Early Warning and Rapid Response System for Pests and Diseases

An Operational Guide

Handbook

CGIAR

AICCRA
Accelerating Impacts of CGIAR Climate Research for Africa

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About AICCRA Reports

Titles in this series aim to disseminate interim research on the scaling of climate services and climate-smart agriculture in Africa, in order to stimulate feedback from the scientific community.

Photos

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About AICCRA

AICCRA
Accelerating the Impact of CGIAR Climate Research for Africa

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CONTENTS

ABBREVIATIONS

AI	Artificial Intelligence
AICCRA	Accelerating Impacts of CGIAR Climate Research in Africa
AIDH	Agricultural Information Data Hub
APHIS	Animal and Plant Health Inspection Service
BNARI	Biotechnology and Nuclear Agriculture Research Institute
CABI	Centre for Agriculture and Biosciences International
CBSVD	Cassava Brown Streak Virus Disease
CGIAR	Consultative Group of International Agricultural Research Centres
CIC	Community Information Centres
CMVD	Cassava Mosaic Virus Disease
COAEON	Crops Officers and Agricultural Extension Officers Network
CRI	Crops Research Institute
CSIR	Council for Scientific and Industrial Research
CSO	Civil Society Organization
DAES	Directorate of Agriculture Extension Services
DRC	Democratic Republic of Congo
ECOWAS	Economic Community of West African States
EPA	Environmental Protection Agency
EWRRS-PD	Early Warning and Rapid Response System for Pests and Diseases
FAW	Fall Armyworm
FIA	Farm Intelligence Application
GAEC	Ghana Atomic Energy Commission
GMet	Ghana Meteorological Services
GPS	Global Positioning System
IITA	International Institute of Tropical Agriculture
INSTI	Institute of Scientific and Technological Information
IPM	Integrated Pest Management
ML	Machine Learning
MoFA	Ministry of Food and Agriculture

MoU	Memorandum of Understanding
MSc	Master of Science
NADMO	National Disaster Management Organization
NGO	Non-Governmental Organisation
PhD	Doctor of Philosophy
PPRSD	Plant Protection and Regulatory Services Directorate
PRISE	Pest Risk Information Service
RCE	Regional Centres of Excellence
SARI	Savanna Agricultural Research Institute
SYRIMAO	Système Régional Innovant de Contrôle des Mouches des Fruits en Afrique de l'Ouest
TWG	Technical Working Group
UDS	University for Development Studies
USDA	United States Department of Agriculture
WACWISA	West Africa Centre for Water Irrigation and Sustainable Agriculture
WAVE	Central and West African Virus Epidemiology

01. INTRODUCTION

The increasing threat of pests and diseases poses significant challenges to agricultural productivity and food security in Ghana. This handbook on the Early Warning and Rapid Response System for Pests and Diseases (EWRRS-PD) developed through efforts under the Accelerating Impact of CGIAR Climate Research in Africa (AICCRA) aims to provide a comprehensive framework for stakeholders involved in pest management, including farmers, agricultural extension workers, policymakers, and researchers. The EWRRS-PD is designed to enhance the capacity for early detection and prompt response to pest outbreaks, thereby mitigating potential losses in crop yields and safeguarding livelihoods.

In Ghana, the interplay of climate change, trade dynamics, and socio-economic factors has intensified the spread of agricultural pests and diseases. By leveraging innovative technologies such as on-ground detection networks, satellite data and predictive modelling, the EWRRS-PD will facilitate timely alerts and actionable information to combat these threats effectively. The collaborative efforts outlined in this handbook emphasize the importance of stakeholder engagement, data sharing, and integrated pest management strategies to foster resilience within the agricultural sector.

This handbook serves not only as a guide for implementing the EWRRS-PD but also as a call to action for all stakeholders to commit to proactive measures that ensure sustainable agricultural practices in Ghana. By strengthening our response mechanisms and enhancing communication channels, we can work together towards a more secure and productive agricultural future.

02. SITUATIONAL ANALYSIS

Background

In Ghana, the agricultural sector faces significant threats from pests and diseases, necessitating the establishment of an Early Warning and Rapid Response System for Pests and Diseases (EWRRS-PD). This system aims to enhance food security and protect agricultural livelihoods by enabling timely detection and response to outbreaks.

Research indicates that farmers who receive early warning alerts and integrated pest management advice experience improved food security, with notable yield increases. For example, smallholder maize farmers involved in pest risk information campaigns reported a 4% gain in yields compared to those without access to such information. This highlights the importance of disseminating actionable pest management information to enhance agricultural productivity and resilience among farming communities

A validation workshop held in Accra saw the commitment of 11 institutions, including the PPRSD, NADMO, EPA, and various research institutes, to implement the EWRRS-PD. These organizations are tasked with developing surveillance and forecasting tools, engaging with farmers, and conducting research to inform policy and action plans. The collaborative effort emphasizes the need for proactive measures against the increasing threat of pests, exacerbated by climate change.

The landscape of pest surveillance, detection, and warning systems is evolving, driven by both traditional practices and innovative technologies. Several mechanisms are currently in place to address pest and disease outbreaks in Ghana. They include programs with protocols and systems for detection, reporting, alerts and response components as well as digital tools available as web applications or mobile phone applications.

Pest / Disease Detection and Response Programs.

Ghana Emergency Response Plan for Invasive Alien Plant Pests: Led by the Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture (MoFA), this plan is a core component of the EWRRS-PD, focusing on invasive alien species.

Fruit Fly Surveillance and Alert System: Ghana has been actively involved in regional efforts to establish fruit fly surveillance and alert systems in West Africa. Ghana is part of the ECOWAS SYRIMAO Project, which aims to set up a regional fruit fly surveillance and control system covering 11 West African countries. The project provides a framework for: monitoring mango production in major growing areas, assessing fruit fly infestation rates, issuing alerts to stakeholders, and planning and evaluating production campaigns. The system utilizes trapping methods for targeted, cost-effective, and environmentally friendly management of fruit flies. The ECOWAS SYRIMAO project has supported capacity building for national laboratories in Ghana and other participating countries. By monitoring populations, assessing risks, and communicating alerts, Ghana aims to minimize the devastating impacts of fruit flies on mango production and exports.

