GEAVET TRAINING PROGRAMME FOR CSA

LIVESTOCK SMART SKILLS AND CLIMATE-SMART POST-HARVEST PROCESSING:

UGANDA

UNIT 2.2 EARLY WARNING AND SEASONAL FORECAST

ENGLISH VERSION

GEAVET Project n° 101129027

Open Educational Resources

PART I – LEARNING MATERIAL

1. Introduction

Climate variability and change, and particularly extreme weather events, affect people, their livelihoods, and the natural resources on which they depend. With increasing frequency, intensity, and duration of extreme atmospheric natural hazard events already occurring and projected to worsen in the coming decades, traditional Early Warning Systems need to evolve to encompass climate change adaptation to better help communities prepare for the worst, now and in the future. The inclusion of climate change adaptation in early warning systems is essential for the development of disaster risk reduction (DRR) approaches that enhance resilience, i.e. the ability of sectors, communities and societies to resist, absorb, accommodate and recover from the effects of climate change related natural hazards. Climate information services can inform decisions that protect individuals and communities as well as the ecosystems and natural environments on which humans depend from the damaging effects of both extreme and slow-onset climate events. Many Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have identified climate services. This includes 88% of Least Developed Countries (LDCs) and Small Island Developing States (SIDS). These agreements commit governments to substantially reduce global disaster mortality, increase access to and availability of EWSA by 2030, and measure progress towards these targets (WMO 2020a). Dealing with the growing challenges of disasters associated with natural hazards is one of the most critical aspects of climate change adaptation. Around 1.4 million people (70% total deaths) in LDCs lost their lives due to weather.

2. Early Warning Systems and Their Elements

Early warning is the provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response. Early Warning Systems for Adaptation (EWSA) are part of the international framework for climate services that link science-based climate predictions, data and information with the management and mitigation of climate-related risks in support of adaptation to climate change in developed and developing countries, as well as in economies in transition. The expression ‘early warning’ is used in many fields to mean the provision of information on an emerging dangerous circumstance where that information can enable action in advance to reduce the risks involved. Early warning systems exist for natural geophysical and biological hazards, complex socio-political emergencies, industrial hazards, personal health risks and many other related risks. Presently, we are concerned with geophysical hazards storms, floods, droughts, landslides, volcanic eruptions, tsunamis, etc. and other related hazards that have a geophysical component, such as wild-land fire, locust plagues and famines which account to 45%

deaths of humans globally, Africa 35% deaths according to World Meteorological Organization (2019). However, many developing countries lack the capacity, infrastructure, technical capacity, communication systems, data-sharing and political will to react to climate disasters in their regions. Therefore, it is imperative to expand efforts to build capacity and effective early warning systems in all countries to disseminate and communicate to the most vulnerable people now and in the future.

Research conducted in various African countries show that farmers' adoption of climate related information ranged from 15% to 80%, and this depends on factors such as information accuracy, format, timing and delivery channels (Jensen et al., 2024). In Kenya and Ethiopia, studies show significant improvements in agricultural productivity and income with farmers who got access to reliable seasonal climate forecasts, with adoption rates higher among educated farmers and those with access to extension services. However, empirical evidence also reveals challenges including low literacy levels, language barriers, limited access to communication technologies and mistrust of meteorological forecasts due to previous inaccuracies.

Uganda's geographical location and climate characteristics presented unique challenges and opportunities for climate information services development and implementation. The country's position straddling the equator with diverse topographical features including mountains, lakes and varying altitudes, created complex microclimatic conditions that demanded sophisticated meteorological monitoring and forecasting capabilities (Katsanevakis et al, 2023). It is clearly known that Uganda's economy heavily depends on climate-sensitive sectors, with agriculture contributing approximately to 25% of GDP and employing over 70% of the population, making accurate and timely climate information crucial for national development (Gebre et al., 2023). Uganda in particular faces a lot of disruptions due to weather changes, for example floods in Bududa, Kasese, Bulambuli districts especially during rainy season, Isingiro district was affected by drought in 2016, locusts' invasions in Karamonja region in 2020 destroying crops which affected humans, livestock, thus reduced developments and threatened food security. Historically, records show that climate-related disasters have caused billions of dollars in damages over the past decades, with inadequate early warning contributing to severity of impacts (Tofu et al., 2023). The establishment of the Uganda National Meteorological Authority (UNMA) in 2012 represented a significant step towards improving the country's climate information services capacity, though challenges remained in terms of infrastructure, human resources and service delivery mechanisms. The context is still in place due to limited technological infrastructure, particularly in rural areas where the majority of the population resided and where climate information is most critically needed for agricultural and livelihood decisions (Teklu et al., 2023).

