive, participatory processes will address barriers to accessing and using weather information, especially for vulnerable groups Scale - Love to see: Process and capacity improvements supported by WISER EWSA at NMWS and

		community. Community members are now actively seeking out weather information, indicating they are interested in and using such information to inform their activities and reduce risk. "People are now interested. They want to learn more. They want to know more…So even as we went on doing our work, it has become more interesting because of how people are interested to hear the information. In the beginning it was very difficult for those people to even entertain you, telling them about weather…it was very difficult because people did not believe in it, and did not believe there were true and accurate forecasts of weather, and they gave examples of how often it was wrong. But now they're more willing to listen. Every day when they seeing you wearing a WISER t shirt they come and ask, and want to be added to the WhatsApp group"	DRRs will result in improved products and services that reach and attract new, inclusive audiences for these partners. Sustainability and Replicability - <u>Expect to see:</u> Weather information services designed to be inclusive will become more available, and urban populations in the three countries will become more aware of their existence, how to access them, and how to use them to make choices that reduce negative impact of severe weather
Brokering Links Between the Pequenos Libombos Dam Managers and Community Mobilisers to Provide a Communication Channel for Early Warning of Rapid Dam Discharges in Mozambique	May 2025	As a result of connections brokered between the ARA-Sul dam managers at Pequenos Libombos dam and community mobilisers in Boane, daily information on dam levels is now shared on the WhatsApp weather group, which can also be used to provide early warning of rapid dam discharges for community mobilisers to circulate the message within their communities to enable people to take risk reduction measures	Innovation - <u>Like to see:</u> Engagement in inclusive, participatory processes under WISER EWSA will result in innovations in how nowcasts are produced and shared Scale - <u>Like to see:</u> Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services for existing audiences for these partners. Sustainability and Replicability - <u>Love to see:</u> Urban populations benefitting from inclusive weather information services will increase their engagement with NMHS and DRR to advocate for and support inclusive weather information services, NMHS and DRR intermediaries will apply co-production and other inclusive approaches to development of other products and

			services, or other MNHS and DRR intermediaries will replicate approaches
Individual Empowerment of Community Members	June 2025	As a result of their role in the project through the co-production process, community members who played the role of community observers and then mobilisers reported a sense of individual empowerment as a result of the skills and knowledge gained through the project. By sharing weather information they became reference points within their community, taking on greater stature, and reported a sense of individual empowerment as a result of this. "So she's saying people before did not mind more about weather information, maybe because they did not have access, but now they know that she has access because she's a mobiliser, so many of them come and ask how the weather will be like. And she explains to them, so she said she's becoming a reference in her area".	Innovation - Love to see: Innovations resulting from inclusive, participatory processes will address barriers to accessing and using weather information, especially for vulnerable groups Scale - Love to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services that reach and attract new, inclusive audiences for these partners. Replicability/Sustainability - Expect to see: Weather information services designed to be inclusive will become more available, and urban populations in the three countries will become more aware of their existence, how to access them, and how to use them to make choices that reduce negative impact of severe weather
Improved Forecast Communication in Zambia		Barriers to communication and use of a limited number of media was impeding the effectiveness of ZMD's dissemination of forecast information. With support from WISER EWSA, ZMD has activated a new Facebook page reaching 1600 followers and systematized its WhatsApp groups, which reach over 3800 people, and plans to further improve communication and accessibility.	Innovation - Like to see: Engagement in inclusive, participatory processes under WISER EWSA will result in innovations in how nowcasts are produced and shared Scale - Like to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services for existing audiences for these partners.
Improved Forecast Quality in Zambia		Greater capacity of Zambian forecasters to use a wider variety of forecast tools has led to an improvement in the accuracy and quality of short-term forecasts that are issued on a daily basis. 16 forecasters participated in the 2024 testbed and gained operational experience generating and issuing nowcasts, using additional	Innovation - Like to see: Engagement in inclusive, participatory processes under WISER EWSA will result in innovations in how nowcasts are produced and shared Scale - Like to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved

	forecasting tools that they formerly did not use (e.g. NFLICS, NWC-SAF and AGADUC) or did not regularly use (RSMC website, EUmetsat). These products are now routinely used to generate the daily forecasts.	products and services for existing audiences for these partners

Overall, the Stories of Change provide illustrations of how the programme has created transformation across the dimensions of innovation, scale and sustainability/replicability, with at least one example of achieving "Love to see" outcomes for each dimension—representing the most downstream and aspirational change for project transformation. This provides evidence showing proof of concept for the project's theory of change for transformation. However, the "Stories of Change" alone do not provide an indication of the prevalence of this transformation across locations and actors.

SEB Analysis

At the time of finalizing the evaluation, only a preliminary draft of the SEB analysis was available. The analysis included estimates of annual avoided losses for several different sets of assumptions:

1. Three different scenarios representing different levels of implementation by the NMHSs, ranging from mainly "no and low cost" changes under Scenario 1, to more substantial investments in forecast quality under Scenario 2, to extensive investments boosting quality and improving advance warning time by a few hours in Scenario 3.
2. Two different assumptions about responsiveness from users, one in which responsiveness rates are unchanged from pre-project levels, and one in which community engagement and quality improvements result in improved responsiveness, meaning those who hear nowcasts and forecasts are more likely to act on them.
3. Two different locations are considered: urban and rural.
4. For each country, location, scenario, and responsiveness level, low (more pessimistic) and high (more optimistic) estimates were produced.
5. For South Africa, scenarios of dissemination of forecasts by cell phone and internet only, and forecasts by cell phone, internet, radio and TV were produced.

It is worth noting that for several of the implementation assumptions even for Scenario 1, there is little evidence from sources such as key informant interviews or Storied of Change to indicate this implementation has already happened at the national level, such as new agreements with media channels. One key assumption—that the NMHS would be able to provide 24 hour staffing during severe weather events to support nowcast production—was specifically mentioned by a key informant interviewer as something they do not see currently happening, and that poses a significant constraint to sustainable nowcast implementation. As a result, Scenario 1 is most likely to be the most applicable for estimating avoided losses to date (and may be overoptimistic regarding implementation).

The analysis models avoided losses related to injury and death, residential asset damage, traffic accidents, livelihood interruptions, and crop storage losses. All of these avoidable loss categories have empirical backing from the project user survey and focus group discussions, which documented people giving examples of actions they could take to reduce losses in these areas if they have good weather information. However, the SEB analysis was not able to put valuation on some potential benefits of better weather forecasts and alerts, particularly mundane benefits such as comfort and convenience, which were mentioned by many respondents. Though small at the individual level, these benefits are likely to apply to many people on a frequent basis, and could be significant in aggregate, but are highly difficult to value. As a result, the estimates should likely be viewed as a conservative estimate of value created assuming each of the scenarios holds. For South Africa, due to lack of data, avoidable losses could only be estimated for traffic accidents and "other". In addition, increased responsiveness was assumed only for Scenario 3, the high implementation scenario, as the primary channel for increasing responsiveness in South Africa was theorized to be improved forecast quality.

It is worth noting that for several of the implementation assumptions even for Scenario 1, there is little evidence from sources such as key informant interviews or Storied of Change to indicate this implementation has already happened at the national level, such as new agreements with media channels. One key assumption—that the NMHS would be able to provide24 hour staffing during severe weather events to support nowcast production—was specifically mentioned by a key informant interviewer as something they do not see currently happening, and that poses a significant constraint to sustainable nowcast implementation. As a result, Scenario 1 is most likely to be the most applicable for estimating avoided losses to date (and may be overoptimistic regarding implementation).

Figure 3. Annual Avoided Losses Estimates for Zambia, Scenario 1, by Urban and Rural, Existing and Improved Responsiveness, and Low and High Assumptions

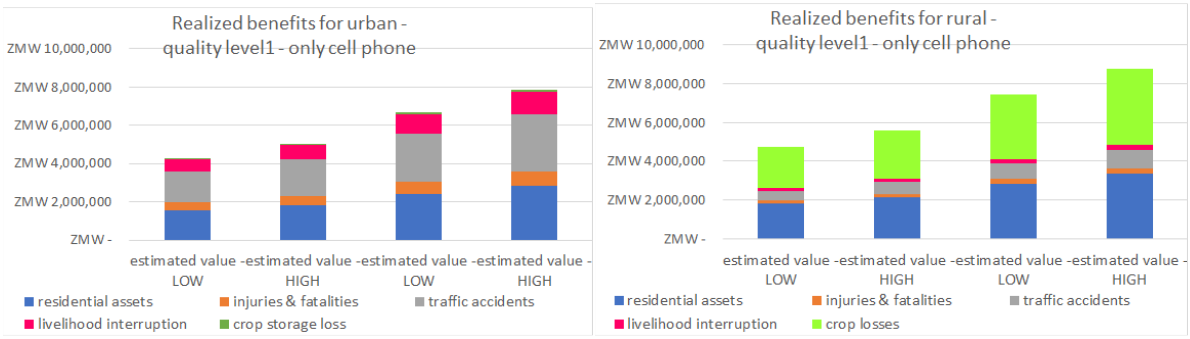


Figure 4. Annual Avoided Losses Estimates for Mozambique, Scenario 1, by Urban and Rural, Existing and Improved Responsiveness, and Low and High Assumptions

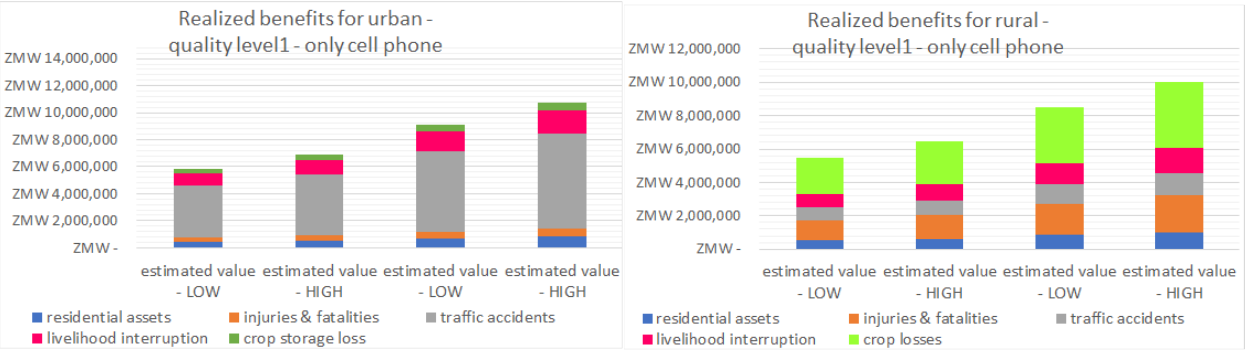
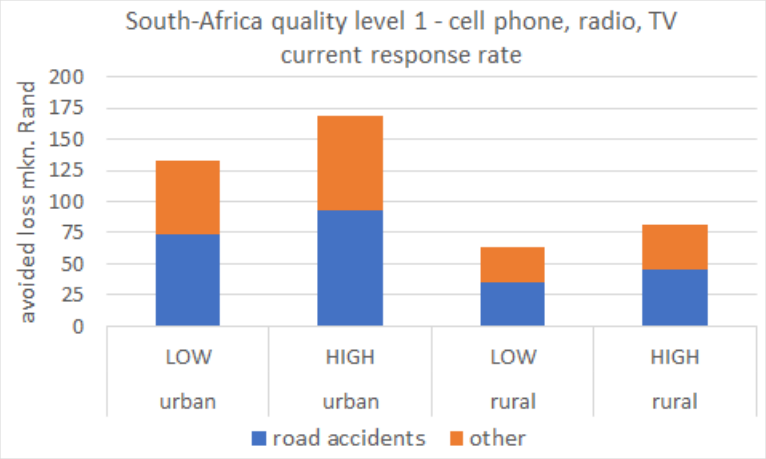


Figure 5. Annual Avoided Losses Estimates for South Africa, Scenario 1, by Urban and Rural, and Low and High Assumptions



The SEB also included illustrative examples of potential costs of implementing each of the three scenarios. For example, illustrative costs for Zambia are about £11,000 per year for Scenario 1, £32,000 per year for Scenario 2, and £54,000 per year for Scenario 3. The analysis then assesses whether the estimated avoidable losses are sufficient to justify these costs. The analysis sets a threshold of a benefit-to-cost ratio of 10, meaning that costs should not exceed 10% of the estimated value of the benefits. Costs and benefits are assumed to have roughly the same profile over time, so no discounting is applied. This threshold provides a guide for the justifiable level of cost given different assumptions about the value of avoided losses. For example, the value of avoidable losses for Zambia ranges from about £280,000 to £540,000 for Scenario 1. This implies justified investment of £28,000 to £54,000 a year, well above the illustrative cost estimate. The results for Zambia suggest that investments in any of the three scenarios are likely to yield a good return on investment. For Mozambique, a similar exercise is completed; however, while the benefit-cost ratio is favourable for lower cost investments as in Scenario

1, for more intensive investment, the ratio falls below 10, suggesting that it is not the best use of public resources. Due to lack of data, this analysis is not completed for South Africa.

The SEB analysis concludes that the favourable findings with respect to return on investment from improved forecasts and early warnings provide a strong incentive for the three country governments to allocate additional resources to NMHSs to achieve these improvements. They also suggest that the £2 million budget for the WISER EWSA project has the potential to be good value for money. However, the SEB analysis also acknowledges the high degree of uncertainty in the estimates, largely due to the large amount of detailed data required to estimate costs and benefits using a weather service chain analysis approach.

Primary data collection

Quantitative Household Survey

Survey Sample and Comparability of Baseline and Endline Samples

The quantitative survey included data for 317 baseline survey participants, and 325 endline survey participants, divided roughly evenly between the three project countries (Table 5).

Table 5. Quantitative Survey Sample Summary

	Mozambique	South Africa	Zambia
Baseline	100	117	100
Endline	98	111	116

To attempt to create comparable endline and baseline survey samples, project staff were instructed to re-survey baseline participants when possible, and when baseline participants could not be found, replace them with new respondents of the same gender and disability status (Table 6, Table 7). This approach was successfully carried out in Mozambique and Zambia, resulting in baseline and endline samples with a similar share of women and individuals with disabilities. However, it was less successful in South Africa, resulting in differences in these key demographic factors that were statistically significant at the 95 percent confidence level. In addition, while the sample selection targeted endline and baseline samples balanced on these two traits, there are a number of other ways the groups may have differed systematically, only some of which (like age) were measured. This suggests that where differences between baseline and endline results are observed—especially for South Africa—it may be difficult to determine whether this is due to project impact, or differences in the sample. This weakness in the methodology will be addressed by triangulated using comparisons between groups with different levels of participation, and evidence from the focus group discussions and key informant interviews.

Another key attribute of the samples is that the samples included large numbers of people who were targeted as participants in different aspects of WISER EWSA community work, including participation in

trainings, testbeds, and as community mobilizers. This—especially when combined with the fact that surveys were carried out by programme implementation staff—creates a risk of responses influenced by social desirability bias—respondents may have been inclined to give the answers they believe the surveyors wanted to hear. This should be kept in mind as a potential factor for all user survey results.

Table 6. T-Test Results for Percent of Sample Reporting Having a Disability, Endline versus Baseline

Percent of Sample with Any Disability			
	Baseline	Endline	
Mozambique	48%	55%	
South Africa	13%	30%	*
Zambia	34%	30%	

* indicates significant difference at 95% confidence level, based on t-test

Table 7. T-Test Results for Percent of Sample that is Female, Endline versus Baseline

Percent Female			
	Baseline	Endline	
Mozambique	59%	61%	
South Africa	58%	45%	*
Zambia	67%	64%	

* indicates significant difference at 95% confidence level, based on t-test

The survey also collected data on what age group the respondent fell into. For Zambia and South Africa, the share of people 50 or older was comparable between baseline and endline, but for Mozambique, the endline sample included a larger number of older people, underscoring the potential for bias when comparing baseline and endline results (Table 8).