WAVE Regional Center of Excellence (WAVE CRe): this is a scientific and technical platform that focuses on plant diseases and pests in Central and West Africa. The main plant diseases that WAVE focuses on are Cassava Mosaic Virus Disease (CMVD) and Cassava Brown Streak Virus Disease (CBSVD), which threaten cassava production. CMVD is widespread in Africa and can cause 40–70% yield loss. CBSVD can cause up to 100% yield loss and is currently present in Rwanda, Burundi, South Sudan, Congo, and DRC. WAVE's work includes:

- Monitoring and predicting the spread of diseases in Central and West Africa.

- Works with governments, smallholder farmers, and local scientists to develop preventive control measures.
- Produces incidence and severity maps to identify disease hotspots.
- Tests cassava varieties for resistance to diseases.
- Conducts training and mentoring programs for MSc and PhD students.

Integrated Pest Management (IPM): This sustainable approach utilizes natural pest enemies and biopesticides, reducing reliance on synthetic chemicals and minimizing health and ecological risks.

One Health Platform: AICCRA is developing a platform that recognizes the interconnectedness of plant, animal, and environmental health, aiming to address climate-driven pests and diseases with tools that have minimal impact on the ecosystem.

Collaboration with National Organizations: The National Disaster Management Organization (NADMO) and the USDA's Animal and Plant Health Inspection Service (APHIS) play crucial roles in coordinating responses to pest outbreaks.

Digital Tools and Innovations

Digital tools are being deployed and developed to enhance the effectiveness of plant health initiatives. A scan of the digital ecosystem brought up the following:

Pest Risk Information Service (PRISE): PRISE is a project initiated by CABI in collaboration with international partners, aimed at improving the livelihoods of smallholder farmers by reducing crop losses due to pests. It utilizes a combination of satellite data, geographic data, earth observation technology, pest modeling and real-time field observations to forecast outbreaks and deliver early warnings about crop pests to farmers. Information is disseminated to farmers through Community Information Centers and SMS, enabling timely action against pests like the fall armyworm, which has caused significant crop losses in Ghana. This information helps farmers implement Integrated Pest Management (IPM) strategies to mitigate potential yield losses. During the 2021 agricultural season, PRISE successfully forecasted fall armyworm outbreaks, significantly aiding farmers in managing this pest.

PlantwisePlus: is a global program developed by CABI to help countries predict, prepare for, and prevent plant health threats in a changing climate. The program aims to reduce crop losses and empower smallholder farmers to increase their incomes, food security, and food safety by producing more and higher quality food. Key objectives of the program include:

- Strengthen detection of and response to pest outbreaks
- Provide agricultural service providers with better digital advisory tools to support farmers in sustainable crop management
- Enhance the availability of nature-positive and low-risk plant protection products to reduce reliance on high-risk farm inputs
- Increase consumer demand for and supply to local markets of safer, higher quality and locally produced food

PlantwisePlus follows three key impact pathways:

- Strengthening pest surveillance and mitigation
- Promoting sustainable crop protection practices
- Reducing pesticide risk and enhancing food safety

Drones for Crop Surveillance: Small-scale farmers in Ghana are increasingly using drones for crop surveillance to enhance pest and disease monitoring. This technology allows for efficient data collection on crop health, although there are concerns about its affordability for poorer farmers. Farmers' cooperatives are embracing this innovation to increase yields and incomes, indicating a shift toward more technologically advanced farming practices

Forecasting Protocols: New tools are being developed to predict pest incidences, allowing for early interventions that can mitigate potential damage to crops. These protocols are essential in adapting to the rapidly changing pest dynamics influenced by climate factors.

Farmers Connect is a Ghanaian registered Tech Start-Up focused on using STS2, a satellite-based digital technology that integrates satellite-derived data and a blend of modern technologies like Machine Learning (ML), Artificial Intelligence (AI), and big data analytics to answer large-area issues in the agriculture. They can provide farm mapping and pest/disease forewarning among a range of services to farmers. Specifically, they can inform farmers about pests and diseases that are likely to be prevented during the current season, provide recommended control measures to mitigate the risk of pest damage. They also include information on the symptoms of diseases for quick identification and utilize weather data to predict the likelihood of certain pests and diseases. In addition, they create detailed information for common pests and diseases affecting specific crops.

Africa FarmNet Limited runs a mobile App called MyAgro360. This App enables farmers to map their farms, diagnose pest and disease situations and access farm advisory services.

The FIA App: Developed by the International Institute for Tropical Agriculture (IITA) for monitoring and managing Fall Armyworm (FAW) infestations in crops. This application is designed to assist farmers and agricultural stakeholders in identifying and reporting FAW occurrences, which is essential for effective pest management and crop protection. Key Features of the FIA App include:

- *Scouting and Reporting:* The app enables users to scout for FAW and report their findings in real-time. This feature helps in gathering data on the spread and severity of infestations across different regions.
- *Data Collection:* It facilitates the collection of valuable data that can be used for research and analysis, aiding in the understanding of FAW behaviour and its impact on agriculture.
- *User-Friendly Interface:* The app is designed to be accessible, allowing farmers with varying levels of technological proficiency to utilize it effectively.
- *Support for Decision-Making:* By providing timely information on FAW presence, the app supports farmers in making informed decisions regarding pest control measures, potentially reducing crop losses and improving yields.

A similar App called FIA- niébé was developed to support cowpea (niébé) production in West Africa. Both Apps were developed in collaboration with national agricultural research systems, extension agencies, and farmer organizations across West Africa. They are available in local languages and designed to be user-friendly for smallholder farmers with limited digital literacy.