To be effective, early warning systems for natural hazards need to have not only a sound scientific and technical basis, but also a strong focus on the people exposed to risk, and with a systems approach that incorporates all of the relevant factors in

that risk, whether arising from the natural hazards or social vulnerabilities, and from short-term or long-term processes. Disasters are increasing in number and severity and international institutional frameworks to reduce disasters are being strengthened under United Nations oversight. It's therefore a must do intervention for all countries to take early warning systems as priority to bridge the gaps and shortcomings which destroy property, lives, livestock and cause internal displacements thus poverty levels, stress, affect economic decline.

3. References

Faith, M. J. (2014). Appropriateness of Early Warning Systems in the Management of Climate Change Impacts in the Mt. Elgon Region, Eastern Uganda

Musiimenta Nancy & Kaziro Nicholas. (2025). Climate Information Services and Early Warning Systems

PART 2 – CURRICULUM

Learning Objectives:

KNOWLEDGE	SKILLS	ATTITUDES
Students will know ● The concept of Early Warning Systems (EWS) and their four key components: risk knowledge, monitoring & forecasting, dissemination & communication, and preparedness & response. ● The available actions to be taken during any hazard., the different sources where related data and information can be found, relevant authorities that concern weather controls. ● How climate variability and climate change influence extreme weather events and disasters. ● The role of climate information	*Student will be able to:* ● Interpret basic weather information, seasonal forecasts, and early warning messages from reliable sources such as UNMA and WMO. ● Analyze climate-related risks affecting communities, including floods, droughts, landslides, and storms. These risks may range from global, continental and national. ● Use credible dissemination channels (radio, SMS/messages/alerts, apps, community structures) to communicate early warnings effectively. ● Apply practical steps for preparedness (for example evacuation planning, safe water storage, identifying shelters).	*Student will develop the following mindset:* ● A proactive will and mindset toward disaster preparedness and community safety which strengthens quick responses when need arises. ● Appreciation of the value of scientific weather information for decision-making by authority and those at risk of any hazard. ● Being responsible for safeguarding their own lives, families, and community members. ● Respect for community protocols, collaboration, teamwork and collective

services in climate change adaptation and disaster risk reduction among communities. ● Regional and national challenges such as limited infrastructure, low literacy levels, mistrust of forecasts, and communication barriers		

TRANSVERSAL SKILLS INTEGRATED:

- **Critical thinking and problem-solving:** Analyzing climate risks, interpreting information
- **Communication skills:** Clarifying warnings and explaining risk weather alerts/ messages and information to peers and community
- **Collaboration and teamwork:** Working in groups to simulate EWS procedures
- **Leadership and decision-making:** Taking initiative during emergency preparedness exercises

DIGITAL SKILLS INTEGRATED:

- Ability to use digital platforms for weather monitoring (UNMA website, mobile weather apps, online EWS dashboards).
- Basic digital literacy for accessing, interpreting, and sharing climate information.
- Responsible use of digital communication tools (SMS alerts, televisions, WhatsApp groups, community radio integration).
- Understanding digital data safety and accuracy (distinguishing verified vs. unverified data sources).

GREEN SKILLS INTEGRATED:

- Ability to make environmentally responsible decisions that reduce vulnerability to climate-related hazards.
- Skills in applying climate-smart and sustainable practices, especially in agriculture, water management, and land use.
- Capacity to integrate seasonal forecasts and climate information into livelihood planning to support adaptation.

- Understanding of how ecosystem protection (forests, wetlands, riverbanks) contributes to reducing disaster risks.
- Competence in identifying environmentally harmful practices that worsen hazards (for example deforestation, poor waste disposal) and proposing safer alternatives.
- Ability to apply principles from global and national environmental policies in planning community climate adaptation actions.
- Ability to practice low-impact behaviors such as efficient water use, proper waste management, and reduced environmental degradation.