Table 8. T-Test Results for Percent of Sample that Over 50 Years Old, Endline versus Baseline

Percent Over 50 Years Old			
	Baseline	Endline	
Mozambique	23%	45%	*
South Africa	21%	17%	
Zambia	29%	36%	

* indicates significant difference at 95% confidence level, based on t-test

The survey also collected information on access to cell phones, and to smart phones (Table 9). Cell phone access was generally high, and there were no significant differences in access rates between the baseline and endline survey. Access to a smartphone was significantly higher for the Mozambique

sample in the endline compared with the baseline, potentially reflecting growing access to smart phones.

Table 9. Cellphone Access, by Country and Baseline/Endline

Cell Access					
	Any Cellphone Access		Smartphone Access		
	Baseline	Endline	Baseline	Endline	
Mozambique	84%	81%	17%	41%	*
South Africa	97%	99%	84%	80%	
Zambia	94%	91%	57%	61%	

* indicates significant difference at 95% confidence level, based on t-test

Attitudes towards and Understanding of Weather Forecasts

The endline survey included questions aimed at understanding attitudes towards and perceptions of weather forecasts, including trust in forecasts, and their perceived clarity and usefulness. For each question, respondents were presented with a statement, and asked to rank their agreement with the statement on a 5-category Likert scale. The summary results are presented in Figure 6- Figure 10.

The survey also used a vignette to test a theorized link between understanding of weather forecasts as providing information on risk, rather than certainty, and higher levels of trust in forecast.

The vignette presented a scenario:

"Ruth sells school notebooks, which can be ruined in heavy rain. Ruth hears a forecast on the radio that there are high risks of thunderstorms and heavy rain in her area on Tuesday. On Tuesday, Ruth does not go out to sell notebooks, so they will not be ruined, but the storm does not happen. Do you think Ruth made a good decision?"

Respondents were asked to respond with the options *"Yes, even though it did not storm, there was high risk she might have lost all her assets"*, "*No, the forecast was not trustworthy and she missed out on income"*, or "*Other*". Overall, 74% of respondents agreed that Ruth made a good decision, while 23% thought she should not have acted based on the forecast. The remaining 3% generally suggested that Ruth should have made some type of compromise, such as carrying an umbrella, or planning to stop sales early if the weather was poor.

These attitude questions were included only in the endline survey, so to assess impact, the results for groups with different levels of participation in EWSA activities are compared (see Table 10. Attitudes by Categories of EWSA Participation). Respondents who participated in EWSA-specific activities (such as EWSA test beds), and participants who reported working as community mobilizers, were significantly more likely to report attitudes aligned with better understanding, and trust in, weather forecasts and early warnings (Table 10). The same pattern can be seen in response to the vignette about Ruth, where

respondents who participated in EWSA activities or community mobilizer work were more likely to see Ruth's decision to stay home as a wise one.

Figure 6. Weather forecasts or early warnings are easy to understand

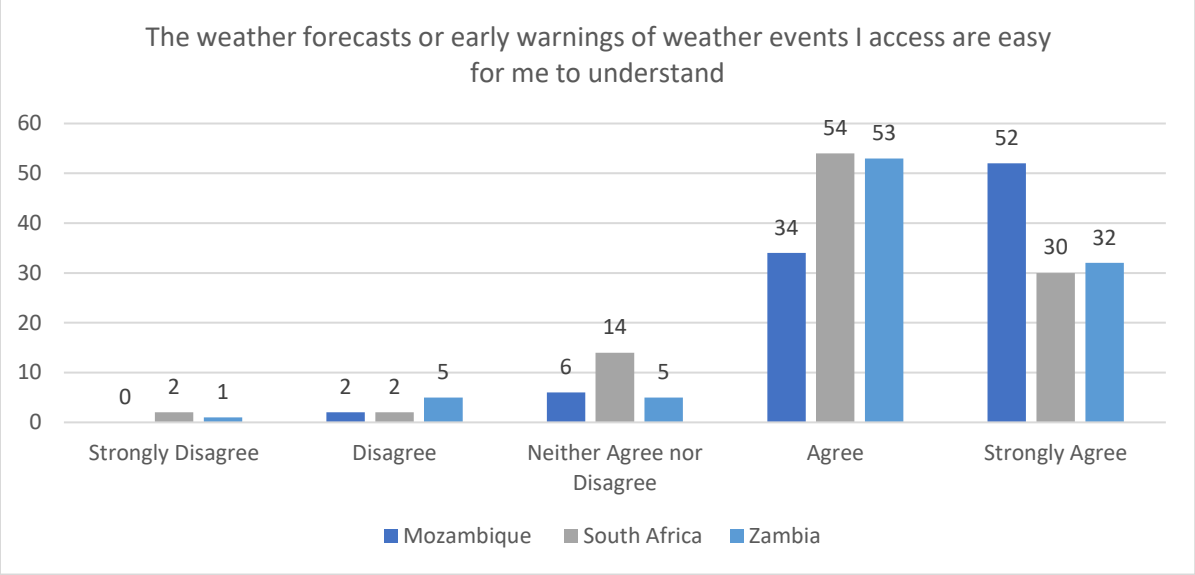


Figure 7. I do not need help to translate or understand the weather forecasts or early warnings

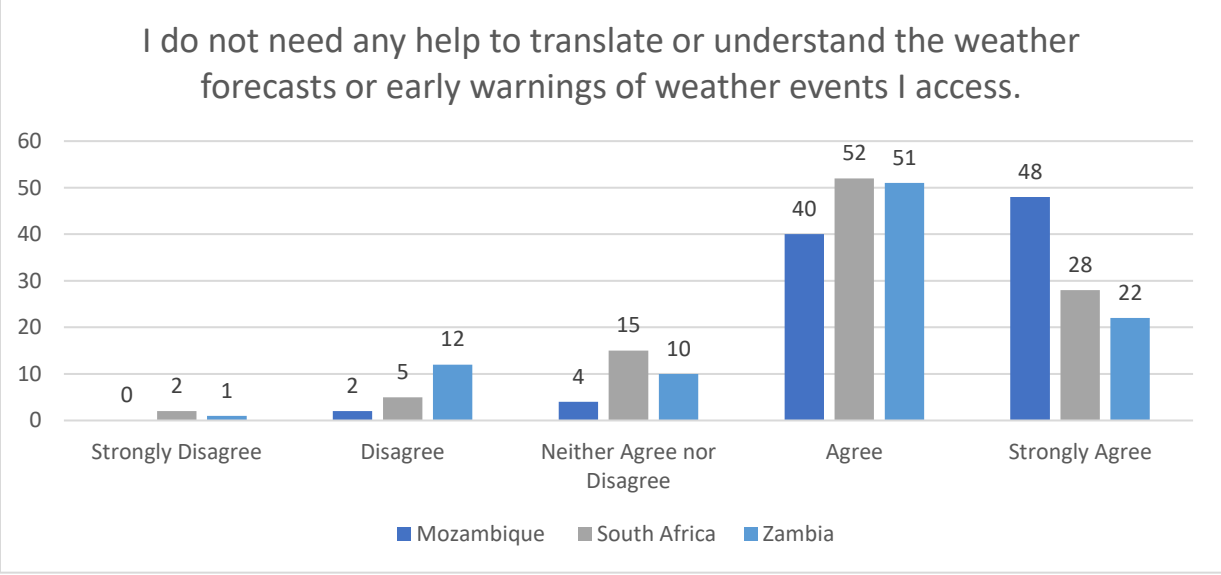


Figure 8. The weather forecasts or early warnings provide good guidance for actions I should take to reduce risk

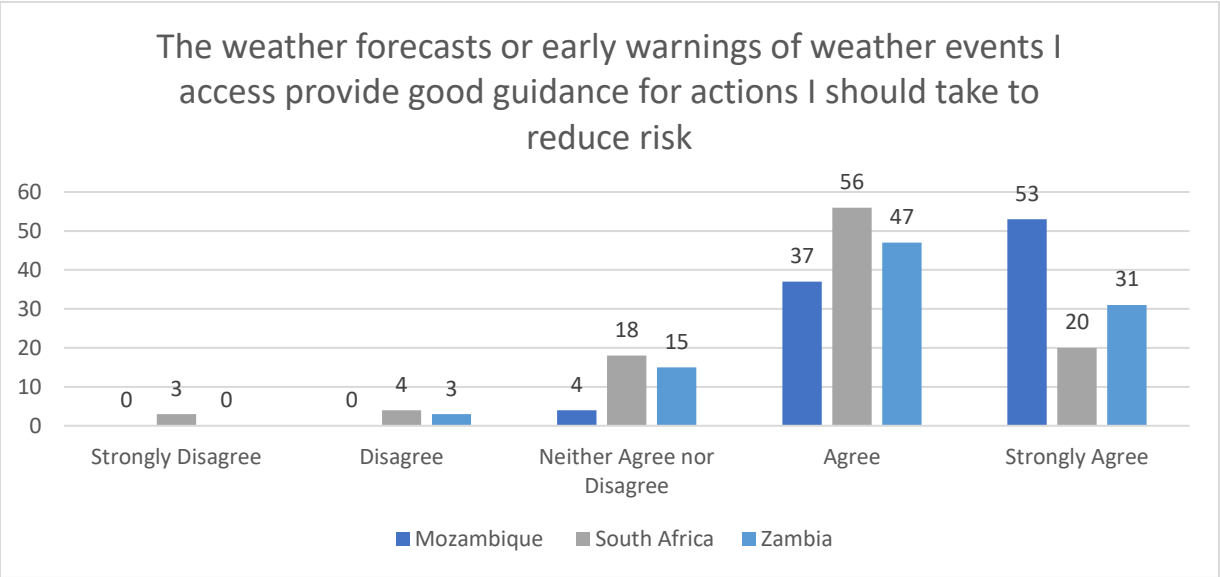


Figure 9. The weather forecasts or early warnings provide accurate information about risks of severe weather

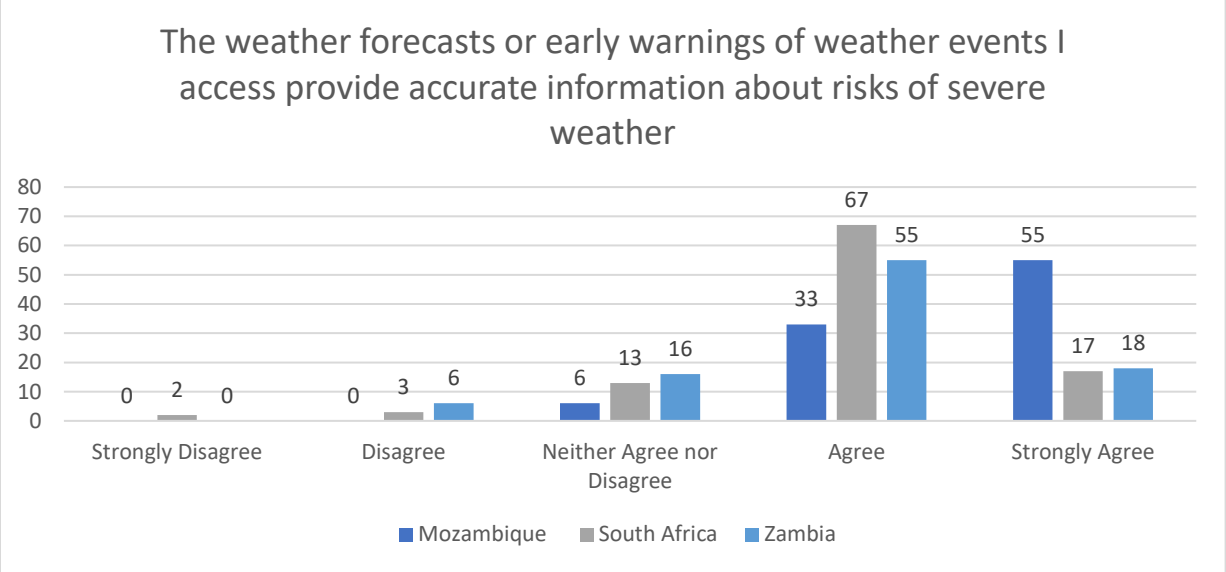


Figure 10. I trust the weather forecasts or early warnings

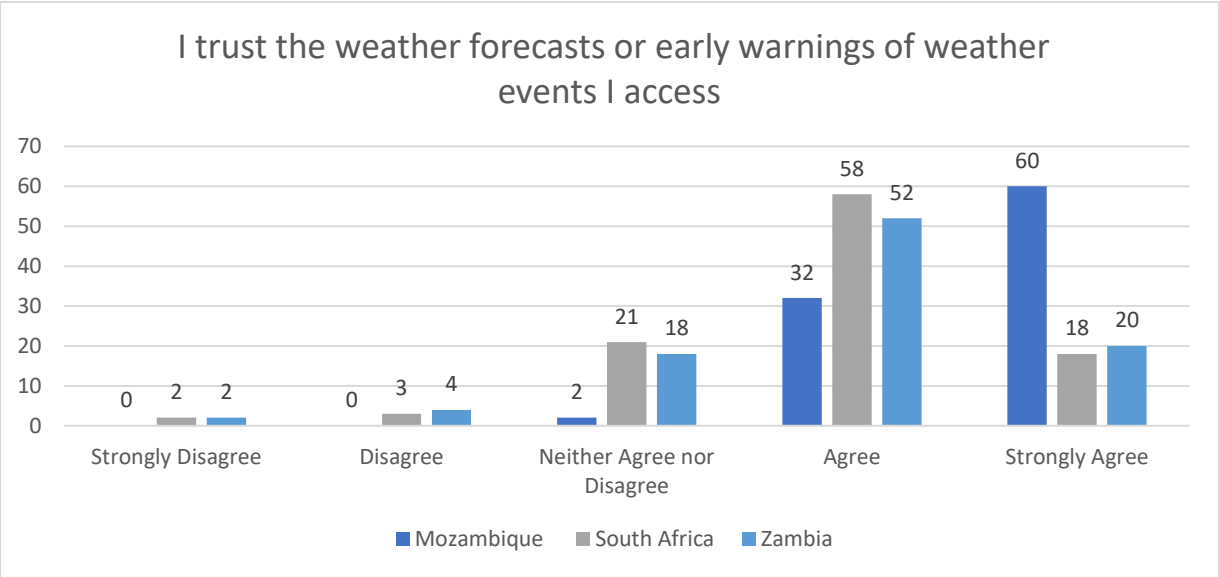


Table 10. Attitudes by Categories of EWSA Participation

Percent who agree or strongly agree with:							
	Participated in an EWSA activity		Did not Participate in an EWSA activity		Serve as community mobilizer	Did not serve as community mobilizer	
The weather forecasts or early warnings of weather events I access are easy for me to understand.	93%		80%	*	100%	86%	*
I do not need any help to translate or understand the weather forecasts or early warnings of weather events I access.	91%		72%	*	97%	80%	*
The weather forecasts or early warnings of weather events I access provide good guidance for actions I should take to reduce risk	91%		75%	*	97%	82%	*
The weather forecasts or early warnings of weather events I access provide accurate information about risks of severe weather	89%		79%	*	92%	83%	
I trust the weather forecasts or early warnings I access	91%		72%	*	94%	80%	*
Percent who agree with Ruth's choice:	87%		63%	*	100%	74%	*

* indicates significant difference at 95% confidence level, based on t-test

There were few differences in attitudes towards weather forecasts between men and women, or people with disabilities and those without (Table 10, Table 11). The exception was for people reporting that they need help to translate or understand weather forecasts or early warnings, where people with disabilities were significantly more likely to report needing assistance. Overall, 7.5% of respondents disagreed or strongly disagreed with the statement that they did not need help to translate or understand forecasts or early warnings. This reinforces the finding from the key informant interviews that accessibility of forecasts is an important barrier, especially for those with disabilities, but also for those without them.