Community Information Centres (CICs): CICs play a crucial role in disseminating pest risk information to farmers. Alerts regarding pest outbreaks, such as those for the fall armyworm, are communicated through these centres and via SMS, enabling farmers to take timely action. This grassroots approach ensures that vital information reaches those most affected by pest threats.

Integration for Synergy

It is crucial to recognize that the PPRSD is the competent national authority responsible for the formulation and implementation of policies concerning crop pest and disease management. To establish a nationally focused program on Early Warning and Response Systems for Pest and Disease (EWRRS-PD) that delivers significant impact, it is essential for the PPRSD to engage with key stakeholders in this domain. This collaboration aims to integrate best practices and tools into a cohesive program. The proposed integrated program should facilitate the active participation of both public and private sector entities, fostering synergy among diverse stakeholders. By leveraging collective expertise and resources, the PPRSD can enhance its effectiveness in managing crop pests and diseases, ultimately contributing to sustainable agricultural development.

03. THE EWRRS-PD FRAMEWORK

The EWRRS-PD aims to enhance the country's capacity to detect, monitor, and respond to pest and disease outbreaks, particularly those driven by climate change. The collaborative framework involves multiple stakeholders from both public and private sectors, focusing on proactive measures to safeguard agricultural productivity and food security.

Ghana's agricultural sector has faced significant challenges from pests and diseases, notably the Fall Armyworm (FAW) outbreak in 2017, which devastated over 14,000 hectares of crops. In response to such crises, stakeholders recognized the need for a robust system that enables early detection and rapid intervention to mitigate potential losses in crop yields and quality. The EWRRS-PD was conceived as a comprehensive approach to address these challenges through improved communication, data sharing, and collaborative efforts among various institutions. The concept was first hinted in Sekabira et al. (2022) following the introduction of the fall armyworm and the risks posed by several invasive alien species of pests and diseases (Tepa-Yotto et al., 2021). The concept of EWRRS-PD was first in an AICCRA-led publication titled "Implementation Outline of Climate-Smart One Health: A Systems-Thinking Approach (Tepa-Yotto et al., 2024) and fully elaborated in Hongar et al. (2023).

The primary objectives of the EWRRS-PD are to enhance early warning by developing mechanisms for timely alerts regarding pest and disease threats; strengthen capabilities for monitoring pest populations and detecting outbreaks before they escalate; foster cooperation among institutions to ensure a coordinated response to pest invasions and equip stakeholders with the necessary skills in risk assessment, communication, and response dissemination.

Institutional Framework

Based on demand and led by the Plant Protection and Regulatory Services of the Ministry of Food and Agriculture, the EWRRS-PD is supported by a consortium of eleven institutions drawn from the public and private sectors of Ghana. Each institution plays a specific role ranging from research and monitoring to direct engagement with farmers, ensuring that information flows efficiently throughout the agricultural value chain (Fig. 3.1).

Implementation Strategy

The implementation of the EWRRS-PD involves several key strategies:

- Data Collection and Analysis: Utilizing satellite technology and local observations to gather data on pest risks.
- Risk Communication: Establishing clear channels for disseminating information about pest threats to farmers through agro-info dissemination companies such as Farmerline, Farm Radio International and ESOKO as well as through community information centers and SMS alerts.
- Training Programs: Conducting workshops and training sessions for stakeholders on best practices in pest management and response tactics.
- Monitoring Systems: Developing tools for real-time monitoring of pest populations to facilitate early detection, including new invasive alien species.

Expected Outcomes

The successful implementation of the EWRRS-PD is expected to yield several benefits:

- Improved food security through enhanced crop yields.
- Reduced economic losses associated with pest outbreaks.
- Strengthened resilience of agricultural systems against climate-driven threats.
- Enhanced collaboration among agricultural stakeholders leading to more effective pest management strategies.