Implementation plan of pedagogical activities - Scheme of work

Duration: 3 hours				
Target: VET Learners, Farmers, Food Processors, Extension Workers.				
No. of Activity	**Duration**	**Training method/activity**	**What the trainers do**	**What the participants do**
1.	55 min	Presentation, guided discussion, brainstorming	● Provide foundational knowledge on weather and climate concepts, including local climatic trends and drivers. ● Give overview on the data used for forecasting (e.g., weather stations, satellite data, remote sensing) and how it's collected and processed. (forecasting tools used), the roles of national	● Share local knowledge of weather patterns ● Practice reading sample forecasts and practice. ● Work in groups to discuss elements of an effective communication channels ● Analyze strengths and gaps in current warning systems. ● Understand their roles in responding to these warnings.

			meteorological services. ● Train participants to interpret standard forecast products, including parameters like temperature, precipitation, and wind, and understand forecast uncertainties. ● Guide open/group discussions when needed	● Take notes, ask questions, participate actively in the training.
2.	40 min	Presentation, open (group) discussion, Group task	● Introduce the concept of hazards, exposure, and vulnerability ● Facilitate community hazard mapping exercises. ● Guide participants to identify risk factors and hotspots and historical data on past hazards events	● Work in groups to discuss elements of an effective communication channels ● Analyze strengths and gaps in current warning systems. ● Understand their roles in responding to these warnings. ● Take notes, ask questions, and participate actively in the training.

3.	45 min	Presentation, Group work, case study, open discussions, brainstorming.	● Present a scenario requiring timely warning dissemination. ● Crafting Clear Messages based on a real scenario, easy to understand, targeting the audience, they should be on time to prevent harm early enough. ● Explain different communication (warning) channels (radio, SMS, televisions, phones alerts, WhatsApp groups) ● Establishing Credibility of warning information for it comes from trusted, recognized authorities and minimizing false alarms. ● Support groups in designing quick communication plans.	● Work in groups to discuss elements of an effective communication channels ● Analyze strengths and gaps in current warning systems ● Understand their roles in responding to these warnings. ● Take notes, ask questions, participate actively in the training.
4.	40 min	Group planning, role-play, scenario-based exercise	● Present early warning response actions (before/during/after an event) ● Defining Roles and Responsibilities: clarify what actions	● Participate in role-play sessions in responses to actions taken during a hazard.

			at the community, local authority, and individual levels. ● Facilitate role-play on responding to warnings. ● Guide participants to develop and update specific disaster preparedness and response plans based on the warnings received.	● Identify community or household preparedness actions ● Participant in developing group early action protocols based on warnings. ● Actively take part in demonstrations, take notes, ask relevant questions
Materials (What trainers need to have prepared): ● Flip charts ● Markers ● Sticky notes, ● Projector/laptop for forecast examples ● Copies of sample weather and warning messages ● Hazard mapping templates or blank maps ● Scenario sheets for preparedness simulations ● Communication tools (mock SMS messages, radios, etc.)				
Other notes: ● Encourage participation from all genders, youth, and persons with disabilities ● Use local examples of hazards (floods, landslides, droughts, storms) ● Ensure participants practice using real warning messages where possible ● Support groups that struggle with reading maps or interpreting forecasts ● Emphasize coordination and timely action, especially in activity 4				

PART 3 – ACTIVITY GUIDE

DESCRIPTION OF THE ACTIVITIES

1. Weather key terms, Weather Monitoring and Forecasting

This activity introduces participants to the fundamental concepts and key terms used in weather monitoring and forecasting, helping them understand how weather information is generated, interpreted, and used for decision-making. The key terms under this session include temperature, humidity, atmospheric pressure, wind speed, precipitation, drought, thunderstorms, seasonal forecasts, climate outlooks, and early warning levels. Participants will also explore how national meteorological agencies collect weather data using tools such as thermometers, barometers, wind vanes, rain gauges, satellites, and radar systems. The activity provides a practical overview of how these instruments work together to observe current atmospheric conditions and generate accurate short-term and medium-range forecasts. By the end of the activity, participants will gain knowledge and skills on the key weather terms, the importance of continuous monitoring, and how to interpret forecasts accurately to support early action in agriculture, transportation, disaster preparedness, and daily community decision-making. This foundational knowledge gained by participants will enhance their ability to respond proactively to any weather-related risks and concerns.

1. Aim of the activity: To equip participants with a clear understanding of key weather monitoring data and forecasts for protection, and preparedness.

2. Duration: 55 minutes

3. Material required:

- Samples of meteorological charts or bulletins
- Markers and flipcharts
- Internet-enabled device
- Projector
- Note books and pens
- Handouts for participants to refer to
- Power Point presentation
- Feedback forms to be filled by participants.

4. Step-by-step instruction of the task/practical exercise/case study:

- ➢ Introduce key weather terms giving relevant examples if possible visual examples.
- ➢ Explain how weather is monitored using instruments and observation systems.
- ➢ Provide real forecast products for group interpretation.
- ➢ Guide participants to identify and interpret warning signs, symbols, and probability levels.
- ➢ Create two weather scenarios and allow participants to react, give their views about it.

- ➢ Groups present conclusions and suggested actions based on the day's topic.