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Table 11. Attitudes towards Weather Forecasts, by Gender

Percent who agree or strongly agree with:		
	Male	Female
The weather forecasts or early warnings of weather events I access are easy for me to understand.	88%	87%
I do not need any help to translate or understand the weather forecasts or early warnings of weather events I access.	83%	82%
The weather forecasts or early warnings of weather events I access provide good guidance for actions I should take to reduce risk	80%	87%
The weather forecasts or early warnings of weather events I access provide accurate information about risks of severe weather	82%	86%
I trust the weather forecasts or early warnings of weather events I access	78%	85%
Percent who agree with Ruth's choice:	74%	78%

* indicates significant difference at 95% confidence level, based on t-test

Table 12. Attitudes towards Weather Forecasts, by Disability Status

Percent who agree or strongly agree with:			
	Has Disability	Does not have disability	
The weather forecasts or early warnings of weather events I access are easy for me to understand.	84%	89%	
I do not need any help to translate or understand the weather forecasts or early warnings of weather events I access.	77%	86%	*
***The weather forecasts or early warnings of weather events I access provide good guidance for actions I should take to reduce risk**	86%	83%	

The weather forecasts or early warnings of weather events I access provide accurate information about risks of severe weather	86%	83%
I trust the weather forecasts or early warnings of weather events I access	82%	82%
Percent who agree with Ruth's choice	80%	74%

* indicates significant difference at 95% confidence level, based on t-test

Accessing Weather Forecasts

Respondents were asked about the frequency with which they access weather forecasts or early warnings. Results are shown for each country at endline and baseline in Figure 11 - Figure 13. Compared with the baseline, respondents in both Zambia and Mozambique were more likely to report accessing forecasts "very often"—defined as more that once per day, and less likely to report accessing them at lower frequencies. In contrast, for South Africa, there was little change in the frequency that respondents reported accessing forecasts. The increase in reports of accessing weather information "very often", and less change at the lower end of the scale, may indicate that impact was concentrated among those who already had an interest in weather information. Responses also may have been influenced by social desirability bias; Mozambique, where the sample included a large number of community mobilizers who had worked closely with WISER EWSA, saw the largest increase in people reporting accessing forecasts "very often".

Reflecting that the largest change appears to be in the highest frequency of weather access, and that the programme focused on promoting nowcasts, which are issued within several hours of severe weather events, the statistical significance of the difference in the share of people reporting access very often was tested; results are shown in Table 13.

Figure 11. Do you access weather forecasts? Zambia

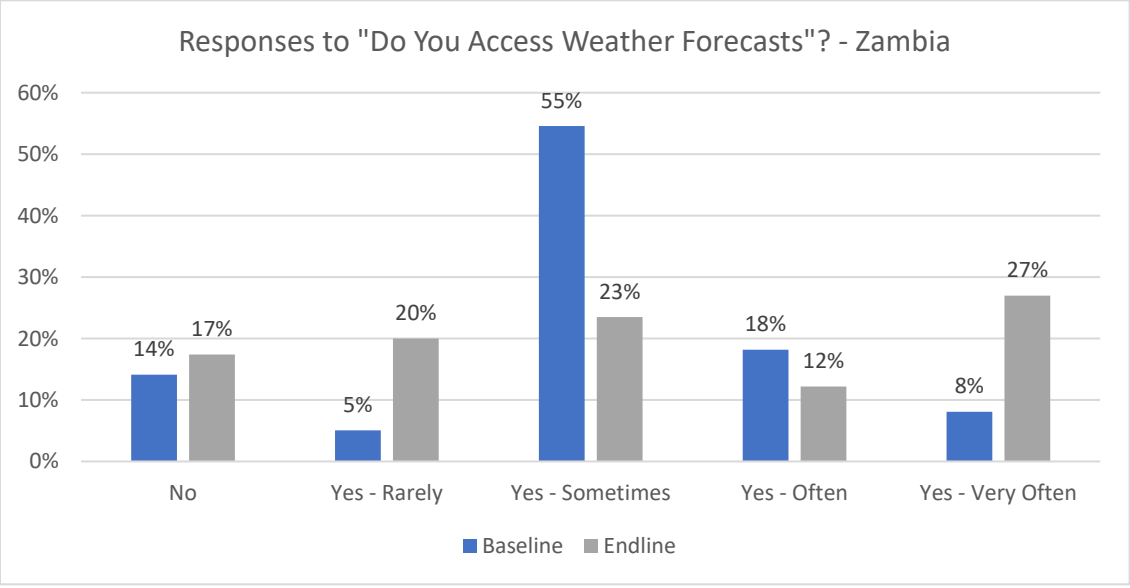


Figure 12. Do you access weather forecasts? Mozambique

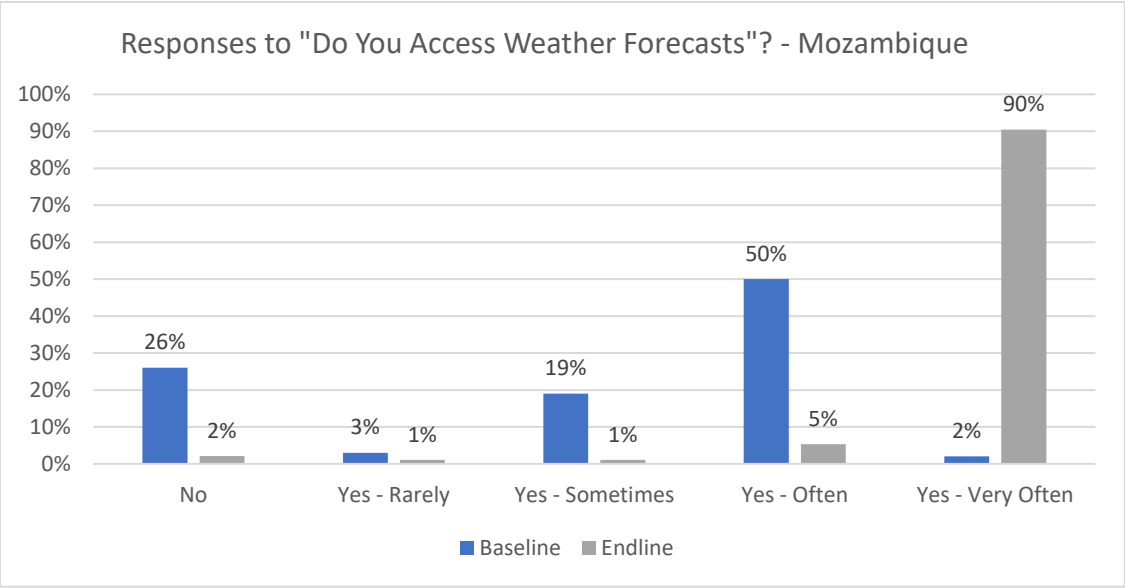


Figure 13. Do you access weather forecasts? South Africa

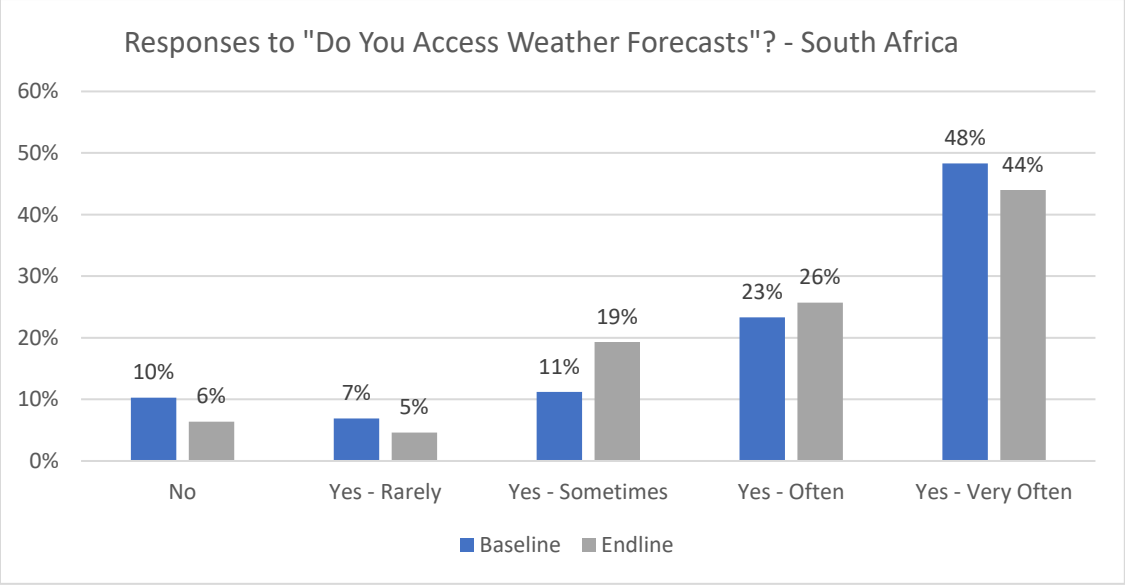


Table 13. Percent of Respondents Reporting Accessing Forecasts "Very Often", by Country and Baseline and Endline

Percent reporting accessing forecasts "Very Often"			
	Baseline	Endline	
Mozambique	2%	89%	*
South Africa	48%	43%	
Zambia	8%	27%	*

* indicates significant difference at 95% confidence level, based on t-test

Respondents in Zambia and Mozambique also reported accessing forecasts more frequently if they participated in EWSA-sponsored activities or served as community mobilizers (Table 14). However, there was no significant difference for South Africa. This provides corroborating evidence that, at least in some contexts, EWSA activities are associated with more frequent access to weather forecasts.

Table 14. Percent of Respondents Reporting Accessing Weather Forecasts "Very Often", by country and EWSA Participation

Percent reporting accessing forecasts "Very Often" at Endline, by Groups			
	Participated in an EWSA activity	Did not Participate in an EWSA activity	
Mozambique	91%	0%	Note: only 1 observation with no EWSA participation, and non missing data for access question
South Africa	49%	40%	
Zambia	62%	10%	*
All 3 countries	74%	24%	*

	Serve as community mobilizer	Did not serve as community mobilizer	
Mozambique	100%	40%	*
South Africa	75%	45%	
Zambia	75%	14%	*
All 3 countries	86%	33%	*

* indicates significant difference at 95% confidence level, based on t-test

For Zambia and Mozambique, very frequent access to weather forecasts increased across demographic groups—both men and women reported large increases in accessing forecasts “very often”, as did both individuals with disabilities, and those without (Table 14). While South Africa saw the largest decrease in gaps between men and women, and those with disabilities and those without, this was largely driven by decreases in the share of those reporting frequent access to weather information among men and those without disabilities.

Table 15. Percent of Respondents Reporting Accessing Forecasts "Very Often", by Country, Gender and Disability Status

By Gender							
	Baseline			Endline			
	Female	Male	Difference	Female	Male	Difference	Difference-in-Difference (Positive indicates increase in female relative to male)
Mozambique	0%	5%	-5%	91%	87%	5%	10%
South Africa	42%	56%	-15%	54%	34%	20%	34%
Zambia	6%	12%	-6%	23%	33%	-10%	-4%
All 3 Countries	17%	27%	-11%	53%	48%	5%	16%

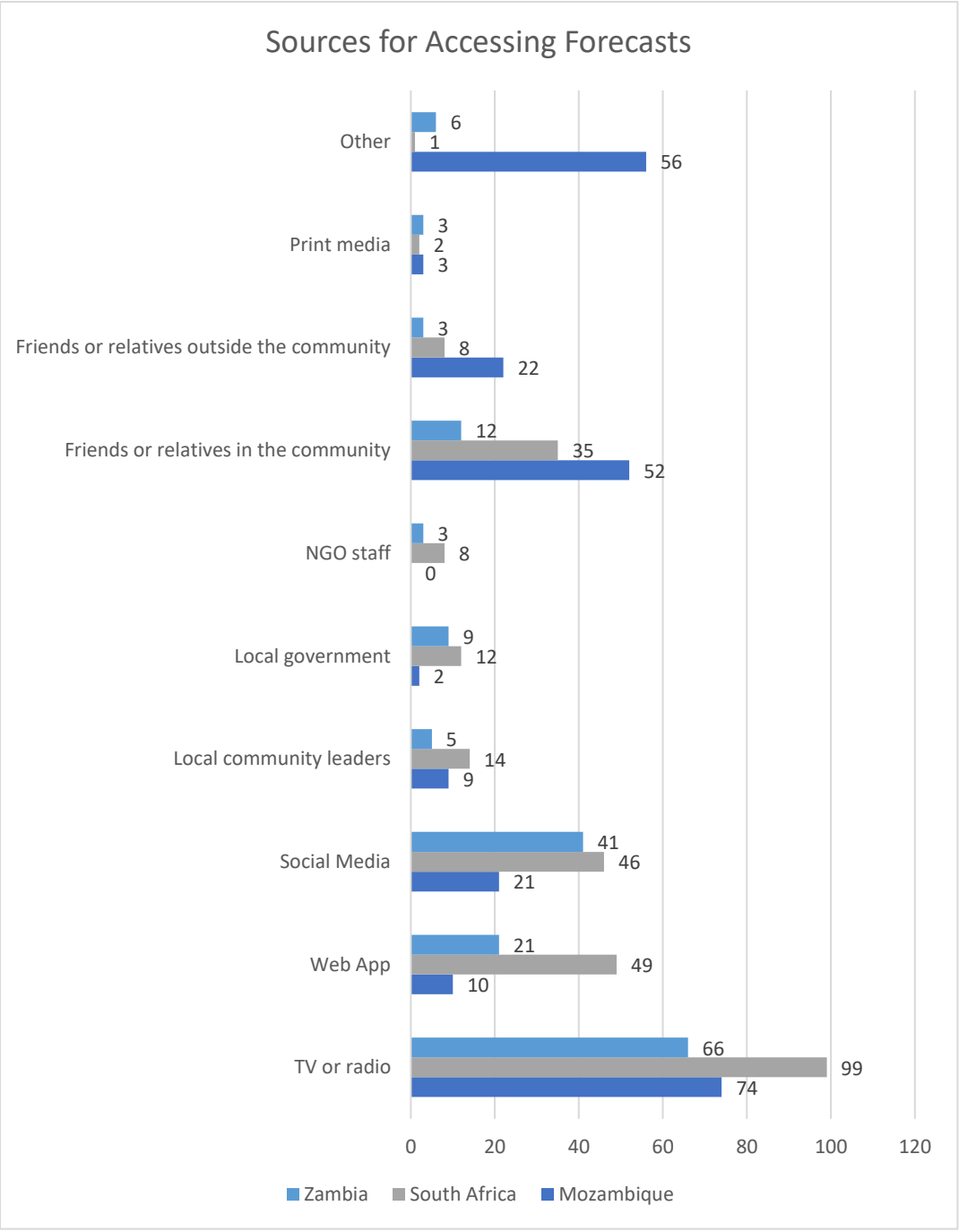
By Disability Status							
	Baseline			Endline			
	Has Disability	Has No Disability	Difference	Has Disability	Has No Disability	Difference	Difference-in-Difference (Positive indicates increase for those with disabilities relative to those without)
Mozambique	4%	0%	4%	85%	95%	-11%	-15%
South Africa	40%	49%	-9%	42%	44%	-1%	8%
Zambia	9%	8%	1%	20%	30%	-10%	-11%
All 3 Countries	11%	25%	-14%	54%	49%	5%	19%

* indicates significant difference at 95% confidence level, based on t-test

There were 292 respondents who reported accessing forecasts at least on rare occasions, and who reported the sources where they got the forecasts (Figure 14). The most common source was radio or television, with 82% reporting accessing forecasts from that source. However, social media and online applications were also important sources (with 37% and 27% accessing weather information from those sources), as were social networks, with 34% accessing information from friends or relatives within their community, and 11% accessing weather information from friends or relatives in different communities.

In total, 41% of respondents reported accessing weather forecast information through social network interactions with friends and neighbours, local government officials or leaders, or non-governmental organizations. However, relatively few people accessed information only through social networks: only about 6% of respondents accessed information from social network sources alone. Most people accessing information through social networks—82%-- reported also accessing information from TV or radio. Hence, a large number of the people who talk about weather forecasts appear to be those who follow weather information in other ways. The results were similar for the subset of respondents who did not participate in EWSA-specific activities, suggesting this is not driven only by programme participation.