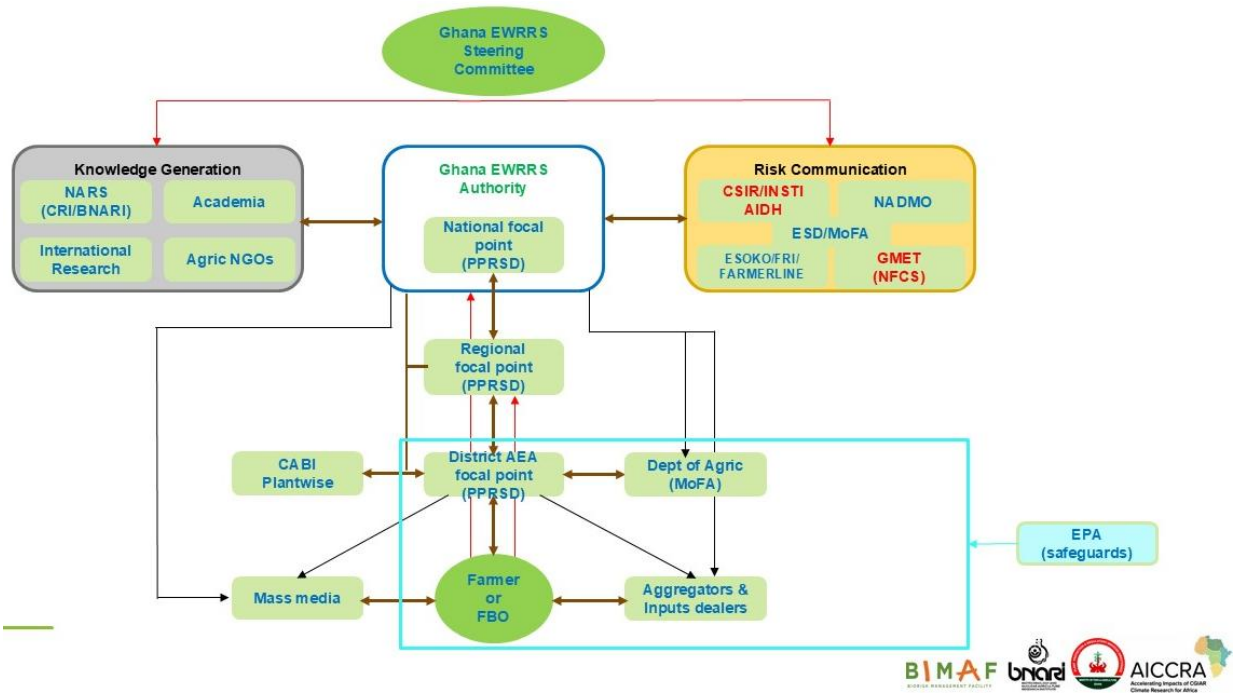

Fig. 3.1: Conceptual Framework of the EWRRS-PD

04. WORKING GROUPS

The Steering Committee

The establishment of a steering committee for the Early Warning and Rapid Response System for Pests and Diseases (EWRRS-PD) developed under the AICCRA Project is essential for enhancing agricultural resilience and food security. It will also ensure national ownership and sustainability beyond the project. This committee will play a vital role in coordinating efforts among various stakeholders to effectively monitor, predict, and respond to pest and disease outbreaks. It will also source for funding to sustain the system for national benefit.

The steering committee will consist of representatives from key governmental agencies, research institutions, non-governmental organizations, and agricultural stakeholders who are party to the EWRRS-PD MoU. Its primary function is to oversee the implementation and operation of the EWRRS-PD, ensuring that the system is responsive to the needs of farmers and agricultural communities. The committee will facilitate collaboration among partners, promote information sharing, and develop strategies for effective pest and disease management.

Objectives

1. ***Coordination:*** Ensure effective collaboration among all stakeholders involved in pest and disease management.
2. ***Monitoring and Evaluation:*** Approve protocols for monitoring pest populations and evaluating the effectiveness of response strategies.
3. ***Capacity Building:*** Enhance the skills and knowledge of stakeholders through training and workshops on pest management and early warning systems.
4. ***Policy Development:*** Provide recommendations for policy frameworks that support sustainable agricultural practices and pest management.

Terms of Reference

1. ***Membership:*** The committee will include representatives from:

- Plant Protection and Regulatory Services Directorate (PPRSD)
- GAEC - Biotechnology and Nuclear Agriculture Research Institute (BNARI)
- National Disaster Management Organization (NADMO)
- Environmental Protection Agency (EPA)
- CSIR - Crops Research Institute (CSIR-CRI)
- CSIR - Savanna Agricultural Research Institute (CSIR-SARI)
- Ghana Meteorological Agency (GMET)
- Directorate of Agricultural Extension Services (DAES) – Ministry of Food and Agriculture (MoFA)

- CSIR – Institute of Scientific and Technological Information (CSIR-INSTI)
- West African Centre for Water, Irrigation, and Sustainable Agriculture (WACWISA)-University for Development Studies (UDS)
- Farmerline

2. ***Meetings:*** The committee will meet twice a year to review progress, assess challenges, and plan future actions. Special meetings may be convened as needed in response to urgent pest outbreaks.

3. ***Reporting:*** The committee will prepare and submit biannual reports to relevant authorities detailing activities, findings, and recommendations for improving the EWRRS-PD.

4. ***Funding and Resources:*** Identify funding opportunities and resource needs to support the implementation of the EWRRS-PD.

5. ***Public Awareness:*** Develop communication strategies to raise awareness among farmers and the public about pest threats and the importance of the EWRRS-PD.

6. ***Research and Innovation:*** Promote research initiatives that enhance pest detection and management, including the use of technology and integrated pest management practices.

Technical Working Group

The Technical Working Group (TWG) for the Early Warning and Rapid Response System for Pests and Diseases (EWRRS-PD) will be responsible for developing the technical framework and guidelines for the system. The TWG will consist of experts from various fields, including plant protection, entomology, pathology, meteorology, and data management. The group will work collaboratively to ensure that the EWRRS-PD is comprehensive, effective, and aligned with international best practices. This will ensure that the EWRRS-PD is technically sound, evidence-based, and responsive to the needs of farmers and agricultural communities.

Objectives

1. ***Develop Technical Guidelines:*** Establish protocols, tools, and guidelines for pest and disease monitoring, early warning, and rapid response.
2. ***Capacity Building:*** Identify training needs and develop capacity building programs for stakeholders involved in the EWRRS-PD.
3. ***Data Management:*** Develop data management systems for collecting, analyzing, and sharing pest and disease information.
4. ***Coordination:*** Facilitate coordination among the various stakeholders involved in the EWRRS-PD, including government agencies, research institutions, and farmer organizations.
5. ***Monitoring and Evaluation:*** Establish mechanisms for monitoring and evaluating the effectiveness of the EWRRS-PD and recommend improvements as needed.

Terms of Reference

1. ***Membership:*** The TWG will consist of representatives from the following institutions:

- Plant Protection and Regulatory Services Directorate (PPRSD)
- GAEC - Biotechnology and Nuclear Agriculture Research Institute (BNARI)
- National Disaster Management Organization (NADMO)
- Environmental Protection Agency (EPA)
- CSIR - Crops Research Institute (CSIR-CRI)
- CSIR - Savanna Agricultural Research Institute (CSIR-SARI)
- Ghana Meteorological Agency (GMET)
- Directorate of Agricultural Extension Services (DAES) – Ministry of Food and Agriculture (MoFA)
- CSIR – Institute of Scientific and Technological Information (CSIR-INSTI)
- West African Centre for Water, Irrigation, and Sustainable Agriculture (WACWISA)-University for Development Studies (UDS)
- Farmerline

2. ***Meetings:*** The TWG will meet quarterly to review progress, discuss challenges, and plan future actions. Special meetings may be convened as needed to address urgent issues.

