

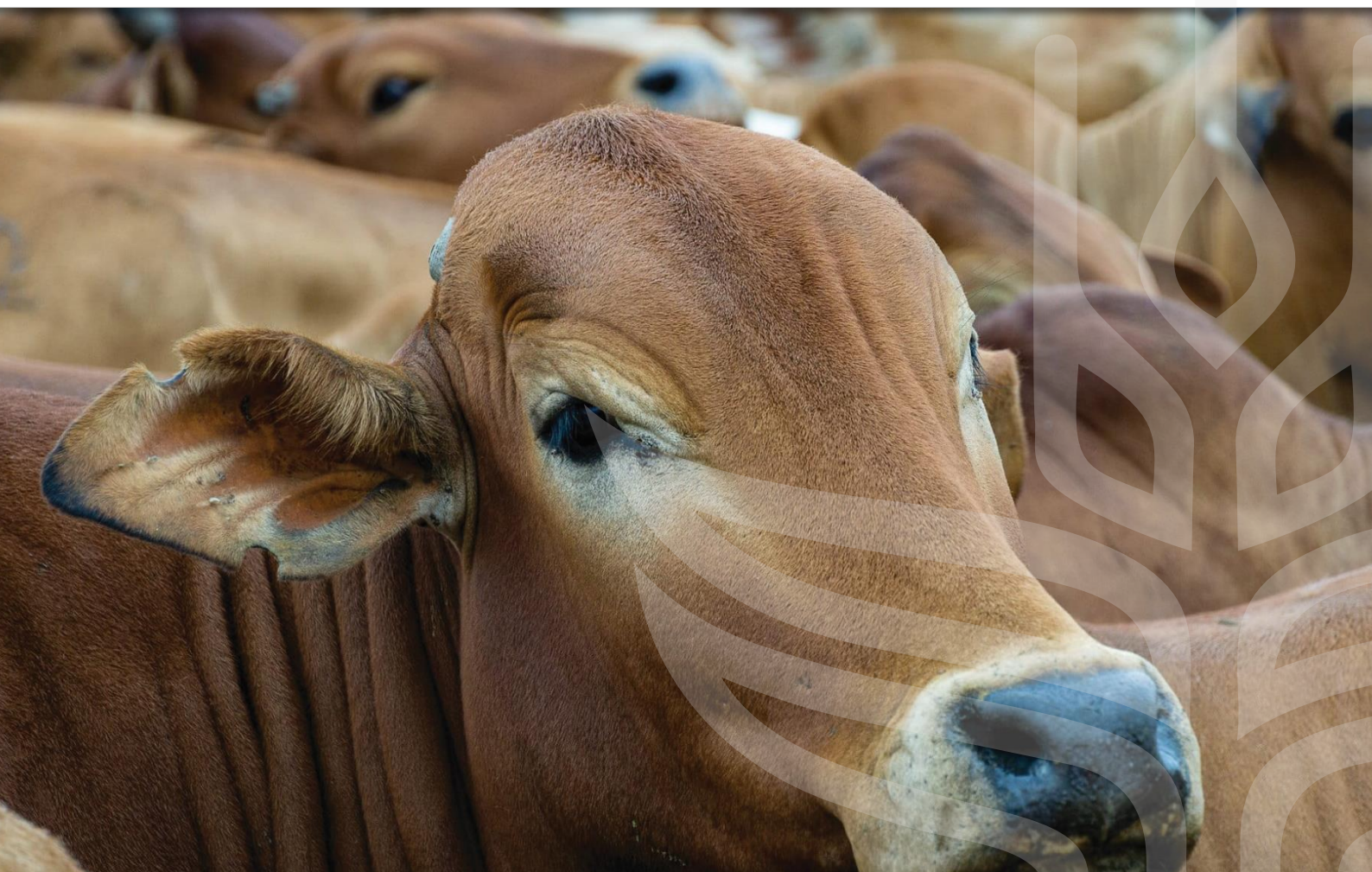


INITIATIVE ON
Livestock and Climate

Bridging the Climate Gap: A Unified Framework for Crop and Livestock Information Services in Senegal.