References/Sources/Further materials:

Radeny, M., Desalegn, A., & Mubiru, D. (2019). *Indigenous knowledge for seasonal weather and climate forecasting across East Africa*. *Climatic Change, 156*(4), 509–526. https://doi.org/10.1007/s10584-019-02476-9

Faith, M. J. (2014). *Appropriateness of Early Warning Systems in the Management of Climate Change Impacts in the Mt. Elgon Region.*

Uganda National Meteorological Authority. (2023). *Understanding weather, climate, and early warning systems*. UNMA Publications.

2. Understanding Risks and Hazards (Risk Knowledge)

Risk is the potential for loss, injury, or damage that could occur due to a hazardous event. Risk knowledge is very important because it's the foundation of all disaster risk reduction efforts as it enables communities to understand the threats they face and plan accordingly.

This particular activity introduces participants to the core concepts of hazards, exposure, vulnerability, and overall risk, helping them build a holistic understanding of how disasters occur and why some groups are more affected than others. The session ensures discussions around the common hazards affecting the majority of communities/countries such as floods, droughts, landslides, epidemics, strong winds, or human-induced hazards and explores their historical frequency, severity, and impacts on people, infrastructure, and livelihoods. Participants also examine factors that increase vulnerability, including poverty, inadequate housing, limited access to health services, environmental degradation, and settlement in high-risk zones. The trainers will also introduce simple risk assessment tools such as hazard calendars, community timelines, and vulnerability checklists. Through a hands-on exercise (group or individual), participants create a community risk map that identifies hazard-prone areas, key community assets such as schools and health centers, evacuation routes, safe shelters, and particularly vulnerable households. They analyze potential impacts and discuss which groups are most exposed, draw effective evacuation plans in case of a disaster and give various satisfying reasons to support their answers. This participatory approach helps participants visualize risk as a combination of physical, social, economic, and environmental factors.

The key outcomes in this session is that participants will be able to interpret local risk patterns and contribute to community disaster planning, making the community better prepared and more resilient.

1. Aim of the activity: To enhance participants' understanding of hazards, vulnerability, and exposure through practical risk mapping

2. Duration: 40 minutes

3. Material required:

- Flip charts and markers
- Community hazard data available
- Colored stickers
- Projectors
- Case study example
- Smartphones and internet

4. Step-by-step instruction of the task/practical exercise/case study:

➢ Introduce key concepts: hazard, vulnerability, exposure, risk.

➢ Brainstorm local hazards and their impacts.

➢ Provide groups with mapping materials.

➢ Groups draw a simple community risk map.

➢ Identify vulnerable populations and assets.

➢ Present findings and discuss risk reduction options including evacuation plans.

References/Sources/Further materials:

Odiase, O., Wilkinson, S., & Neef, A. (2020). Risk of a disaster: Risk knowledge, interpretation and resilience. *Jàmbá: Journal of Disaster Risk Studies*, *12*(1), 1-9.

Scheer, D., Benighaus, C., Benighaus, L., Renn, O., Gold, S., Röder, B., & Böl, G. F. (2014). The distinction between risk and hazard: understanding and use in stakeholder communication. *Risk Analysis*, *34*(7), 1270-1285.

Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). *At risk: Natural hazards, people's vulnerability and disasters*. Routledge.

Musiimenta Nanc and Kaziro Nicholas. (2025). Evaluating C*limate Information Services and Early Warning Systems*

3. Warning Dissemination and Communication

Warning dissemination and communication is the process of spreading timely, clear, and actionable information about potential hazards to at-risk populations using multiple channels to ensure they receive, understand and take actions accordingly. This activity focuses on helping participants develop the skills needed to craft clear, concise, and actionable warning messages tailored to specific populations, including vulnerable groups such as persons with disabilities, children, the elderly, and remote

communities. The session introduces essential components of an effective warning message: the nature of the hazard, the location at risk, expected impacts, timeframe, recommended protective actions, and contact points for further information. Participants also explore how communication barriers such as language differences, low literacy levels, lack of technology, misinformation, and cultural beliefs affect the effectiveness of warning dissemination. The facilitator presents real examples of warning messages from radio, SMS, community meetings, sirens, television banners, and social media alerts. Participants analyze these examples to identify what makes some messages more effective, trustworthy, and actionable than others. Working in groups, participants are given hazard scenarios and asked to design short, impactful messages appropriate for different communication channels. They also evaluate which dissemination pathways are the fastest, most reliable, and most inclusive for each scenario. By the end of the activity, participants will appreciate the importance of accuracy, clarity, consistency, and timeliness in warning communication and will understand how well-crafted messages contribute to reducing disaster impacts and encouraging proactive behavior.