3. ***Reporting:*** The TWG will prepare and submit quarterly reports to the Steering Committee, detailing activities, findings, and recommendations for improving the EWRRS-PD.

4. ***Technical Guidelines:*** The TWG will develop and regularly update technical guidelines for pest and disease monitoring, early warning, and rapid response. These guidelines will be based on international best practices and adapted to the local context in Ghana.

5. ***Capacity Building:*** The TWG will identify training needs and develop capacity building programs for stakeholders involved in the EWRRS-PD. This may include workshops, training manuals, and online resources.

6. ***Data Management:*** The TWG will develop and maintain data management systems for collecting, analyzing, and sharing pest and disease information. This will include establishing data standards, protocols for data sharing, and mechanisms for data quality control.

7. ***Coordination:*** The TWG will facilitate coordination among the various stakeholders involved in the EWRRS-PD. This may include organizing meetings, workshops, and other events to foster collaboration and information sharing.

8. ***Monitoring and Evaluation:*** The TWG will establish mechanisms for monitoring and evaluating the effectiveness of the EWRRS-PD. This may include developing performance indicators, conducting regular assessments, and recommending improvements as needed.

Crops Officers and Agricultural Extension Officers Network

The Crops Officers and Agricultural Extension Officers Network (COAEON) is a vital component of the EWRRS-PD. This network will enhance communication, collaboration, and information dissemination among agricultural extension officers and crops officers across the country. By leveraging their on-ground presence and expertise, the network will facilitate timely detection, reporting, and management of pest and disease outbreaks, ultimately contributing to improved food security and agricultural productivity. Ultimately, this will strengthen the capacity of the national agricultural workforce to respond effectively to pest and disease threats, ensuring sustainability and resilience of the agricultural sector.

Objectives

1. ***Information Dissemination:*** Ensure timely sharing of pest and disease risk information, early warning alerts, and response strategies with farmers and agricultural stakeholders.

2. ***Capacity Building:*** Provide training and resources to enhance the skills of extension officers and crops officers in pest and disease management.

3. ***Field Surveillance:*** Conduct regular field surveillance to monitor pest populations and disease outbreaks, reporting findings to the EWRRS-PD.

4. ***Farmer Engagement:*** Foster strong relationships with farmers to encourage proactive reporting of pest and disease symptoms and to implement recommended management practices.

5. ***Feedback Mechanism:*** Establish a feedback loop where farmers can report their experiences and challenges, which will inform the network's strategies and interventions.

Terms of Reference

1. ***Membership:*** The network will consist of:

- Crops Officers from the Plant Protection and Regulatory Services Directorate (PPRSD)
- Agricultural Extension Officers from the Directorate of Agricultural Extension Services (DAES)
- Representatives from Local Government Departments of Agriculture
- Environmental Protection Agency (EPA) District Officers
- National Disaster Management Organization (NADMO) District Officers
- Other relevant stakeholders involved in pest and disease management (NGOs, CSOs, Private Extension Service Providers)

2. ***Meetings:*** The network will convene monthly to discuss progress, share experiences, and plan joint activities. Additional meetings may be called as needed in response to emerging pest threats.

3. ***Reporting:*** Members will submit monthly reports on pest and disease observations, extension activities, and farmer feedback to the EWRRS-PD TWG.

4. ***Training and Capacity Building:*** The network will organize regular training sessions and workshops to equip members with the latest knowledge and skills in pest and disease management, surveillance techniques, and effective communication strategies.

5. ***Field Surveillance Protocols:*** Develop and implement standardized protocols for field surveillance, ensuring that all members are equipped to monitor and report pest and disease occurrences accurately.

6. ***Communication Strategy:*** Create a communication plan that outlines how information will be disseminated to farmers, including the use of mobile technology, community meetings, and printed materials.

7. ***Collaboration with Other Stakeholders:*** Work closely with the Technical Working Group (TWG) and other stakeholders to align efforts, share data, and coordinate responses to pest and disease outbreaks.

8. ***Evaluation and Feedback:*** Establish mechanisms for evaluating the effectiveness of the network's activities and gathering feedback from farmers and extension officers to continuously improve the system.

Communication Group

The Communication Group for the EWRRS-PD will enhance the flow of information between stakeholders involved in pest and disease management. This group will focus on developing effective communication strategies to ensure timely dissemination of pest alerts, risk assessments, and response guidelines to farmers, agricultural extension officers, and relevant institutions. By facilitating clear and accessible communication, the group will empower stakeholders to take informed actions against pest and disease threats, thereby improving agricultural resilience and food security in Ghana. They will also ensure that all stakeholders are well-informed and prepared to act against agricultural threats.

Objectives

1. ***Information Dissemination:*** Ensure timely and effective communication of pest and disease alerts, risk assessments, and management strategies to all stakeholders.

2. ***Stakeholder Engagement:*** Foster collaboration and dialogue among farmers, researchers, government agencies, and NGOs to enhance the collective response to pest and disease outbreaks.

3. ***Capacity Building:*** Train stakeholders on effective communication practices and the use of communication tools for pest and disease management.

4. ***Feedback Mechanism:*** Establish channels for stakeholders to provide feedback on communication effectiveness and information needs.

Terms of Reference

1. ***Membership:*** The Communication Group will consist of representatives from:

- MoFA - Department of Agriculture Extension Services (MoFA-DAES)
- MoFA - Plant Protection and Regulatory Services Directorate (MoFA-PPRSD)
- Ghana Meteorological Agency (GMet)

- Agricultural extension services
- Non-governmental organizations (NGOs) involved in agricultural communication
- Media representatives
- Ghana Community Radio Network

2. ***Meetings:*** The group will meet quarterly to review communication strategies, assess information dissemination effectiveness, and plan upcoming activities. Additional meetings may be convened as needed in response to urgent pest threats.