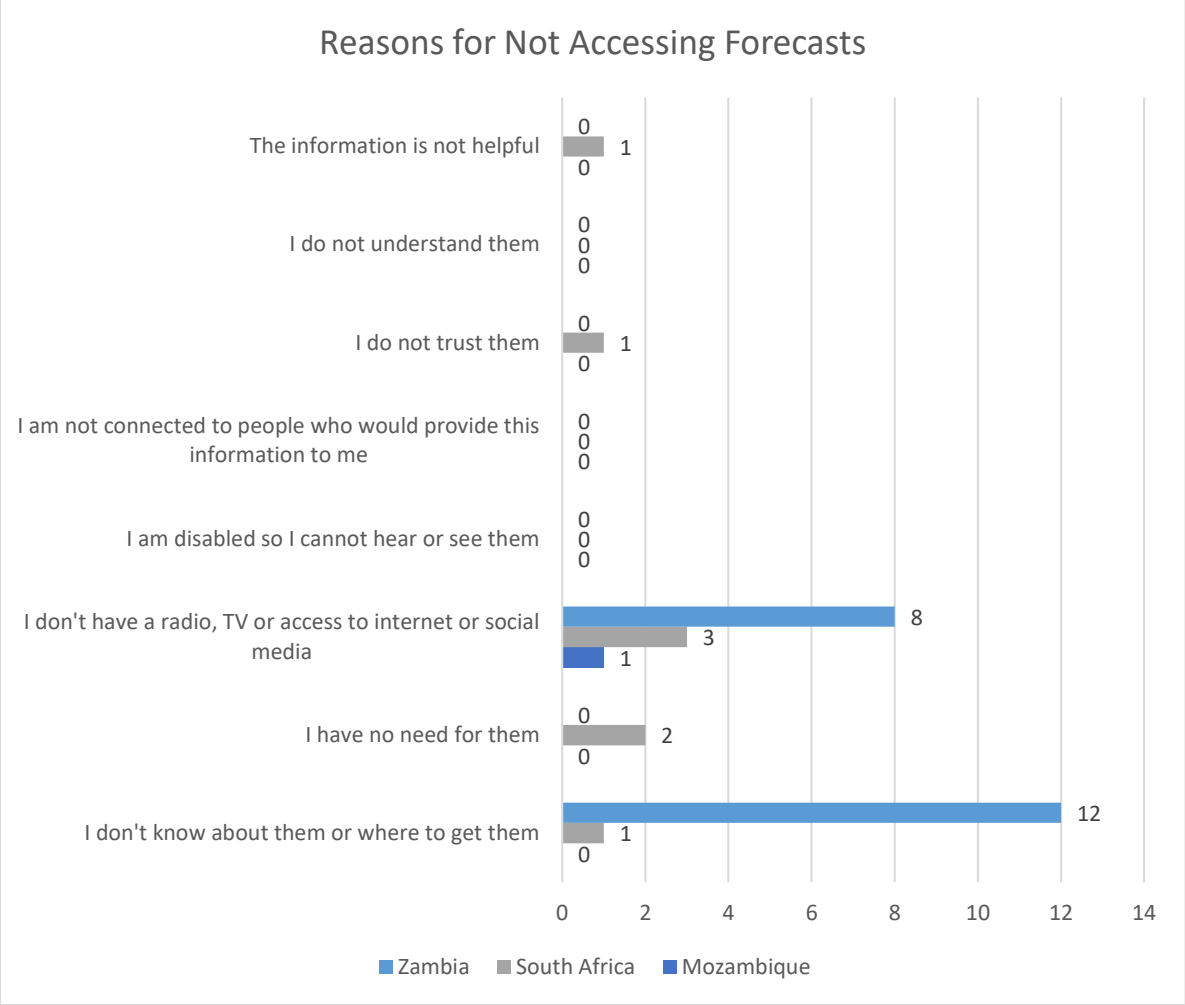
Figure 14. Sources for accessing forecasts



A total of 27 respondents reported never accessing weather forecasts (Figure 15). Overwhelmingly, the reasons for not accessing them given were not knowing about them or where to get them (cited by 48%

of those who reported not accessing forecasts), or not having access to technology to access the information including radio, internet, or social media (cited by 44%).

Figure 15. Reasons for not accessing forecasts



Accessing Nowcasts

Respondents were also asked specifically about accessing nowcasts in the past 2 years. Overall, 56% of respondents reported accessing a nowcast in that period. Access rates by country are reported below in Table 16. Differences in access rates likely reflect differences in the share of the sample made up of participants in project activities. Participants in EWSA-specific activities were more likely to report accessing nowcasts: 81% of participants in EWSA-specific activities reported accessing them, versus 30% of non-participants. Among those who accessed nowcasts, 95% found them useful or very/extremely useful.

Table 16. Nowcast Access by Country

	Accessed Nowcast in Past 2 Years
Mozambique	93%
South Africa	61%
Zambia	25%

Taking Note of, and Acting on, Weather Forecasts

For who accessed weather forecasts or information at least sometimes were asked if they take note of the forecasts, and act on them. Results for the share of respondents who reported taking notice of forecasts or weather information were similar to those for accessing weather forecasts: for Zambia and Mozambique, there was a notable and statistically significant uptick in the share of respondents who reported "Practically Always" taking note of forecasts in the endline compared with the baseline (Figure 16, Figure 17). However, there was no significant change for South Africa (Figure 18). As with access, the gains in taking note of forecasts seem to be concentrated among those who already took some notice of weather information.

Figure 16. Do you take notice of forecasts? Zambia

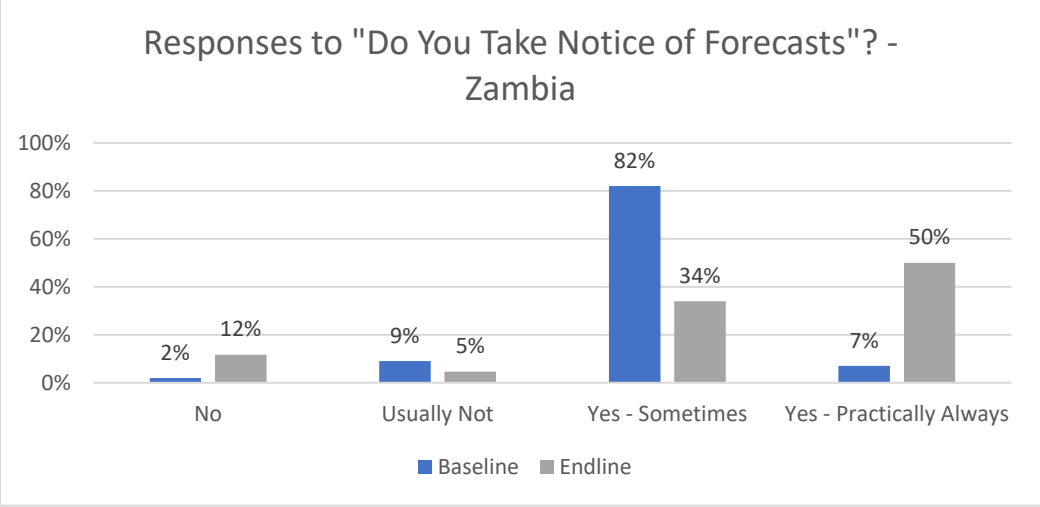


Figure 17. Do you take notice of forecasts? Mozambique

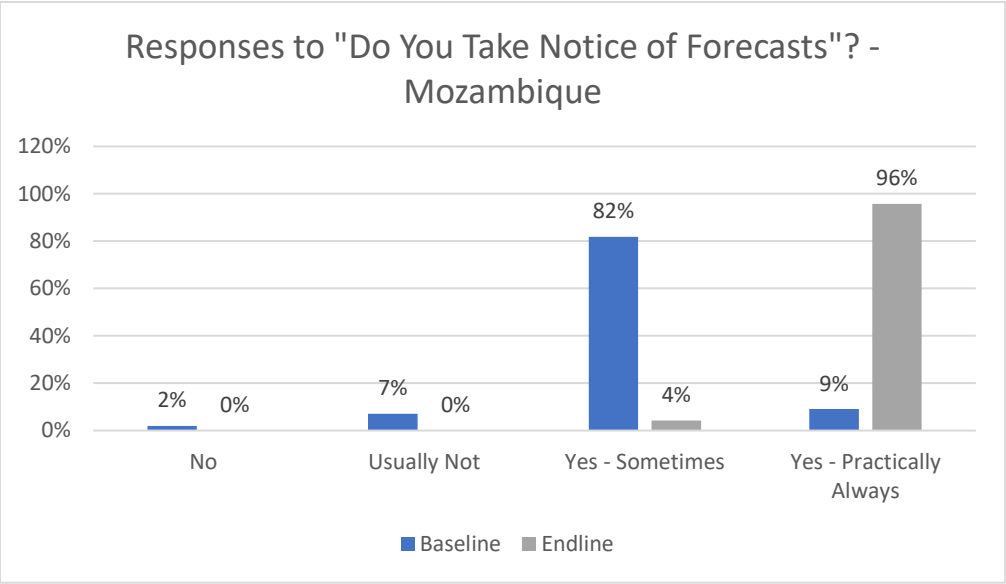
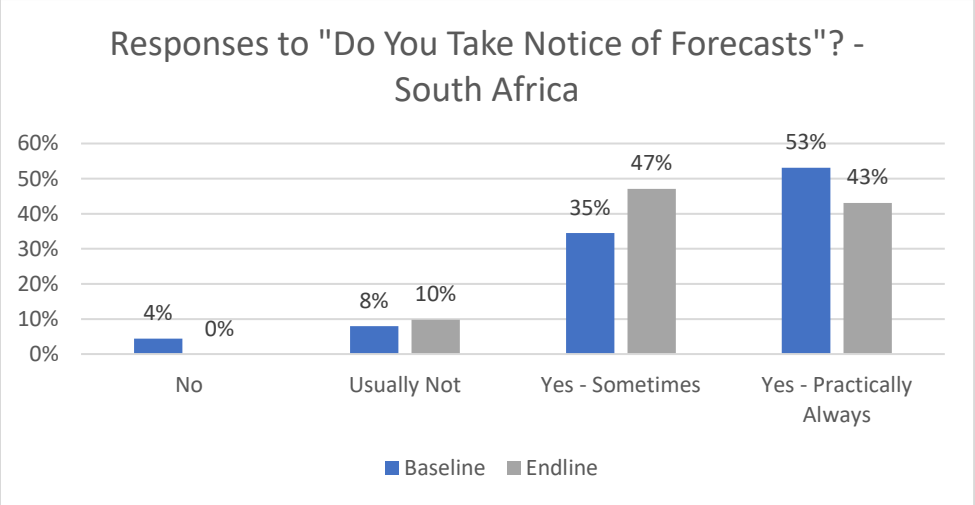


Figure 18. Do you take notice of forecasts? South Africa



As with the results for accessing weather information, participation in EWSA activities and acting as a community mobilizer was associated with much higher likelihood of “practically always” taking note of weather information in Zambia and Mozambique, but not South Africa (Table 17). However, in Mozambique and Zambia, the share of people reporting they “practically always” take note of weather information was higher than baseline even for people who did not report participating in WISER EWSA activities, or acting as a community mobilizer.

Table 17. Percent of Respondents Reporting Noticing Forecasts "Almost Always", by Country and Baseline and Endline

Percent reporting noticing forecasts "Practically Always"			
	Baseline	Endline	
Mozambique	9%	96%	*
South Africa	53%	43%	
Zambia	7%	50%	*

* indicates significant difference at 95% confidence level, based on t-test

Table 18. Share of Respondents Reporting Noticing Forecasts "Practically Always", by EWSA Participation

Percent reporting noticing forecasts "Practically Always", by EWSA Participation			
	Participated in an EWSA-sponsored activity	Did not Participate in an EWSA-sponsored activity	
Mozambique			Note: No observations with no EWSA participation, and non-missing data for access question
South Africa	41%	44%	
Zambia	86%	29%	*
All 3 Countries	81%	37%	*

	Serve as community mobilizer	Did not serve as community mobilizer	
Mozambique	100%	47%	*
South Africa	50%	48%	
Zambia	87%	23%	*
All 3 Countries	89%	40%	*

* indicates significant difference at 95% confidence level, based on t-test

The higher rates of people reporting “practically always” taking note of weather information in Zambia and Mozambique again reflected improvements across demographic groups, including women and people with disabilities (Table 19). In South Africa, the reduced gap between men and women, and those with disabilities and those without, again reflected reduced levels of “practically always” taking note of weather information among men and people without disabilities.

Table 19. Share of Respondents Reporting Noticing Forecasts "Practically Always", by Gender and Disability Status

Percent reporting noticing forecasts "Practically Always", by Gender and Disability Status							
By Gender							
	Baseline			Endline			
	Female	Male	Difference	Female	Male	Difference	Difference-in-Difference (Positive indicates increase for female relative to male)
Mozambique	9%	8%	1%	95%	97%	-2%	-4%
South Africa	57%	48%	9%	54%	33%	21%	12%
Zambia	5%	12%	-8%	47%	56%	-9%	-1%
	24%	24%	0%	66%	58%	8%	8%
By Disability Status							
	Baseline			Endline			
	Has Disability	Has No Disability	Difference	Has Disability	Has No Disability	Difference	Difference-in-Difference (Positive indicates increase for those with disabilities relative to those without)
Mozambique	13%	4%	9%	96%	95%	1%	-8%
South Africa	36%	56%	-20%	40%	44%	-4%	16%
Zambia	3%	9%	-6%	56%	48%	8%	14%
	13%	29%	-17%	70%	58%	12%	29%

* indicates significant difference at 95% confidence level, based on t-test

Responses regarding acting on forecasts again followed similar patterns to those related to accessing and noticing forecasts. For Zambia and Mozambique, respondents in the endline were significantly more likely to say they “practically always” act on weather forecasts compared with the baseline (Figure 19, Figure 20). However, for South Africa, respondents were significantly less likely to report “practically always” acting on forecasts, reflecting an increase in the share reporting they “sometimes” act on the information (Figure 21). As with responses relating to access, and taking note of forecasts, there is potential for social desirability bias to play a role in these responses. Programme activities that emphasized sharing climate information with neighbours—an easy action many can take—may also have played a role, as telling others was cited as an action by many participants in both the user survey and project reporting on participant feedback.

Figure 19. Do you act on forecasts? Zambia

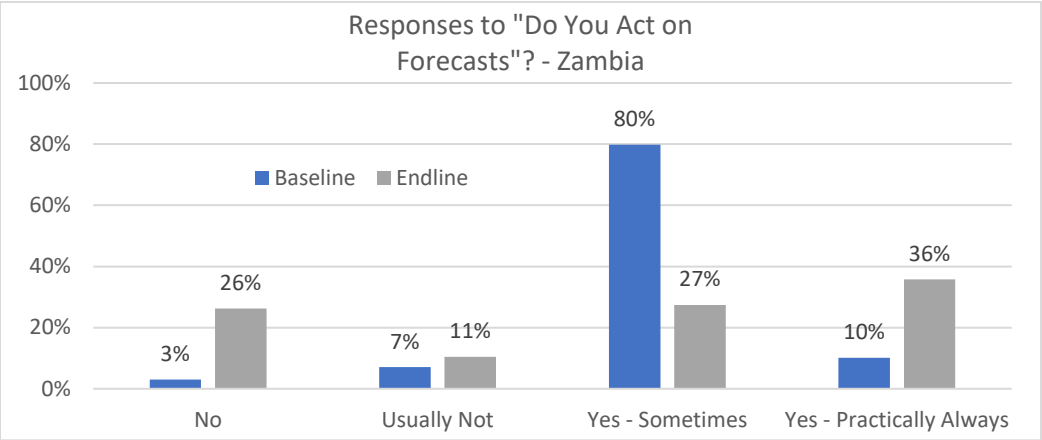


Figure 20. Do you act on forecasts? Mozambique

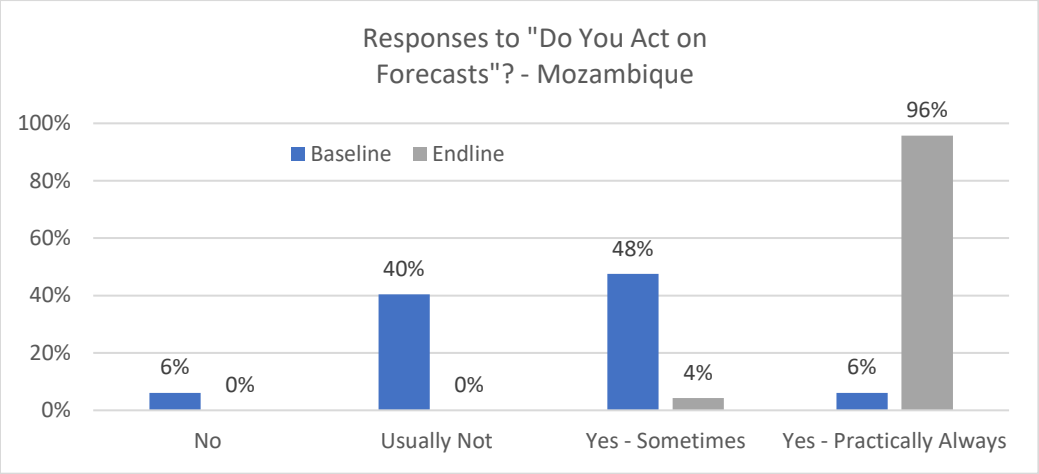


Figure 21. Do you act on forecasts? South Africa

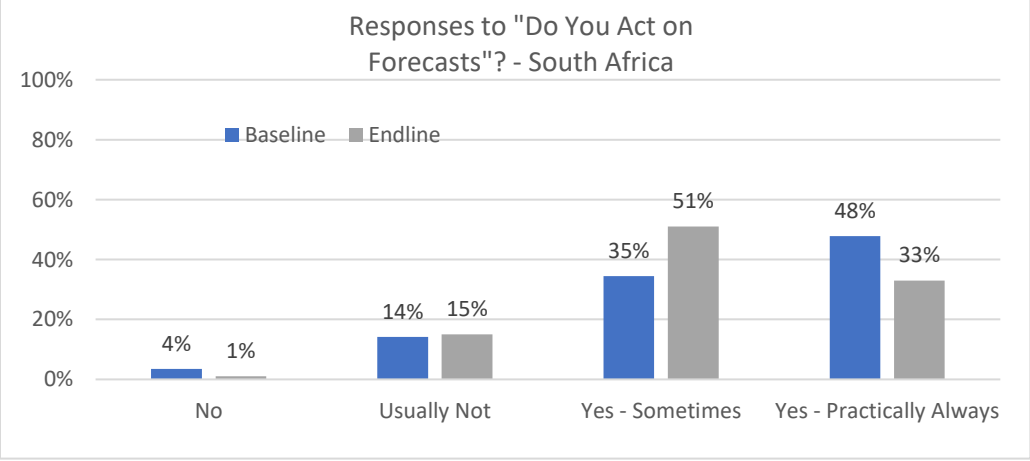


Table 20. Share of Respondents Reporting Acting on Weather Forecasts "Almost Always", by Country and Baseline and Endline