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December 2024



Contents

- Acronyms 3**
- Executive Summary 4**
- Introduction 5**
- CIS dissemination for crop sector..... 6**
 - Key Initiatives and Actors 6
 - Coverage and Scope..... 7
 - Impact and Improvements..... 7
- CIS dissemination in livestock sector 7**
- Private sector and CIS dissemination. 8**
 - Mlouma: Pioneering CIS Through SMS and USSD Technology 8
 - Jokalante: A Comprehensive Multi-Channel SAAS Platform..... 9
 - Strategic Partnerships and Collaboration 9
- Challenges for CIS dissemination..... 9**
 - Key Challenges 10
 - Opportunities and Solutions 10
 - Key recommendations for Enhancing Climate Information Services (CIS) Dissemination in Senegal 12
- Conclusion 13**
 - Proposed Solutions for Effective CIS Dissemination..... 13
- References 15**

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Acronyms

AICCRA	Accelerating Impacts of CGIAR Climate Research for Africa
ANACIM	Agence Nationale de l'Aviation Civile et de la Météorologie
ANCAR	Agence Nationale de Conseil Agricole et Rural
AVENIR	Adaptation et Valorisation de l'Entrepreneuriat dans l'agriculture Irriguée
AVSF	Agronomes et Vétérinaires Sans Frontières
CIAT	Centre International d'Agriculture Tropicale
CIS	Climat Information Services
CoP	Community of Practice
CSE	Ecological Monitoring Centre
ICARDA	International Center for Agricultural Research in Dry Areas
ILRI	International Livestock Research Institute
ISRA	Institut Sénégalais de Recherche Agronomique
L&C	Livestock and Climate
LCSR	Livestock, Climate and System Resilience
MWG	Multidisciplinary Working Group
SDDR	Departmental Services of Rural Development
SPAI	Système Pastoral d'Alerte et d'Information
WCIS	Weather and Climate Information Services

Executive Summary

Climate change and variability are increasingly placing pressure on agriculture and livestock farming in Senegal, impacting fodder availability, soil fertility, and the food security of rural communities. To address these challenges, Climate Information Services (CIS) are crucial for both agricultural producers and transhumant livestock farmers. Various stakeholders—such as the National Civil Aviation and Meteorology Agency (ANACIM), Multidisciplinary Working Groups (MWG), private startups (Jokalante, Mlouma), and NGOs—are mobilized to disseminate relevant meteorological information and agro-climatic advice through SMS, community radios, and digital platforms.

However, insufficient coordination among these multiple stakeholders, a lack of sustainable funding, and the absence of a unified dissemination framework continue to compromise the effectiveness of CIS. In light of these challenges, establishing a harmonized national architecture, supported by strengthened MWGs and closer institutional partnerships, is essential. Furthermore, integrating a pastoral component requires continuous dissemination solutions, especially outside the rainy season. By addressing structural gaps and optimizing collaborative approaches, Senegal can enhance the resilience of its agriculture and livestock, improving food security and economic prosperity for rural communities.

Key Messages

- **Strengthen Coordination:** A centralized mechanism and formalized partnerships are essential to prevent message duplication and ensure the coherence of CIS.
- **Ensure Equitable Coverage:** Information dissemination must be tailored to the specific needs of farmers and livestock breeders, considering access inequalities (literacy, connectivity, gender).
- **Sustainably Support MWGs:** Consistent financial and technical support will enable the harmonization of dissemination channels, enrich agro-climatic content, and deploy CIS throughout the year, particularly crucial for livestock farmers.

Introduction

Climate variability and change present significant challenges to the agricultural sector in sub-Saharan Africa. Shorter growing seasons result in lower yields, thereby affecting food availability, accessibility, and prices (Omotoso et al., 2023). In Senegal, the impacts of climate change are already evident, particularly in the northern regions where biomass production has declined significantly. This has reduced fodder availability for livestock, while also affecting soil fertility, prolonging the dry season, raising the risk of pest infestations, and reducing crop yields—all of which jeopardize food security. These shifts expose smallholder farmers to increased weather variability and uncertainty (CSE, 2010). Livestock farming, practiced by one-third of the households in Senegal, is a crucial pillar of the economy, contributing 3.4% of GDP. Meanwhile, the crop sector accounts for 9.6% of GDP (2019) and employs over 69.2% of the workforce (ANSD, 2022; ANSD.RGPH-5, 2023). The combined impact of climate change on these sectors highlights the urgency of strengthening adaptation and resilience measures.