3. ***Reporting:*** The group will prepare and submit quarterly reports to the Steering Committee, detailing communication activities, stakeholder engagement efforts, and recommendations for improving information dissemination.

4. ***Communication Strategy Development:*** The group will develop a comprehensive communication strategy that outlines methods for disseminating information, including the use of social media, mobile technology, community meetings, and traditional media.

5. ***Training and Capacity Building:*** Organize training workshops for stakeholders on effective communication practices, including how to interpret and act on pest and disease alerts.

6. ***Monitoring and Evaluation:*** Establish mechanisms to monitor and evaluate the effectiveness of communication efforts, including feedback surveys from stakeholders and analysis of engagement metrices.

7. ***Collaboration with Other Groups:*** Work closely with the Technical Working Group (TWG) and other relevant groups to ensure that communication aligns with technical guidelines and strategies.

8. ***Public Awareness Campaigns:*** Design and implement public awareness campaigns to educate farmers and communities about pest threats, prevention strategies, and the importance of timely reporting.

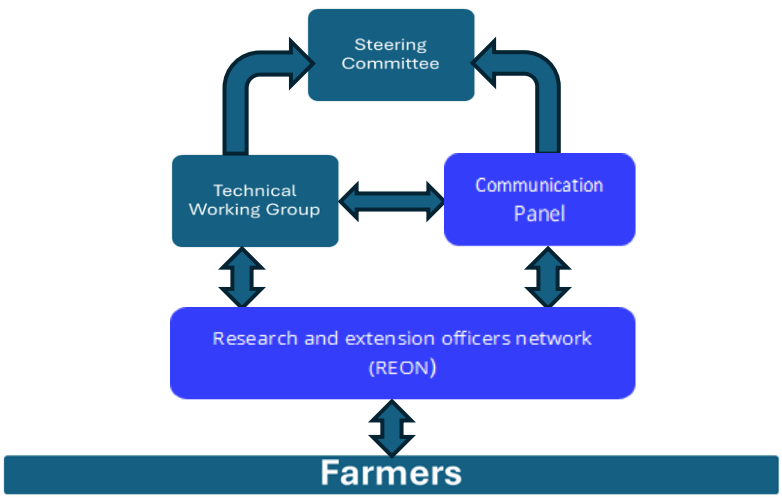

Fig. 4.1. Organizational structure of the EWRRS-PD working groups

05. EWRRS-PD DIGITAL PORTAL

To streamline effective coordination and concerted efforts, the Early Warning and Rapid Response for Pests and Diseases (EWRR-PD) portal under the Agricultural Information Data Hub (AIDH) functions as a digital centralized system for managing and coordinating emergency reporting and responses for pest and disease outbreaks. At the heart of this system is a structured series of steps designed to streamline the reporting and response process, starting with Reporting Sub-System. The Reporting Sub-System of the portal is accessible to designated lead farmers in communities, Crops Officers of PPRSD, and Agric Extension Officers trained to use the portal for reporting incidents to the Validation Sub-System. Registered reporters report potential pest or disease incidents using the form in Figure 1 below. Information captured includes the category of the risk (pest and/or diseases), the name of the pest or disease if known, the region from which report is made, a brief text description of the situation on the ground, images to support the report, and an automatic GPS location capture by the Reporting Sub-System.

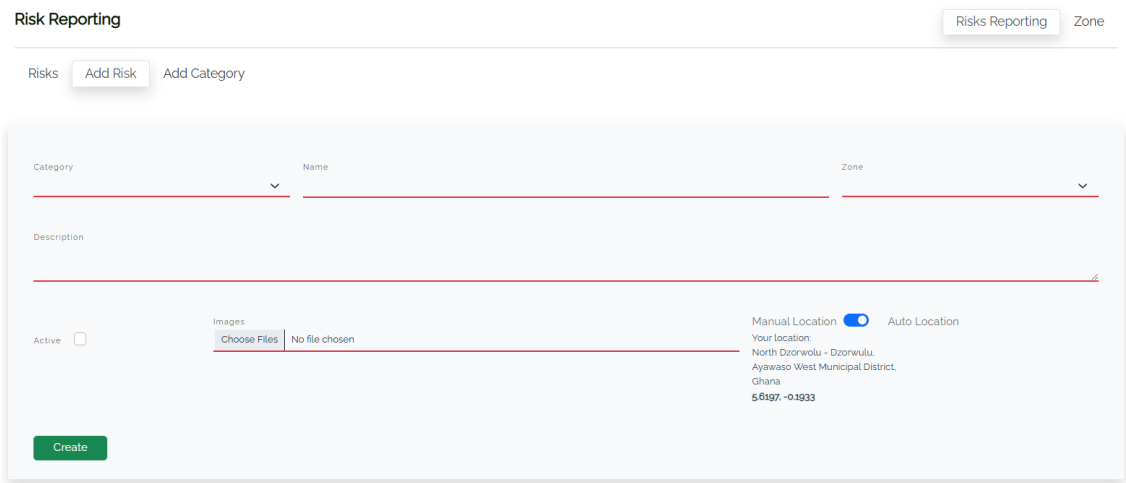

Fig. 5.1: pest and disease reporting form

All reports are passed onto the validation layer and a notification is triggered to assign validators within the regions from which the reports are submitted. The validation portal gives an overview of all received reports in a map interface (Figure 2), making it easy for validators to choose and validate reports in their assigned regions or communities.