Percent reporting acting on forecasts "Practically Always"			
	Baseline	Endline	
Mozambique	6%	96%	*
South Africa	48%	33%	*
Zambia	10%	36%	*

* indicates significant difference at 95% confidence level, based on t-test

Higher levels of interaction with EWSA were also associated with higher rates of reporting acting on forecasts “practically always”, except for South Africa. In Zambia, participants in EWSA-specific activities were much more likely to report acting on forecasts frequently; in both Mozambique and Zambia, community mobilizers were much more likely to do so (Table 21).

Table 21. Share of Respondents Reporting Acting on Weather Forecasts "Almost Always", by Country and EWSA Participation

Percent reporting acting on forecasts "Practically Always" at Endline, by Country and EWSA Participation			
	Participated in an EWSA-sponsored activity	Did not Participate in an EWSA-sponsored activity	
Mozambique			Note: No observation with no EWSA participation, and non missing data for access question
South Africa	30%	35%	
Zambia	64%	19%	*
All 3 Countries	73%	27%	*

	Serve as community mobilizer	Did not serve as community mobilizer	
Mozambique	100%	45%	*
South Africa	25%	41%	
Zambia	75%	18%	*
All 3 Countries	81%	35%	*

* indicates significant difference at 95% confidence level, based on t-test

The increase in the share of respondents who reported “almost always” acting on weather information in the endline versus the baseline reflected increases in this response across both men and women, and people with disabilities and those without, in Zambia and Mozambique (Table 22). It also reflected a decrease in the share of men and people with no disabilities who reported “almost always” acting on weather information in South Africa.

Table 22. Share of Respondents Reporting Acting on Weather Forecasts "Almost Always", by Country, Gender and Disability Status

Percent reporting acting on forecasts "Practically Always", by Gender and Disability Status							
By Gender							
	Baseline			Endline			
	Female	Male	Difference	Female	Male	Difference	Difference-in-Difference (Positive indicates increase for female relative to male)
Mozambique	7%	3%	5%	95%	97%	-2%	-7%
South Africa	48%	48%	0%	40%	27%	13%	13%
Zambia	6%	19%	-13%	29%	47%	-18%	-6%
All 3 Countries	21%	25%	-4%	56%	53%	3%	7%
By Disability Status							
	Baseline			Endline			
	Has Disability	Has No Disability	Difference	Has Disability	Has No Disability	Difference	Difference-in-Difference (Positive indicates increase for those with disabilities relative to those without)
Mozambique	10%	2%	8%	96%	95%	1%	-8%
South Africa	36%	50%	-14%	35%	32%	2%	16%
Zambia	12%	9%	3%	44%	32%	12%	9%
All 3 Countries	15%	26%	-12%	66%	48%	19%	30%

* indicates significant difference at 95% confidence level, based on t-test

Actions in Response to Weather Forecasts

Respondents reporting acting in response to weather forecasts or information were asked specifically what actions they took, and what if any costs these actions entailed. The responses are summarized below in Table 23. The most common actions were staying inside or in a safe place, sharing the weather information with others, unspecified precautions, dressing appropriately, and fortifying dwellings.

Prevalence of responses varied by country. For example, respondents in Mozambique were more likely to cite staying inside or away from vulnerable locations and fortifying dwellings; this may reflect the fact

that Mozambique in particular is vulnerable to cyclones which can pose severe weather risks including flooding. Mozambique respondents were also especially likely to mention sharing weather information. Zambia was the only location where respondents mentioned harvesting crops early. This could reflect this population being more likely to engage in farming, or a particular recent experience with severe weather occurring near harvest time for that location. South Africa accounted for most of the "unspecified precautions"; the South Africa responses for this question were often missing or vague. Some example responses that were placed in this category included "Because I own a car wash it's wise for me to always check the weather" and "I prepare myself for whatever that's going to happen the following day".

Not all respondents who cited actions provided information about the costs of those actions, but where information was provided, the number of people reporting no cost for that type of action, as well as the number reporting costs in terms of both time and other costs, was tallied. Many of the most common actions were often cited as having no costs, such as staying inside, carrying an umbrella or dressing appropriately, or fortifying homes or closing windows. Actions cited as entailing costs included not doing their livelihood that day (resulting in foregone income), sharing the weather information (citing as taking up time, and requiring airtime or internet credit), protecting crops (entailing input costs, transport costs, and farm labour costs). Unspecified actions were often cited as having time or other costs that were also not specified. Some respondents cited staying inside or changing their plans as having a time cost. Actions to protect assets, including property, could either be cited as having no costs, or carrying costs, depending on the action taken. For example, one person citing an action with no cost said "When I received information that it was going to be very hot, I reduced the amount of tomatoes I bought to resell in order to reduce losses', while one cited a similar action to protect inventory with a cost: "I buy more ice for the fish". Actions to fortify buildings, such as use of sandbags or weighting roofs with bricks, depended on whether those materials were already on hand.

Some of the actions discussed by respondents were indicative of the disproportionate costs and risks that weather events can have for people with disabilities. Several people mentioned staying at home, or away from vulnerable areas, as being particularly important for people with difficulty moving. One individual with a disability stated "We stay in place so that the floods don't find us outside since we can't run"; another said "I don't leave the house because I can't be caught in the rain or wind outside the house. It's not easy to walk on crutches on rainy days and strong winds." Some individuals also mentioned providing help for people with disabilities; one women said "I prepare a safe place to leave my disabled husband".

Table 23. Actions Taken in Response to Weather Information, and the Costs of Actions

				Costs to Actions?	Examples of Costs

Climate Response Actions	Total Number of Times Reported	Count Zambia	Count Moz.	Count South Africa	No	Yes, time	Yes, other	
Don't do livelihood	6	1	2	3	1	1	4	Lost business income, Don't make money that day
Don't go out/to town/stay in safe place	54	10	40	4	38	2	3	Can't complete errands
Tell children to stay inside	3	0	2	1	2	0	1	
Avoid vulnerable locations	5	0	4	1	2	0	0	
Evacuate	1	0	0	1	0	1	0	
Change activities/plans for the day	13	0	5	8	4	4	2	
Buy food or other supplies so don't have to go out	2	1	1		1	0	1	Buying food early
Share information with others	47	8	32	7	10	11	23	Airtime/internet credit, one mention of buying cloth to put up flags as a means of comm, batteries for radio, travel costs
Take actions to protect others (various or unspecified)	5	1	2	2	2	0	2	
Carry umbrella	10	2	3	5	9	1	1	
Dress appropriately	23	5	11	7	16	2	1	
Purchase clothes, umbrella, boots	1	1	0	0	0	1	1	Purchase gumboots, umbrella
Close doors, windows	7	3	4	0	6	0	0	
Turn off appliances	2	0	2	0	1	0	0	
Fortify dwelling, eg sandbags on roof	17	0	14	3	11	1	1	Buy bricks to weight roof, Purchasing material for sealing roofs
Prepare to address leaking roof	1	1	0	0	1	0	0	
Unspecified precautions or actions	28	6	0	22	9	7	5	
Create emergency plan	1	1	0	0	0	0	0	
Stay hydrated, carry water	4	2	0	2	1	1	1	
Protect crops, eg harvest early	4	4	0	0	0	1	3	Purchasing weather resistant varieties, paying workers to harvest, transport to field
Prepare mentally	7	5	2	0	7	0	0	

Follow advice of weather advisories	3	1	2	0	1	0	0	
Actions to preserve productive assets	3	0	3	0	1	0	1	buy ice for fish
Actions to preserve household assets including food, goods	4	0	4	0	3	0	1	buy ice for food storage, change watering schedules, move valuables to safer places, don't do laundry

Perceived Reduction of Impact of Weather Events

If access to weather information gives people improved ability to act to reduce losses associated with severe weather, this could be expected to result in people viewing severe weather events as having less impact. As a result, assuming the severity of weather shocks is unchanged, perceived lower impact of weather would be a strong indication of persistent improved capacity to mitigate severe weather shocks as a result of better weather information. The survey included questions about the perceived frequency of different types of severe weather shocks, and the perceived impact they have on different aspects of well-being.

For most countries, types of weather shock, and areas of impact, there were no significant differences between baseline and endline (Table 24-Table 31). Where there were significant differences, changes in perception of impact moved largely in line with perceptions of frequency of severe weather. This suggests that the changes in perception of weather impact were largely driven by weather trends, rather than increased ability to mitigate the impact of severe weather. For example, Zambia experienced one of its worst droughts in decades in the 2024 growing season, leading the government to declare a national emergency in February 2024. In the baseline data, collected before the drought, only 1% of respondents reported that droughts occur often or very often, and 0% to 1% reported negative or extensive negative impact from droughts across different dimensions such as health or income. However, in the endline data, 55% of respondents reported droughts occur often or very often, and between 26% to 42% reported negative impact for the different dimensions of welfare. Similarly, there were significant reductions in the share of respondents reporting negative impact from thunderstorms and strong winds for several dimensions of welfare in Zambia, but this corresponded with significant reductions in perceived frequency of thunderstorms and strong winds(possibly related to lower rainfall during the drought).

Table 24. Perceived Frequency of Heatwaves, by Country and Baseline/Endline

Perception of Frequency of Heatwaves
Percent reporting "Often" or "Very Often" (Once a Year or More)

	Baseline	Endline	
Mozambique	100%	100%	
South Africa	97%	87%	*
Zambia	100%	92%	*

* indicates significant difference at 95% confidence level, based on t-test

Table 25. Perceived Impact of Heatwaves, by Country, Baseline/Endline, and Dimension of Welfare

Perception of Impact of Heatwaves								
Percent reporting "Negative" or "Extensive Negative" Impact								
	Mozambique		South Africa			Zambia		
	Baseline	Endline	Baseline	Endline		Baseline	Endline	
Physical Health	100%	100%	82%	70%	*	71%	72%	
Mental Health	100%	100%	61%	65%		24%	43%	*
Work	100%	99%	70%	61%		54%	52%	
Earnings	100%	99%	58%	48%		46%	44%	
Assets	100%	99%	52%	47%		13%	17%	
Other	99%	100%	55%	58%		31%	27%	

* indicates significant difference at 95% confidence level, based on t-test

Table 26. Perceived Frequency of Thunderstorms, by Country and Baseline/Endline

Perception of Frequency of Thunderstorms			
Percent reporting "Often" or "Very Often" (Once a Year or More)			
	Baseline	Endline	
Mozambique	100%	100%	
South Africa	88%	78%	
Zambia	99%	90%	*

* indicates significant difference at 95% confidence level, based on t-test

Table 27. Perceived Impact of Thunderstorms, by Country, Baseline/Endline, and Dimension of Welfare

Perception of Impact of Thunderstorms	
Percent reporting "Negative" or "Extensive Negative" Impact	
	Physical Health

	Mozambique		South Africa			Zambia		
	Baseline	Endline	Baseline	Endline		Baseline	Endline	
Physical Health	100%	100%	72%	67%	*	80%	57%	*
Mental Health	100%	100%	67%	64%		35%	53%	*
Work	100%	100%	70%	69%		75%	59%	*
Earnings	100%	100%	69%	59%		62%	56%	
Assets	100%	100%	70%	61%		51%	56%	
Other	99%	100%	66%	60%		52%	50%	

* indicates significant difference at 95% confidence level, based on t-test

Table 28. Perceived Frequency of Drought, by Country and Baseline/Endline

Perception of Frequency of Drought			
Percent reporting "Often" or "Very Often" (Once a Year or More)			
	Baseline	Endline	
Mozambique	100%	100%	
South Africa	19%	20%	
Zambia	1%	55%	*

* indicates significant difference at 95% confidence level, based on t-test

Table 29. Perceived Impact of Drought, by Country, Baseline/Endline, and Dimension of Welfare

Perception of Impact of Drought							
Percent reporting "Negative" or "Extensive Negative" Impact							
	Physical Health						
	Mozambique		South Africa		Zambia		
	Baseline	Endline	Baseline	Endline	Baseline	Endline	
Physical Health	100%	100%	45%	36%	0%	42%	*
Mental Health	100%	100%	45%	35%	0%	31%	*
Work	100%	100%	43%	37%	0%	33%	*
Earnings	100%	100%	44%	38%	0%	35%	*
Assets	100%	100%	39%	35%	1%	26%	*
Other	99%	100%	42%	36%	0%	31%	*

* indicates significant difference at 95% confidence level, based on t-test

Table 30. Perceived Frequency of Strong Winds, by Country and Baseline/Endline

Perception of Frequency of Strong Winds
Percent reporting "Often" or "Very Often" (Once a Year or More)

	Baseline	Endline	
Mozambique	100%	100%	
South Africa	68%	83%	*
Zambia	97%	84%	*

* indicates significant difference at 95% confidence level, based on t-test

Table 31. Perceived Impact of Strong Winds, by Country, Baseline/Endline, and Dimension of Welfare

Perception of Impact of Strong Winds							
Percent reporting "Negative" or "Extensive Negative" Impact							
	Physical Health						
	Mozambique		South Africa		Zambia		
	Baseline	Endline	Baseline	Endline	Baseline	Endline	
Physical Health	100%	100%	63%	71%	58%	43%	*
Mental Health	100%	100%	53%	65%	33%	34%	
Work	99%	100%	49%	51%	34%	19%	*
Earnings	100%	100%	54%	63%	36%	22%	*
Assets	100%	100%	59%	65%	37%	31%	
Other	100%	100%	59%	63%	32%	30%	*

* indicates significant difference at 95% confidence level, based on t-test

Focus Group Discussions

Participation

The focus group discussions were conducted in June 2025, with five groups in Zambia and Mozambique. In total, 77 individuals participated in the focus group discussions, of which 29 were male, and 48 were female. The groups also included a large number of individuals with different disabilities, and individuals with family members with disabilities (Table 32).