1. Aim of the activity: To build the capacity of participants to create clear, timely, and actionable early warning messages and select appropriate dissemination channels, appreciate the importance of making quick action plans to avoid excessive damages.

2. Duration: 45 minutes

3. Material required:

- Sample warning action messages depending on a hazard
- Audio of any warning message/alert
- Different symbols of warnings
- Flipcharts and markers
- Scenario cards
- Internet
- Notebooks/pens
- Feedback forms

4. Step-by-step instruction of the task/practical exercise/case study:

➢ Explain the purpose and components of an effective warning message.

➢ Analyze strong and weak examples of actual warnings.

➢ Give groups a hazard scenario and target audience.

➢ Groups prepare a concise warning message.

➢ Discuss which dissemination channels best reach the large audiences.

➢ Let it be an open discussion with participants, present example messages and receive feedback on each.

References/Sources/Further materials:

UNDRR. (2015). *Sendai Framework for Disaster Risk Reduction 2015–2030*. https://www.undrr.org/media/16176/download?startDownload=20251128

Taylor, A. L., Kox, T., & Johnston, D. (2018). Communicating high impact weather: Improving warnings and decision making processes. *International Journal of Disaster Risk Reduction*, *30*, 1-4.

Oktari, R. S., Munadi, K., & Ridha, M. (2014). Effectiveness of dissemination and communication element of tsunami early warning system in Aceh. *Procedia Economics and Finance*, *18*, 136-142.

Koll, C., Lindell, M., Chen, C., & Wang, H. (2023). Emergency warning dissemination in a multiplex social network. *Journal of Artificial Societies and Social Simulation*, *26*(1).

Video on early warning: https://www.youtube.com/watch?v=FQiWCduNWao

4. Preparedness and Response Capabilities

Preparedness and response capabilities refers to the process to determine how well communities can act on early warnings and limit the negative impacts of hazards. This activity guides participants through the essential elements of preparedness, including household planning, community coordination, emergency supplies, evacuation procedures, and communication systems. In this activity, an overview of why preparedness is necessary and how its absence can lead to increased loss of life, property damage, and livelihood disruption during emergencies is learned. Participants engage in a guided assessment that evaluates current preparedness levels at household and community levels, exploring aspects such as access to first aid, transportation, safe shelters, communication trees, and support arrangements for vulnerable groups. The facilitator can also give relevant examples of best practices from recognized disaster management agencies, including how to communicate an emergency to the public for quick responses/rescue, assemble emergency kits, identify safe evacuation points, establish community watch groups, and develop simple communication protocols. Participants work in either groups or individually to create a preparedness plan for a specific hazard scenario, outlining clear roles and responsibilities, evacuation routes, meeting points, and actions to be taken before, during, and after a warning is issued. To reinforce learning, a short simulation or tabletop drill is conducted to test how the plan would work in a real situation. The outcome of the activity includes understanding of the importance of coordinated preparedness and how strong response capabilities help save lives, property, livestock and strengthen community resilience.

1. Aim of the activity: To build participants' capacity to assess preparedness levels and develop actionable household or community preparedness plans.

2. Duration: 40 minutes

3. Material required:

- Preparedness checklists
- Flipcharts/markers
- Example emergency kit items
- Scenario cards for drill
- Internet
- Projector
- Feedback forms

4. Step-by-step instruction of the task/practical exercise/case study

➢ Explain components of preparedness and coordinated response.

➢ Conduct a preparedness self-assessment.

➢ Provide examples of good preparedness practices.

➢ Groups develop a hazard-specific preparedness plan.

➢ Groups present and refine plans.

References/Sources/Further materials:

Mohapatra, M. (2024). Climate and weather forewarning systems for disaster preparedness and response. In *Disaster Risk and Management Under Climate Change* (pp. 39-54). Singapore: Springer Nature Singapore.

Guillot, S., Jarvis, P., Powell, T., & Kenkre, J. (2020). Knowledge, experience and preparedness: Factors influencing citizen decision-making in severe weather situations. *International journal of emergency management*, *16*(1), 60-77.

Ryan, B., Johnston, K., & Taylor, M. (2022). Recognizing and measuring competency in natural hazard preparation: A preparedness competency index. *International Journal of Disaster Risk Reduction*, *73*, 102882.

Titko, M., Ristvej, J., & Zamiar, Z. (2021). Population preparedness for disasters and extreme weather events as a predictor of building a resilient society: The Slovak Republic. *International journal of environmental research and public health*, *18*(5), 2311.