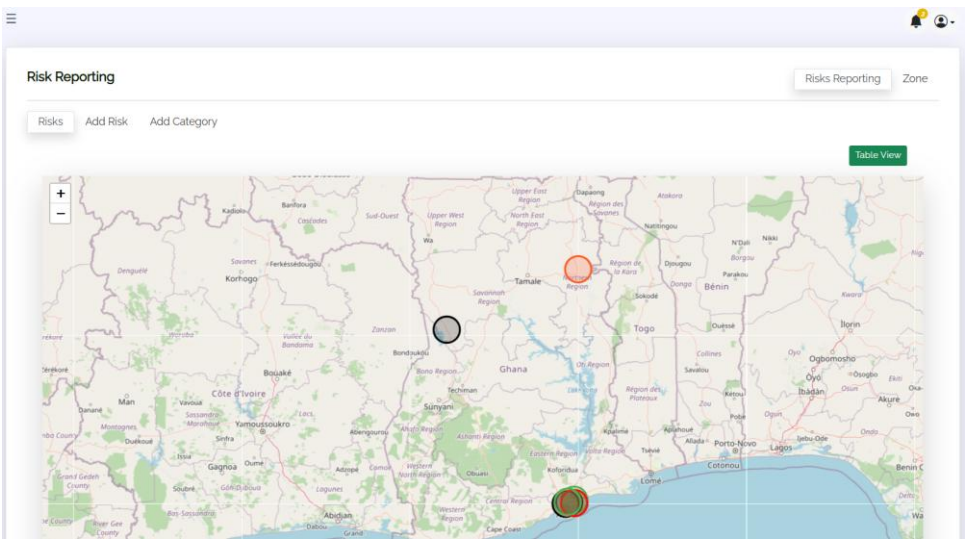

Fig 5.2. Map view of reported incidents

The validation process may include physical visits and investigations to ascertain the validity and level of the reported risk. Following successful validation, an authorized validator logs into the portal to add his/her validation comment to a reported risk and forwards the updated report to the Risk Response Sub-System. A mock example of an update by a validator is shown in figure 3 below.

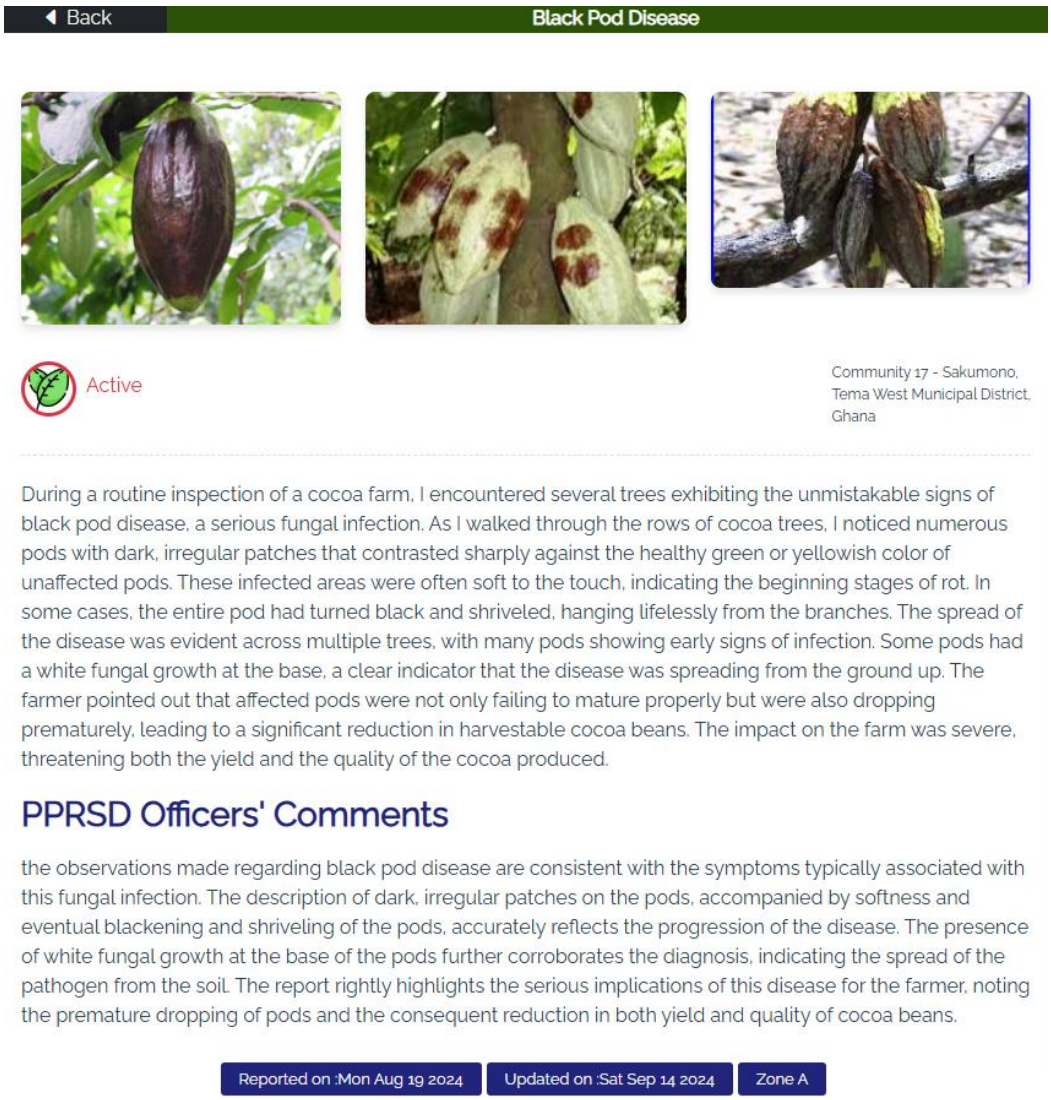

Fig. 5.3: Validator comment added to an incident report

Key stakeholders also conduct risk assessments based on the gathered data, evaluating the severity and potential impact of the situation to prioritize response efforts. The process then moves to verification & validation, where regional and national teams review the risk assessment and validate the incident, ensuring accurate and reliable response. With validation completed, the portal facilitates coordination among critical response entities, including Extension Services, PPRSD officers, experts from collaborating institutions, NADMO (National Disaster Management Organization), and MOFA (Ministry of Food and Agriculture), to align their response strategies.