Table 32. Focus Group Discussion Group Profiles

	Country	**Participants**	**Notes**
Group 1	Zambia	9 men	Included individuals with disabilities including difficulty hearing, seeing, and other
Group 2	Zambia	8 women	Included individuals with disabilities including difficulty hearing, seeing, and other
Group 3	Mozambique	5 men, 18 women	Also included 4 community mobilizers, and journalists. Ended early when boomslang snake fell out of tree into the discussion.
Group 4	Mozambique	4 men, 15 women	Included individuals with disabilities. Also included 6 community mobilizers, and journalists.

Group 5	Mozambique	11 men, 7 women	Also included 6 community mobilizers, and journalists. Participants were staff in district local government.

Costs of Weather Events

The focus group discussion addressed the types of costs that different severe weather events create for communities, and specifically for people with disabilities.

Heatwaves: Health problems, and discomfort, including difficulty sleeping, were consistently mentioned. One participant mentioned fainting, being hospitalized, and experiencing ongoing subsequent health issues. Other costs mentioned included water shortages, difficulty traveling, difficulty working, loss of livestock, and loss of crops or food stores. Interestingly, some benefits of heatwaves were noted, including business opportunities such as selling frozen snacks or drinks, and solar chargers working better. Heatwaves were described as disproportionately affecting older people or those with high blood pressure, and those in lower quality housing. It also disproportionately affects those with disabilities: one man who uses a wheelchair said he needed help getting water when it is very hot, and a woman with blindness described being unable to see where there is shade so that she could go there to cool down.

Thunderstorms and flooding: Groups cited risk of death, with individuals sharing personal experiences of people who had died, and damage to houses. One participant described a fire that started at his neighbour's house due to lightening, and which was eventually put out by rain. Inability to go out, travel, or go to work were commonly mentioned. Thunderstorms and flooding impeding movement was seen as disproportionately affecting people with disabilities, including ability to access communal toilets during floods, for those with difficulty moving. Other costs mentioned included loss of power, and electronic devices being damaged. Several groups also mentioned that thunderstorms cause a great deal of stress and fear, and there are beliefs and superstitions that they are tied to witchcraft or judgement for poor behaviour. This mental cost of severe weather may explain the quantitative survey finding that many people said they "prepare mentally" as a response to receiving weather information. Public infrastructure damage, including the destruction of a local bridge, was also mentioned.

Drought: Food and water shortages, including taps running dry, were most frequently mentioned. Loss of livestock (one participant related a story about a family member who lost 500 chickens), increase in diseases, poor crop yields, and high food prices were also mentioned. One group noted that women in particular may face extra time required to fetch water.

Severe winds: As with thunderstorms, this was commonly cited as posing risk of death, due to collapsing structures or trees, or falling metal roofing sheets, with participants citing people they knew who had died. Damage to houses, including increased fire risk from sparks blown from traditional cooking fires, was mentioned. Other costs included crop destruction, food blowing away during drying or processing, risk to fishing, and discomfort including dust in eyes and coughing.

Actions to Mitigate Weather Events, and their Costs and Benefits

The focus groups were then asked about actions they could take to mitigate the impact of different severe weather events, what these actions cost, and what losses they helped to avoid. The focus group

facilitators found that it was very difficult, even with probing, for the participants to estimate costs and benefits for many of the actions. However, where the groups could estimate costs and benefits of actions, these estimates are useful for understanding the potential financial barriers to many actions, and some of the net benefits associated with being able to take these actions. As with the findings from the quantitative data, many of the actions discussed have little cash cost, such as avoiding unsafe locations, or moving belongings.

The discussion also sought to identify which actions were likely to be enabled, or made easier or more effective, by weather forecasts. Weather information was credited with making it easier to move people, belongings, or livestock to safer locations; change livelihood activities; avoid going out or going to unsafe locations; unplug electronics; or plan for behaviours like drinking more. Longer term forecasts were credited with enabling investment in things like solar fans or home improvements, and or change their crop production plans. For other actions, such as collecting water or taking it to the farm in droughts, or renting a home with a toilet during floods, weather information was not discussed as playing a role. (See Table 33).

Focus groups also discussed access to, and use of, weather information, and barriers to accessing forecasts. Several groups reported improvements in weather forecasts, including better quality, less technical language in forecasts, the ability to access information through WhatsApp groups, and more information sharing through community mobilizers. One group mentioned that people are not currently using weather information because they don't trust it. The groups also had a number of suggestions for how forecasts can be made more accessible, especially for those with disabilities, including providing forecasts in local languages and use of sign language on television. There were also requests for more detailed forecasts, forecasts that explain the likely impact of weather, and for more seasonal and agriculture-focused forecasts.

Table 33. Focus Group List of Actions in Response to Severe Weather, and their Costs and Benefits

Action	Relevant Weather Risk	Cost of Action	Benefit of Action	Impact of Information on Action	Barriers to Action
Install solar fan or ceiling	Heat	About £32		With enough time, can save for investment	Cost, renters can't (or have less incentive to) invest in house improvements
Move to other house/location	Thunderstorm or Flooding	If have to rent another house, rental		Gives them time to move	Need an option for where to go
Move belongings to safer locations	Thunderstorm or Flooding, Heat			Gives them time to move items	
Change where and when you sell (food and livestock venders)	Heat	Potential loss of business	Avoided loss of fruit or veg stock estimated at £3 per day	Inform decision about if, when and where to sell	

Avoid unsafe buildings or trees	Thunderstorm or Flooding	No cost		Useful to be able to prepare	
Avoid going out	Thunderstorm or Flooding, Winds	No cost		Know when to avoid going out – note, at least one group specified they would prefer information 2-3 days in advance	
Change when to go out, eg go out early	Heat			Use information to modify schedule, eg collect veg early	
Secure livestock in home or pen	Thunderstorm or Flooding, Drought	Cost of building a pen, health risk of keeping animals in house	Reduced loss of livestock (an internet search values a goat at about £60 in Zambia)	Gives them time to move animals or build pens	Cost, health risk of animals inside
Rent home with toilet	Flooding	Rent for a home with no toilet is about £16, versus £48-64 for house with accessible toilet	Improved		
Collect water in jerry cans	Drought	£0.38 per jerry can filled (Zambia) (Jerry can is normally 20 – 25 litres) £0.06 for 20 litres (Mozambique)			
Bring water to farm	Drought	Animal needs 20 litres of water a day, £0.06 for 20 litres (Mozambique)			
Stockpile food	Drought				
Fortify house with stronger roof, or sandbags on roof	Winds	About £320 for a new roof for 2 room house; in Mozambique cited about £9.20 for a roofing sheet size unclear.	Note: this might also be the value of loss avoided if the wind destroys old roof and repair is needed. Didn't know cost of sandbags for roof.		
Fortify house with sand	Thunderstorm or Flooding	About £32 for tipper of sand			
Change ag practices, eg grow different foods,	Drought		Avoided loss of maize seed for ½ acre valued at £6	Need seasonal forecasts to do this	Lack of water sources for irrigation

plant different location, save seed for next year			Another group priced commercial seed at £2 per kg – about £10 for half an acre.	
Drink more water, bathe to cool	Heat	Small additional water cost		Warning "useful". One group noted they do not get early warnings, so can't prepare.
Traditional practices	Thunderstorms			
Switch off electronics	Thunderstorms			Weather information viewed as useful
Don't dry crops outside	Wind			Need forecasts to do this
Dress appropriately	Heat			

What actions can people take to reduce actions, and what type and timing of weather information is needed?

Both the focus group discussions and the quantitative user survey included questions about what actions people do take, or could take, to reduce the negative impact of extreme weather events, if they receive timely weather information. The results from both sources were used to develop a list of actions that community members view as realistic, and categorise them according to the type of impact they mitigate, and the type and timing of weather information that is needed to be able to effectively take this action. This information can be used to validate assumptions about the type of impact that improvements in different weather services are likely to have in terms of avoided losses. The results are shown in Figure 22.

Figure 22. Loss Avoidance Actions, by Type of Loss, and Timing of Information to Take Action

	Nowcasts/Alerts	Forecasts	Seasonal Forecasts
Save Lives	Avoid dangerous areas, stay home, avoid trees/downed powerlines	Close schools, evacuate risk areas	Major home improvements
Health	Carry water, drink more	Carry water, stock water/food	
	Prepare mentally, traditional/religious practices	Install solar fan	
Comfort/ Convenience	Dress appropriately, carry umbrella	Dress appropriately, carry umbrella	
		Purchase clothes, umbrella, boots	
Lifestyle/ Activities	Don't do laundry	Plan events, eg weddings	
	Plan time/location of activities	Plan time/location of activities	
Livelihoods	Protect productive assets, perishable inventory	Protect productive assets, perishable inventory	Make crop, planting decisions
	Secure livestock	Harvest early, move items from farms	
	Close windows, fortify home		
Property	Turn off appliances	Buy sandbags, bricks to weight roof	Major home fortification
	Move valuables to safe places		
Community	Share weather information, check on people with disabilities		

Key Informant Interviews

Key Informant Interviews (KIIs) were conducted with four members of the stakeholder coordination team, the user engagement lead, two members of the meteorological training team, and one member of the meteorological services team. Two additional members of the meteorological services team were sent interview requests, but did not respond. The KIIs focused on the impacts that the team members saw at the levels of weather information systems, and in communities, as well as their feedback on what went well and should be replicated in future programmes, and what did not work and should be changed.

Impact on capacity to generate early warnings (weather information systems level): KII respondents consistently reported observing increased capacity for nowcast production, impact-based forecasting, and other improvements in forecasting and dissemination at the level of individual forecasters participating in the trainings and testbeds. This was evidenced by use of case studies, in which participants had to present a case study on a weather event in their area, and how they would go about developing and issuing warnings. On KII respondent reported that this method demonstrated that "the knowledge came across". Several KII respondents also described forecasters as experiencing mindset change and increased awareness of the importance of designing weather information messaging to be accessible and inclusive, and cited innovations in forecasting such as translation into more local languages, translation into sign language, use of less technical terminology, and use of more visualizations.

However, many of the KII respondents raised concerns about the ability of the meteorological services' ability to fully implement these innovations, including nowcasts, largely due to the limited resources within these agencies. Standard operating procedures for nowcasts were developed, but one respondent described them as needing to be adapted to each country. There was a view that implementing nowcasting would be a process requiring developing customized approaches in each of the three countries, and careful consideration of what is realistic given financial and other resources. Potential barriers to implementation mentioned included insufficient staffing, including need for night shift staffing, and no (or poorly functioning) radar systems.

Despite these limitations, KII respondents described several innovations that were—or are in the process of being—implemented on a larger systems level due to WISER EWSA. This included Mozambique and Zambia beginning to issue alerts using the Common Alerting Protocol, which can be viewed on the Alert Hub. According to the respondent, "now the alerts are better crafted, and can reach targeted audiences." SAWS was also reported to be planning a training on use of early warnings and impact-based forecasting for local officials.

Impact on awareness of early warnings among, and collaboration with, disaster risk management and other intermediary organizations (weather information systems level): In general, engagement with intermediary organizations and disaster risk management institutions was described as mixed. For example, in South Africa, local disaster management officials were described as very engaged in activities like testbeds: "In the community that was identified, the disaster management structures there were quite engaged and still are engaged. The two intensive, as well as king sized test beds, they were very involved." However, provincial level officials were described as less involved. In addition, the presence of non-governmental intermediary organizations focused on people with disabilities was found to be less robust than expected in some of the targeted locations, leading the project to pivot to working through schools, or with organizations focused on working with elderly people.

The respondents were confident that participants from disaster risk management institutions had increased awareness of early warnings and impact-based forecasting as a result of programme activities, and some improved engagement. Disaster risk management institutions, particularly at local level, were described at being critical to impact-based forecasting processes, as they can help provide information about communities, including disaster risk management capabilities, that is needed to predict impact of severe weather events. "Pre-WISER, municipality and met services were involved in early warnings. What WISER did: it raised and improved involvement." On the side of community engagement, increased integration of people with disabilities into disaster risk management committees was reported.

KII respondents were uncertain whether increased awareness was translating into impact on operations: "To what extent it translates into daily activities is the uncertainty." However, there was optimism that over time, the new procedures created under WISER EWSA could result in better relationships between disaster management structures and meteorological services.

Impact on progress towards new business models to finance improvements in weather information services (weather information systems level): KII respondents struggled to identify examples of concrete steps in this area, and saw lack of action as a major constraint to the potential impact of WISER

EWSA. The respondents described increased awareness at the technical level of what types of resources are needed for nowcast production, including staffing requirements. They credited the testbeds with not only demonstrating the importance of these resources, but also their feasibility. There was hope that this awareness would translate into internal advocacy for resources: "We are hoping that will give them the motivation to go to superiors to request additional funds to support people working at night, because it is important to save lives and property." Respondents also cited hope that the sustainability model that was presented to directors at the meteorological services and ministries would provide a further push for allocating this funding, but noted that "only time will teach us if those recommendations will be implemented", and feared that "lack of proactivity for looking for money could be a barrier. There may need for another intervention."

The one example of a new business model that is actively being explored was in South Africa, focused on looking at how to improve the sustainability of community mobilization. There is reported discussion of looking at how to use simple incentives, such as discounts on food, to support ongoing engagement by community members who participated in WISER EWSA.

The KII respondents also described a number of valuable lessons learned with respect to sustainability and viability of business models as a result of the project. For example, through implementing the intensive testbeds and king-sized testbed, participants were able to see firsthand the resources needed to produce nowcasts, and identify gaps, such as staffing and radar data. The king-sized testbed was seen as being a more realistic model for the meteorological services, especially in Zambia and Mozambique. These lessons—and the proof that nowcasts can be successfully implemented—are likely to be important in advocating for and designing realistic, country-specific implementation.

The respondents also mentioned some outcomes that could lay the groundwork for attracting more resources for improved early warning systems, including global and regional recognition that WISER EWSA has received for its work, and increased connections between stakeholders, including potential funders. They also described seeing increased demand for weather services at the community level, and evidence of spillover effects in this area; in Mozambique, interest in improved forecasts led to two additional Districts participating in programme activities.

Impact on access to weather information (community/household level): KII respondents reported that WISER EWSA resulted in people in the targeted three communities accessing weather information through a number of new media, including WhatsApp, webpages, social networks, church forums, schools, community forums, and intermediary organizations. While some of these mechanisms were pre-existing, such as Facebook pages, these were not fully functioning or utilized. Receiving information through family, friends and neighbours, a mechanism that is particularly important for those with difficulty seeing or hearing, was described as strengthened, as community mobilizer networks grew (in some cases the number of volunteers tripled) and their capacity improved. An important lesson KII respondents described is that communities have more ability to use technology to access information that many people assume, making media like WhatsApp and webpages an important part of communication strategy.

The KII responses also demonstrated that WISER EWSA has prompted important conversations around the responsibility and role of meteorological services in access to forecasts and early warnings. In addition to the mindset change earlier described around issuing forecasts in local languages and accessible terms, one of the KII respondents working with meteorological services described how WISER EWSA—and the deaths of over 400 people in the 2022 floods in KwaZulu-Natal—prompted them to grapple with the role of meteorological services is in forecast dissemination: "I've got headaches thinking, is this the remit of the national met service? But met service fails if warnings don't go out to those on the ground." These conversations may result in better systems for providing access to weather information systems in the future.

Impact on use of weather information (community/household level): KII respondents did not provide any specific examples of community members using weather information to take actions to avoid losses during the course of the programme. However, they did cite examples of increased capacity and propensity to take action. One of the most striking outcomes they described was increased understanding of weather forecasts, and associated trust in them. They described participants as having a greater understanding of forecasts as representing a risk—rather than a certainty—of a weather event. As a result of this understanding, they were more forgiving of differences between forecasts and actual weather outcomes. Communities, especially those with disabilities, were also described as having an improved perception of the usefulness of weather forecasts and warnings. Finally, although they did not see examples of actions taken in response to weather information, they reported that community members were able to clearly articulate how they would use forecasts to improve outcomes, including providing examples specific to their jobs or livelihoods.

Synthesized Conclusions

This section summarizes key findings from the project evaluation, by evaluation question.

What was the impact of the programme among the targeted communities in Mozambique, South Africa, and Zambia, particularly for those with disabilities?

- There was **strong evidence of sustainable innovations in limited areas**, such as adoption of Common Alerting Protocol for alerts by Zambia and Mozambique, new links for disseminating dam discharge information to communities in Mozambique, and possibly changes to language, terminology, and visuals in forecasts to make them more accessible and inclusive, from key informant interviews and Stories of Change.
- There was **strong evidence of improved capacity among forecasters** to produce nowcasts and design accessible and inclusive warnings; and increased focus on dissemination, from nearly all key informant interviews conducted.
- However, there was **limited evidence for systemic changes that would be needed to widespread adoption of nowcasts,** including concrete steps towards implementing new

business models, to support sustained and country-wide adoption of nowcasts; several key informant interview respondents expressed reservations that the service would be scaled.

- There was **mixed evidence of increased capacity and engagement with intermediary organizations to support nowcast use and dissemination**, with key informant interviews suggesting that some organizations were highly involved, and project reporting recording a large number of organizations participating in events, but also a need to pivot to different types of organizations, and key informants describing less engagement for some intermediaries.
- There was **strong evidence of increased interest, understanding, and trust in forecasts, and demand for them, among targeted communities**, from the user surveys, focus group discussions, key informant interviews, and stories of change, and **some examples of positive spillovers outside the targeted communities**, such as the participation of two additional Districts in Mozambique
- There was **strong evidence of increased access to weather information among targeted communities** through wide range of media including technology, from the user surveys, key informant interviews, focus group discussions, and Stories of Change. There was limited evidence of increased access to weather information in other communities, in part due to limitations in the data collected.
- There was **somewhat limited evidence of increased avoided losses to date in the targeted communities**, and very limited evidence of increased avoided losses to date at the national level, in part due to limitations in the data collected. What evidence there was suggested that the impact fell short of the very ambitious targets. **There was some evidence of increased capacity and propensity to use forecasts, and some evidence of increases in low-cost actions** like staying in during bad weather, among targeted communities, from the user surveys, focus group discussions, Stories of Change, and participant interviews in project reporting.

Did the programme achieve its goals with respect to targets, transformational change, sustainability, and cost effectiveness?

Targets

WISER EWSA achieved or surpassed all but one of its output and outcome level targets, showing good ability to execute its planned activities, and achieve results largely within project control.

In terms of impact targets, the project surpassed its target for direct beneficiaries with improved ability to avoid or reduce damage caused by extreme weather conditions through access to co-produced nowcast alerts. For indirect beneficiaries, the project reported reaching 5.5 million people, against a target of 5 million. About 400,000 of these individuals represent members of the three communities where nowcasts were targeted, and the estimate is based on evidence including the user survey results. For the remaining individuals, the estimate is based on estimates from SAWS of listenership for their

existing dissemination channels, through which they report sharing forecasts improved with support from WISER EWSA; there is a greater deal of uncertainty around the accuracy of that estimate.

For the value of avoided losses from extreme storm events to urban populations, it is estimated that the programme created about £1 million in avoided losses, of which 70% was for urban populations, falling short of the £10 million target. These estimates rest on a large number of assumptions; the majority of estimated avoided losses are for South Africa, which had extremely limited data to support the analysis. However, as described in the SEB Analysis, much of the benefit of the project is likely to occur going forward. Therefore, a complete analysis of cost effectiveness should include estimates for future benefits in addition to benefits accrued to date; the SEB Analysis suggests that when future benefits are accounted for, the project has good potential value for money.

Overall, there is a large degree of uncertainty in terms of the project impact results, reflecting limitations in data availability and documentation, and the inherent complexity of SEB analysis using weather services value chain approaches.

An additional consideration in assessing programme success at reaching its targets is that the impact indicators include a degree of specificity, such as including only those benefitting from access to nowcast alerts, and avoided losses only for urban populations. This poses a challenge for capturing the full impact of the programme, including improvements such as producing messaging with more accessible language, with potential widespread benefit.

Transformational Change and Sustainability

For all dimensions of transformational change, at least some examples of achieving “love to see” results were documented through the Storied of Change. However, these examples do not necessarily indicate that the change illustrate is indicative of results across the project.

In the area of innovation, the markers of change are:

- Expect to see: NMHS and DRR will engage in inclusive, participatory processes supported by WISER EWSA
- Like to see: Engagement in inclusive, participatory processes under WISER EWSA will result in innovations in how nowcasts are produced and shared
- Love to see: Innovations resulting from inclusive, participatory processes will address barriers to accessing and using weather information, especially for vulnerable groups. NMWS and DRR will make innovations in the processes for developing products and services that sustainably improve inclusive participation in weather services design

The evidence from project reporting on participation, key informant interviews, Stories of Change and focus groups suggests that trainings and testbeds were very effective at including women, elderly people, and people with disabilities, and that these activities did result in changes in how nowcasts were shared in communities; there was also evidence that these helped address barriers to access to weather information. There was also some evidence that some of these changes, especially in the targeted communities, would be sustainable. There is limited evidence of sustainable change that addresses barriers to access and use at a national level. Therefore, **in the area of innovation, the project appears**

to have achieved its "expect to see", "like to see", and to some extent its "love to see" transformation goals.

In the area of scale, the markers of change are:

- Expect to see: Participatory processes supported by WISER EWSA will reach the targeted number of direct beneficiaries.
- Like to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services for existing audiences for these partners.
- Love to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services that reach and attract new, inclusive audiences for these partners.

Evidence from project reporting on activities shows that the project exceeded its target for direct beneficiaries. There is some evidence for improved products and services, especially in the targeted communities, but more limited evidence at the national level, which is relevant to scale. There is good evidence that the activities created new interest and demand for products in the targeted communities, from the user surveys, focus groups, and key informant interviews, and some spillover effects outside those communities, such as interest from additional Districts in Mozambique. Therefore, **in the area of scale, the project appears to have achieved its "expect to see", "like to see", and its "love to see" transformation goals at the level of the targeted communities, but not yet at the national level.**

In the area of Replicability/Sustainability, the markers of progress are:

- Expect to see: Weather information services designed to be inclusive will become more available, and urban populations in the three countries will become more aware of their existence, how to access them, and how to use them to make choices that reduce negative impact of severe weather
- Like to see: Targeted populations will take actions based on access to inclusive weather services that reduce the negative impact of severe weather, and NMHS and DRR will take steps to institutionalize provision of inclusive weather information services
- Love to see: Urban populations benefitting from inclusive weather information services will increase their engagement with NMHS and DRR to advocate for and support inclusive weather information services, NMHS and DRR intermediaries will apply co-production and other inclusive approaches to development of other products and services, or other MNHS and DRR intermediaries will replicate approaches

As with scale, in the area of replicability and sustainability, there is stronger evidence at the level of the three targeted communities, where there is strong evidence from user surveys, focus groups, and key informant interviews of greater availability of inclusive weather services, and awareness of them. There is also some evidence of some actions taken to reduce weather impact, and institutionalization of inclusive approaches within the three targeted communities. However, evidence for this is limited at the national level, and there was little evidence found of NMHS or DRR intermediaries applying co-production processes to other services, or these approaches being replicated elsewhere within national

systems as of the end of the programme. Therefore, **in the area of replicability and sustainability, the project appears to have achieved its "expect to see", and to some extent its "like to see" goals at community level, but has not achieved its "love to see" transformation goals**.

Cost Effectiveness

The SEB Analysis findings were used to estimate avoided losses to date due to the programme of about £1 million, against a programme budget of £2 million. In addition, the SEB analysis estimates that with additional modest and cost-effective investments by the NMHSs, avoided losses over the coming years could be much larger. This suggests that the programme has potential to deliver good value for money, contingent on the capacity improvements at NMHSs being sustained or even scaled within the organization. However, the SEB Analysis relied on a large number of assumptions that lack empirical evidence to back them, so there is a high degree of uncertainty in these estimates, as well as the risk that the NMHSs will be unable to sustain and replicate nowcast production and other improvements.

What aspects of the theory of change were validated, and which require adaptation?

This section summarizes the theory of change developed at the start of the WISER EWSA project, the extent to which the theory of change held true, and the assumptions that the evidence suggest did not hold, and that should be adapted when considering future programme design.

Barriers: The WISER EWSA Theory of Change identified four key barriers: technology barriers and capacity barriers on the NMHS side, demand barriers on the community side, and communications systems barriers. All of these proved to be applicable. The programme showed very good proof of concept for being able to overcome demand barriers. On the side of NMHS, there was evidence that the approach can address individual capacity constraints, but technology challenges, as well as institutional capacity barriers, proved to be a greater barrier than anticipated.

Activities: All WISER EWSA activities described in the theory of change were carried out, with some minor adaptations.

Outputs:

- **Urban populations who know how to access, understand and use early warnings**: There was strong evidence from multiple sources that community participants in WISER EWSA, and their social networks, have increased interest in, and capacity to use early warnings and other forecasts.
- **Awareness of nowcast potential for DRR, especially among intermediary organizations**: This was mixed, with strong evidence of results for some intermediary organizations. A large number of organizations participated in trainings. Achievement of this output was constrained by the limited number of high capacity organizations in this space, particularly those working with people with disabilities.
- **Business models for co-produced EW sustainability**: A business case was presented to government officials, and there is evidence for some ideas for new business models. However, no complete business models—including plans for operationalization--- for replicating nowcasts

in other districts were identified, and key informant respondents reported scepticism about sustainability.

- **Improved capacity to generate EW and co-produce alerts in 3 countries**. There is strong evidence of increased capacity at the level of individual forecasters, and system capacity at the level of the three targeted community, but little evidence of sufficient systems capacity at national level to support replication.

The original theory of change identified several assumptions for achieving outputs: interest and capacity of user groups to actively participate in the co-production process and take action based on alerts; capacity of NMHS to dedicate staff to training and communicating nowcasts; and interest of DRR intermediary users to use and communicate nowcast EWs. There was strong evidence of interest and capacity among communities, including people with disabilities. Although there were some initial challenges with NMHS participation, the testbeds proved successful at engaging them. DRR capacity for full participation proved to be mixed; this appears to be a key context factor in creating successful links between improved weather forecasts, and their dissemination and use in communities.

Outcomes:

- **Greater demand for nowcasts within a suite of weather and climate information across timescales.** There was strong evidence of this at the level of the targeted communities, from user surveys, focus groups, Stories of Change, and key informant interview. There was also some evidence of this effect outside targeted communities; for example, additional Districts in Mozambique asking to participate in programme activities.
- **Strengthened links between NHMS and DRR organisations and user groups for sustainable generation, communication and use of nowcast EWs.** The evidence for this is mixed; while there were a couple examples of strong collaboration, such as engagement with Wings of Change, and the integration of people with disabilities into disaster risk management committees, other DRR organisations and intermediaries were less engaged or absent.
- **Sustainable (technical and funded) capacity for co-producing nowcasts in countries of Africa.** While the testbeds appear to be a good mechanism for robust learning and developing capacity in terms of forecaster capacity, there is limited evidence of sustainable technical system capacity for co-producing nowcasts, and very limited evidence of funding for it at this point.

The key assumptions for outputs translating into outcomes included that NMHSs had sufficient capacity to keep generating and communicating nowcast products; interest from intermediary organisations and user groups to receive and act upon nowcasts and alerts; and ongoing government (on budget) or organisational support for the co-production process. While it was reported that the NMHSs hoped to continue to provide nowcasts and other forecasts integrating learning from the project, as of the end of the project, there was little evidence that the NMHSs had made sufficient budget allocations or changes to staffing that would be required to replicate production of nowcasts. Based on feedback from key informant interviews, the NMHSs may require further support to develop and implement plans for funding these services, and improving capacity for generating and disseminating weather information products.

Impact: Reduced negative effects (lives saved and reduced economic losses) of extreme storm events

There was some evidence of improved capacity to access weather information and use it to avoid losses from severe weather within the three targeted communities, based on the user surveys, focus group discussions, and participant quotes in project reporting. However, there was little evidence of reduced losses at a national level, in part due to limited data on users outside the three targeted communities.

Weaknesses in the theory of change: The key weakness in the theory of change appears to be the assumption, explicitly identified at project start, that NMHSs would have sufficient capacity to continue producing and disseminating inclusive nowcast products. It was recognized that while the project would work with these organisations to identify and demonstrate the viability of business models to support these investments, they would also require financing outside the scope of WISER EWSA's work. It is still possible that this will happen, as all three NMHS are working on proposals for further funding. However, it is important to acknowledge the time that may be required to find funding and implement these changes—as well as other potential support that may be needed to move from a business case to a fully operational business model, especially in the context of NMHSs that may already be stretched in terms of staff time, or technical staff that lack experience with government budgeting or grant application processes. A project that wants to be sure this part of the theory of change can be achieved is likely to require a substantial run time and budget for consistent institution building.

An additional weakness in the theory of change was with respect to the role of intermediary organizations. While many organizations participated in WISER EWSA activities, indicating interest, only a small number appeared to play a meaningful role in creating sustainable links between NMHSs and communities, including communities of people with disabilities. This reflects in part a dearth of high capacity organizations and institutions working in this space. The extent to which it is realistic to assume that intermediaries can play the role of championing better weather information and dissemination is thus likely to be highly context specific.

Unanticipated Results and Mechanisms for Change: There were a couple outcomes and observed mechanisms for change that were not explicitly identified in the original theory of change. The first was an unanticipated positive outcome for programme participants: members of marginalized groups, specifically people with disabilities, who participated in testbeds, joined disaster risk management committees, or who recruited to act as community mobilizers, reported feeling they experienced increased social standing as a result of their role providing high quality, valuable weather information in their communities. The second was the link between understanding forecasts, trusting them, and seeking out and using them. There was evidence from key informant interviews, user surveys, and focus groups that community members who participated in programme activities had a better understanding of forecasts, were more forgiving of forecasts that did not perfectly predict weather in their area, and had greater trust in forecasts. This in turn was described as resulting in more interest in them, and greater propensity to seek them out and act on them.

What are the lessons learned for future projects?

The project evaluation identified a number of lessons for future projects, including things that worked well, which should be replicated or built on, and things that should be changed or improved in future projects. Some of the key lessons included:

- WISER EWSA found that training approach matters. For engaging NMHS forecasters, online training not effective. However, the in-person testbeds were seen as very effective, especially the king-sized testbed, which was seen as the most realistic fit for NMHS capabilities. There was high confidence that the final methodologies for training would be very effective if applied in future programming.

- The WISER EWSA community engagement approach very effective at including people with disabilities, and at increasing their interest in, understanding of, and access to weather information, and that inclusive co-creation had additional positive benefits in terms of social status for participants. However, there are questions about how to make this level of community engagement sustainable.

- Related to the issue of creating sustainable systems for engaging marginalized communities, engagement by intermediary organizations was uneven, with implications for impact especially at systems level. Understanding the landscape of organizations working with people with disabilities and disaster risk management organizations and government institutions, including their will and skill to play a role in weather information dissemination, is important for understanding the feasibility of approaches aimed at improving weather information services. Incorporating intermediary organizations as full partners could be considered to ensure full buy-in.

- The project appears to have encountered more constraints within the national meteorological and disaster risk management systems than expected, including limitations in terms of staff skills, time availability, weather data and communications technology, staffing structures, and financial resources. The number and severity of these constraints raised concerns about the likelihood that NHMSs would be able to institutionalize nowcasts at country level. There do appear to be opportunities for “low hanging fruit” improvements, such as ensuring all dissemination mechanisms are working, and ensuring the language in forecasts is accessible, that could be achieved through efforts to addressing general capacity, efficiency and coordination challenges within the NHMS, but institutionalizing these changes at national level would likely require on going support over a longer-term period.

- Related to the previous lesson, there appeared to be a mismatch between the targets for WISER EWSA, the context in which the programme was working, and the resources and strategies of the programme. The project demonstrated proof of concept for many of individual activities in terms of achieving immediate outcomes. However, this did not appear to be sufficient to create certainty of sustainable change at the national level. The project correctly identified the willingness and ability of NHMS to find additional resources to support these changes as a key assumption, and attempted to support this by sharing business case data, and using testbeds to

demonstrate value of nowcasts at technical staff level. However, given the number of constraints, the institution building needed to support many of these changes permanently and at scale likely requires more time, funding, and dedicated and persistent capacity building support than the project design allowed for. This is especially true for weather information services related to extreme weather events, as the procedures for these are not practiced on a daily basis, and thus are likely to take longer to become entrenched.