The alert preparation stage involves crafting alerts and advisories tailored to the incident, which are then distributed in the alert dissemination phase to key stakeholders, such as extension officers and farmers. Extension officers at the end of the entire process are given access to the dissemination portal where they can share response strategies with farmers under their jurisdiction in multiple forms (SMS, audio, video, etc.)

This comprehensive workflow summarized in figure 4 below, integrates with and enables the AIDH Extension Portal users to manage each phase of pest and disease response efficiently, from initial reporting to coordinated action across multiple agencies, ensuring a robust and unified emergency response system.

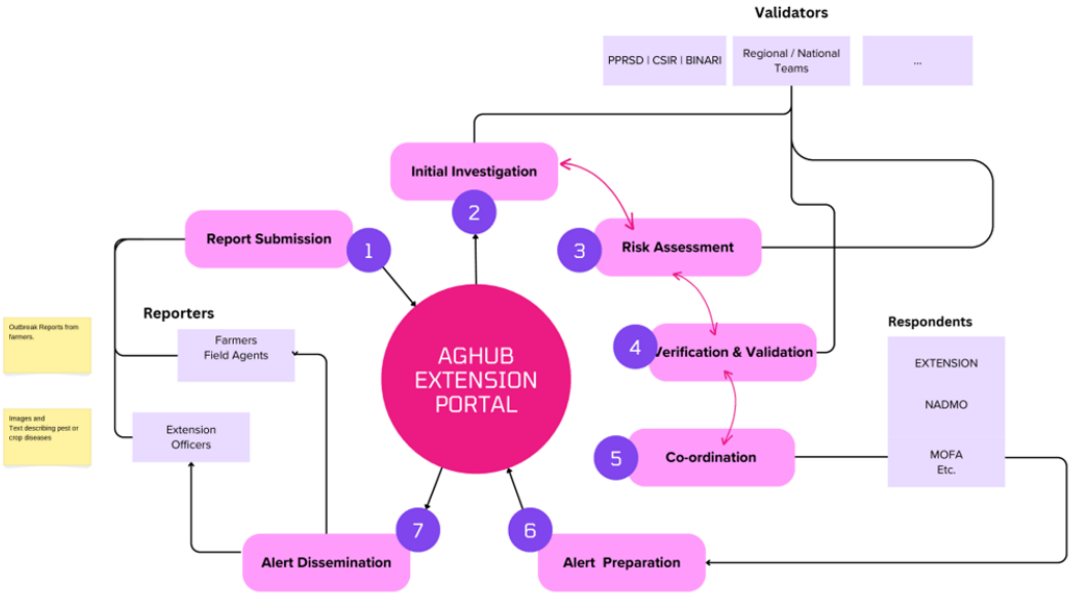

Fig. 5.4: Summarized workflow of the EWRR-PD digital portal

06. POLICY IMPLICATIONS AND WAY FORWARD

The EWRRS-PD developed under the AICCRA project represents a critical advancement in agricultural resilience against climate-driven threats. This system aims to enhance the country's preparedness and response capabilities to pest outbreaks, thereby safeguarding food security and agricultural productivity.

The EWRRS-PD emphasizes the need for robust collaboration among various stakeholders, including governmental bodies, research institutions, and local communities. The signing of a Memorandum of Understanding (MoU) among 11 institutions, including the Ministry of Food and Agriculture (MoFA) and the Environmental Protection Agency (EPA), underscores a collective commitment to pest management. This collaborative framework is essential for effective information sharing, resource allocation, and coordinated response efforts.

The system's design incorporates data collection and analysis mechanisms that facilitate timely detection of pest threats. By leveraging technology such as satellite data and real-time monitoring, stakeholders can make informed decisions that enhance response strategies. This approach aligns with global best practices in integrated pest management (IPM) and positions Ghana to better anticipate and mitigate pest impacts. Development of the digital portal for the EWRRS-PD linked to the AIDH make this initiative even more versatile with great potential to deliver the required impact.

The EWRRS-PD integrates climate-smart practices into pest management strategies. By focusing on sustainable methods that consider the ecological impacts of pest control, such as using biopesticides and natural pest predators, the system supports long-term agricultural sustainability while minimizing human and environmental health risks associated with chemical pesticides.

A critical aspect of the EWRRS-PD is its focus on capacity building among stakeholders. Training programs aimed at enhancing skills in risk communication, monitoring, and response dissemination are vital for ensuring that all parties are equipped to act swiftly in the face of pest threats. This investment in human capital will foster a culture of proactive pest management within Ghana's agricultural sector.

Way Forward

The operationalization of monitoring tools that facilitate early detection of pests is paramount. Stakeholders would prioritize the development of user-friendly applications that allow farmers and extension workers to report pest sightings quickly. This grassroots approach will ensure that information flows efficiently from local to national levels, enabling rapid responses.

Increasing awareness among farmers about the EWRRS-PD's functionalities is crucial. Public campaigns would focus on educating farmers about reporting mechanisms and the importance of early detection in managing pest outbreaks. Engaging communities through workshops and training sessions will empower them to take an active role in pest management.

For the EWRRS-PD to be effective in the long term, sustainable financing models must be established. This includes securing funding from both governmental sources and international partners to support ongoing training, research initiatives, and technology development necessary for effective pest management. In line with this, the PPRSD would link all such initiatives with all development partners under one umbrella to build synergy, ensure efficient resource mobilization and enhance the impact.

Regular assessments of the EWRRS-PD's effectiveness are essential to adapt strategies based on emerging challenges posed by pests and diseases. Stakeholders would establish feedback loops that allow for continuous improvement of the system based on real-world experiences and outcomes.

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