- Impact indicators could be designed more broadly, to allow for flexibility and adaptation in programme approaches, and to ensure that the full range of benefits is captured in project reporting. For example, the impact indicators for this project on number of people with improved ability to reduce losses specified that this be due to nowcast access; the value of avoided losses was only for urban populations. However, through the co-production, training, and testbed processes, a number of improvements in forecast quality and accessibility in alert messaging, such as producing forecasts in local languages and accessible terminology, were identified with potential to create positive impact across a wider range of weather information services. While the project team appears to have capitalized on some of these opportunities that fell outside nowcast production alone, broader indicators would help to incentivize such adaptation, and capture unintended positive consequences.

- For many outcomes, especially at the impact level, there was limited rigorous evidence, and confidence in findings was low. The project was attempting to look at outcomes across several system levels – meteorological systems, disaster risk management and other intermediary systems, communities, and individuals—and comprehensive avoided losses for a range of severe weather events. In addition, there was the added complexity of implementation targeting direct participants, indirect beneficiaries in targeted communities, and indirect beneficiaries at national level. The user survey, while generating some very valuable learning around project impact and use of weather information, was limited in quality as a result of relying on implementation staff for data collection, and there was no similar data collection activity outside of the three target communities to provide evidence of impact at the national level. As a result, estimates of people benefitting from improved services and the SEB Analysis were highly dependent on (and sensitive to) assumptions that did not have strong empirical backing. If higher quality estimates are desired for future programming, additional MEL resources should be considered.

Annex A: WISER EWSA Logframe

Impact		Linked to WISER Africa Result	Indicators	2023 Annual Transformation Score	Baseline data and source	Results LOP		Data Source	Frequency of Data Collection	Disaggregation of Data
Impact:	Reduced negative effects (lives saved and reduced economic losses) of extreme storm events	Impact: People in Africa, especially the most vulnerable, have improved resilience and countries adaptive capacity to prepare for and respond to the effects of climate change through improved use of weather and climate information services	Number of people (disaggregated by gender, age and disability) with improved ability to avoid or reduce damage caused by extreme weather conditions through access to co-produced nowcast alerts: Direct Beneficiaries			Target	270	annual survey (end 2023, end 2024, end 2025)	6 months	gender, age, disability status
						Actual	795			
			Number of people (disaggregated by gender, age and disability) with improved ability to avoid or reduce damage caused by extreme weather conditions through access to co-produced nowcast alerts: Indirect Beneficiaries			Target	5 million	endline survey and systems mapping	Endline	gender, age, disability status
						Actual	5,351,168			
			Value of avoided losses from extreme storm events to urban populations (disaggregated by gender, age and disability)			Target	£10 million	endline survey; stories of change; SEB analysis; monitoring reports	Endline	gender, age, disability status, direct and indirect beneficiaries
						Actual	£743,450			

Outcomes	Outputs		Linked to WISER Africa Result	Indicators	2023 Annual Transformation Score	Baseline data and source	Results	2025	Data Source	Frequency of Data Collection	Disaggregation of Data
Outcome 1:	**IO1: Strengthened links between NHMS and DRR organisations and user groups for sustainable generation, communication and use of nowcast Ews**		**Outcome: Greater and improved use of WISER weather and climate information services and evidence/analysis strengthening policy, planning, resource allocation and other resilience, innovation and investment decisions amongst users at regional, national and community level in Africa**	IO2: Number of organisations and institutions with improved/greater access to weather and climate information services (ICF KPI 15: Scale; Sustainability)		0	**Target**	**40**	**Project surveys**	**6 months**	**type of organisation (RCC, NMHS, DRR, etc)**
							Actual	**68**			
	Output A:	Urban populations who know how to access, understand and use Ews	**Output 1: Strengthened co-production between producers, intermediaries and users to improve the uptake and use of WISER weather and climate information services across weather to climate timescales**	Op1.1: Number of People (women, men, PWDs, young people and older people and other groups identified as marginalised) in producer, intermediary and user organisations trained in areas related to the generation, co-production and use of weather and climate information services, of which 70% agree the training is useful (ICF KPI Replicability)		0	**Target**	270	**training reports and post training surveys**	**6 months**	**gender, age, disability status**
							Actual	**1094**			

		(additional indicator relating to output A)		Op1.3: Number of People (women, men, PWDs, young people and older people and other groups identified as marginalised) engaged in co-production processes with > 70% rating the process to 'improve' or 'considerably improve' their ability to use weather and climate information in their decision making (ICF KPI 15: Replicability)		0	**Target**	270	**training reports and post training surveys**	**6 months**	**gender, age, disability status**
							Actual	795			
	Output D:	Improved capacity to generate EWs and co-produce alerts in 3 countries	**Output 3: Strengthened designated producers' capacity to deliver WISER weather and climate information services**	Op3.1: Number of RCCs and NMHSs with improved ability to generate and deliver enhanced weather and climate information services, including CapEx to upgrade technology and hardware (ICF KPI 15: Scale)		0	**Target**	6	**Training attendance records, post training surveys, project surveys, and evidence of nowcasts being generated**	**6 months**	**none**
							Actual	4			
	Output B	Awareness of nowcast potential for DRR, especially among intermediary organisations	**Output 2: Strengthened global, regional and national networks, partnerships and coordination mechanisms to support the improved generation, uptake and use of**	Op2.1: Number of global, regional, national and local forums, decision-making platforms and cooperation mechanisms established or strengthened that support user led weather and climate information services, and plans for continued sustainability (ICF KPI 15: Sustainability,		0	**Target**	9	**project surveys, systems mapping**	**6 months**	**none**
							Actual	**21**			

			WISER weather and climate information services	evidence of effectiveness is shared)							
		(additional indicators relating to outputs D and B in particular)	Op4.3: No of evidence products rated useful by key institutions/users supported by WISER (ICF KPI 15: Replicability)	Op4.3: No of evidence products rated useful by key institutions/users supported by WISER (ICF KPI 15: Replicability)		0	**Target**	6	project surveys	**6 months**	**none**
							Actual	16			
		(additional indicators relating to outputs D and B in particular)		Op4.2: Number of evidence/knowledge products produced by organisations supported by WISER to influence use of services and analysis in decision-making (ICF KPI 15: innovation?)		0	**Target**	6	project surveys	**6 months**	**none**
							Actual	10			
Outcome 2:	**IO2: Sustainable (technical and funded) capacity for co-producing nowcasts in countries of Africa.**		**Outcome: Greater and improved use of WISER weather and climate information services and evidence/analysis strengthening policy, planning, resource allocation and other resilience, innovation and investment decisions amongst users at regional, national and community level in Africa**	IO3: Number of new or enhanced weather and climate information services being delivered in line with agreed standard operating procedures (of which specifically integrate GESI) (ICF KPI 15: Scale; Sustainability)		0	**Target**	3	report from NMHS	**6 months**	**none**
							Actual	3			

	Output C	Business models for co-produced EWs sustainability	**Output 4: Strengthened enabling and policy environment for better delivery, use and sustainability of WISER weather and climate information services**	own indicator 1: No of NMHS with business models developed		0	**Target**	2	**report from NMHS**	**6 months**	**none**
							Actual	2			

Annex B: Transformation Progress Marker Capture Sheet

Dimension of transformation: Innovation
Summary of expected transformation benefit: NMHS and DRR will develop processes that allow for inclusive, participatory input into the design of nowcasts and the systems for delivering them, resulting in innovations in product and delivery
Boundary partners: NMHS and DRR direct partners and direct beneficiaries in three target countries
Progress markers:
Expect to see: NMHS and DRR will engage in inclusive, participatory processes supported by WISER EWSA
Like to see: Engagement in inclusive, participatory processes under WISER EWSA will result in innovations in how nowcasts are produced and shared
Love to see: Innovations resulting from inclusive, participatory processes will address barriers to accessing and using weather information, especially for vulnerable groups NMWS and DRR will make innovations in the processes for developing products and services that sustainably improve inclusive participation in weather services design

Dimension of transformation: Scale
Summary of expected transformation benefit: A sufficient number of direct beneficiaries will be reached to result in systemic positive impact on weather information services, which will in turn result in
Boundary partners: NMHS and DRR direct partners and direct beneficiaries in three target countries
Progress markers:
Expect to see: Participatory processes supported by WISER EWSA will reach the targeted number of direct beneficiaries.
Like to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services for existing audiences for these partners.
Love to see: Process and capacity improvements supported by WISER EWSA at NMWS and DRRs will result in improved products and services that reach and attract new, inclusive audiences for these partners.

Dimension of transformation: Sustainability and Replicability
Summary of expected transformation benefit:

Improvements in weather information services will be reinforced by increased awareness – and realization—of the benefits of weather services, resulting in increased demand for high quality services that meet the needs of different groups, creating a virtuous circle supporting sustainability and crowding in effects
Boundary partners: NMHS and DRR direct partners and direct and indirect beneficiaries in three target countries
Progress markers:
Expect to see: Weather information services designed to be inclusive will become more available, and urban populations in the three countries will become more aware of their existence, how to access them, and how to use them to make choices that reduce negative impact of severe weather
Like to see: Targeted populations will take actions based on access to inclusive weather services that reduce the negative impact of severe weather, and NMHS and DRR will take steps to institutionalize provision of inclusive weather information services
Love to see: Urban populations benefitting from inclusive weather information services will increase their engagement with NMHS and DRR to advocate for and support inclusive weather information services, NMHS and DRR intermediaries will apply co-production and other inclusive approaches to development of other products and services, or other MNHS and DRR intermediaries will replicate approaches

Annex C: Endline survey

WISER EWSA - ENDLINE - Zambia.pdf

WISER EWSA - ENDLINE - South Africa.pdf

WISER EWSA - ENDLINE - Mozambique.pdf

Annex D: EWSA Endline Focus Group Discussion Protocol

I. Interview Summary Information

Country	
Community Name	
Date	
Interviewer Name(s)	

II. Consent

Thank you for your interest in this focus group discussion. I am working as part of a team to investigate the ways in which people living in cities are currently accessing and using weather forecasts and early warnings. The information will be used by the Zambia Meteorological Department and other partners to inform the development of forecasts and early warnings for severe weather events. It Is up to you to decide if you would like to take part. If you would like to participate, I will talk through a number of statements to check you understand about taking part. If you change your mind, you can stop at any time. You don't have to say why if you don't want to.

I will ask you about your experiences of extreme weather and access of weather forecasts and early warnings, as well as some demographic information. Your name and contact information will not be collected, so your responses will be anonymous.

Please ask if there is anything you don't understand, or that I have not explained properly?

	Do all participants respond affirmatively?
Do you confirm that you have understood the objective of this focus group?	☐ Yes ☐ No
Do you understand that your participation in this focus group is voluntary and that you are free to withdraw at any time without giving any reason and without there being any negative consequences?	☐ Yes ☐ No
Do you understand that no identifying information is being collected, and that your name will not be linked with the study and will not be identified or identifiable in any reports or academic publications that result from the focus group?	☐ Yes ☐ No
Do you agree that your anonymised data will be kept for future research purposes such as publications related to this study after the completion of the discussion today?	☐ Yes ☐ No
Do you agree to take part in this discussion?	☐ Yes ☐ No

III. Cost and Responses to Weather Events

I am going to ask you about the impact of different kinds of extreme weather events in your communities. *Note to interviewer: skip any weather events that are not relevant to that community.*

Extreme Heat/Heat Waves

	Lives – how often are lives lost, how many people?	**Health – what types of health issues, how often, how many people?**	**Assets – what types of assets, how often, what value?**	**Livelihoods – what types of livelihoods, how often, how much change in income?**	**Social – what types of impact?**
Can you tell me what kinds of impact or costs that event might create in your communities? *Prompt for impact on lives, health, assets, livelihoods, social. Write N/A if no significant impact in that category, and skip follow up questions*					
Are there things people can do to reduce these impacts? What are they?					
What is the cost of these actions?					
Would you rate timely, accurate weather					

information as necessary, helpful, or unnecessary to take these actions? **If necessary or helpful, explain**					
Is this impact the same for people with disabilities, women? Prompt if impact is greater, lower, or different					
What other barriers besides information prevent people from taking actions to reduce the impact of this weather event?					

Thunderstorms

	Lives – how often are lives lost, how many people?	Health – what types of health issues, how often, how many people?	Assets – what types of assets, how often, what value?	Livelihoods – what types of livelihoods, how often, how much change in income?	Social – what types of impact?
Can you tell me what kinds of impact or costs that event might create in your communities? *Prompt for impact on lives, health, assets, livelihoods, social. Write N/A if no significant impact in that category, and skip follow up questions*					
Are there things people can do to reduce these impacts? What are they?					
What is the cost of these actions?					
Would you rate timely, accurate weather information as necessary, helpful, or unnecessary to take these actions?					

If necessary or helpful, explain					
Is this impact the same for people with disabilities, women? Prompt if impact is greater, lower, or different					
What other barriers besides information prevent people from taking actions to reduce the impact of this weather event?					

Droughts

	Lives – how often are lives lost, how many people?	Health – what types of health issues, how often, how many people?	Assets – what types of assets, how often, what value?	Livelihoods – what types of livelihoods, how often, how much change in income?	Social – what types of impact?
Can you tell me what kinds of impact or costs that event might create in your communities? *Prompt for impact on lives, health, assets, livelihoods, social. Write N/A if no significant impact in that category, and skip follow up questions*					
Are there things people can do to reduce these impacts? What are they?					
What is the cost of these actions?					
Would you rate timely, accurate weather information as necessary, helpful, or unnecessary to take these actions?					

If necessary or helpful, explain					
Is this impact the same for people with disabilities, women? Prompt if impact is greater, lower, or different					
What other barriers besides information prevent people from taking actions to reduce the impact of this weather event?					

Strong Winds

	Lives – how often are lives lost, how many people?	**Health – what types of health issues, how often, how many people?**	**Assets – what types of assets, how often, what value?**	**Livelihoods – what types of livelihoods, how often, how much change in income?**	**Social – what types of impact?**
Can you tell me what kinds of impact or costs that event might create in your communities? *Prompt for impact on lives, health, assets, livelihoods, social. Write N/A if no significant impact in that category, and skip follow up questions*					
Are there things people can do to reduce these impacts? What are they?					
What is the cost of these actions?					

Rains/Flooding

	Lives – how often are lives lost, how many people?	Health – what types of health issues, how often, how many people?	Assets – what types of assets, how often, what value?	Livelihoods – what types of livelihoods, how often, how much change in income?	Social – what types of impact?
Can you tell me what kinds of impact or costs that event might create in your communities? *Prompt for impact on lives, health, assets, livelihoods, social. Write N/A if no significant impact in that category, and skip follow up questions*					
Are there things people can do to reduce these impacts? What are they?					
What is the cost of these actions?					
Would you rate timely, accurate weather information as necessary, helpful, or unnecessary to take these actions?					

If necessary or helpful, explain					
Is this impact the same for people with disabilities, women? Prompt if impact is greater, lower, or different					
What other barriers besides information prevent people from taking actions to reduce the impact of this weather event?					

IV. Costs of Inaccurate Forecasts

Weather forecasts are not always perfect. Sometimes a forecast says a weather event is likely, but it doesn't happen. What kinds of impact or costs might happen in your community if there is a forecast of severe weather, but that severe weather doesn't happen? For example, do people not go out for work? Do they have extra expenses, such as taking a bus instead of walking, or buying things to protect buildings or possessions?	
What is the typical value of these costs? *For livelihoods, what is the value of lost income?* *If people have extra expenses, what is the value of those?*	
How often does this happen?	

V. Forecast Access and Quality

What is needed for weather forecasts to be useful for people? Prompt regarding timing, method of access, content of forecast	
Has access to timely, high quality weather forecasts and information changed in your community in the past 2 years? If yes, how?	
Has access to timely, high quality weather forecasts and information for people with disabilities changed in your community in the past 2 years? If yes, how?	
What do you hope to see in the next 3 years that would help people in your community, especially those with disabilities, reduce the impact of severe weather events on their lives?	