The use of Climate Information Services (CIS) has been widely recognized as a powerful tool for improving agricultural productivity, food security, and farmers' financial incomes (Bizo et al., 2024; Diouf et al., 2022, Djido et al., 2021). By leveraging text and voice messaging platforms, CIS enables timely communication with farmers in remote areas, providing them with essential information for key farming decisions such as planting, harvesting, and pest management, based on climate forecasts and advisory updates. Evidence from Ethiopia shows that access to weather and climate services increases maize productivity by 27% and wheat productivity by 17% (Tamru et al., 2023). In Senegal, weather-based decision-making has contributed to a 15% increase in groundnut yields and a 50% increase in millet yields (James & Dannie, 2022), while another study showed a yield increase of respectively 15.48% and 14.7% for millet and rice (Diouf et al., 2022).

For the livestock sector, pastoralists utilize CIS to make informed adaptation decisions, such as destocking during climatic extremes, thereby reducing risks to livestock production and livelihoods (Nkuba et al., 2020). These findings demonstrate the critical role of CIS in building climate resilience and enhancing agricultural productivity.

Despite its potential, the use of Climate Information Services (CIS) faces significant challenges. Chief among them is the need to strengthen the global, regional, and national hydrometeorological systems to ensure the operationalization and timely delivery of climate information products and services at the national level, especially in developing countries where the need is greatest (WMO, 2019). Without this capacity, many vulnerable communities remain excluded from the benefits of CIS. Unpredictable rainfall patterns and extreme weather events such as droughts and floods continue to disrupt agricultural production, exacerbating food insecurity and poverty (Bizo et al., 2024). In the Sahel region, where agriculture remains largely underdeveloped and dependent on natural resources, these disruptions are further aggravated by increasing water scarcity and growing conflicts between farmers and pastoralists (Wang et al., 2023).

To address these challenges, several initiatives led by CGIAR centers aim to improve access to tailored weather and climate information for smallholder farmers in Senegal. Key initiatives include:

- Climate Change, Agriculture, and Food Security (CCAFS) (2011-2021) – Focused on integrating climate-smart agriculture, now concluded.
- Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) – Enhancing access to climate information and advisory services.
- Adaptation and Valorization of Entrepreneurship in Irrigated Agriculture (AVENIR) – Supporting youth and women's entrepreneurship in climate-resilient irrigated agriculture.
- CGIAR Initiative on Climate Resilience (ClimBeR) – Building resilience to climate shocks and stressors in food systems.
- Livestock, Climate, and System Resilience (LCSR) – Focusing on sustainable and climate-resilient livestock production systems.

These initiatives aim to empower smallholder farmers with actionable, location-specific weather forecasts and advisory services, enabling better decision-making in planting, harvesting, and livestock management. Collectively,

they contribute to improving productivity, reducing risk, and enhancing resilience in the face of climate change. In Senegal, Weather and Climate Information (WCI) is produced by the National Meteorological Agency (ANACIM), which is responsible for transmitting this information directly to the Multi-Actor Working Group (MWG), rural radios, Departmental Services of Rural Development (SDDR), and farmers. While ANACIM plays a central role in WCI production, the dissemination of agro-advisory services is primarily handled by private sector actors and community radio stations. Various partner organizations and institutional experts are involved in translating raw climate information into actionable agro-advisory messages tailored for farmers. However, a key challenge remains: the mechanisms for disseminating CIS differ for the crop and livestock sectors, with livestock farming often overlooked in CIS initiatives (Houessionon et al., 2023). Unlike farmers, who require forecasts during the rainy season for planting and harvesting, pastoralists rely on CIS during the dry season to locate water and feed for their livestock, especially in the context of transhumance.

With the aim of discussing practical modalities and building a synergy of action for access and use of climate information in Senegal, a one-day consultation workshop was organized on May 28th, 2024, at ONOMO Hotel, Dakar. This event brought together the initiators of different projects focused on the production and dissemination of climate information services in crops and the livestock sectors.

This policy brief aims to highlight current CIS dissemination mechanisms for both the crop and livestock sectors and propose strategies et recommendations for synergy and integration. By aligning dissemination channels and ensuring both sectors receive timely, relevant climate information, the impact on agricultural productivity, resilience, and livelihoods can be significantly enhanced.

CIS dissemination for crop sector

The dissemination of Climate Information Services (CIS) and agro-advisory services in Senegal's crop sector is driven by a combination of CGIAR initiatives, public agencies (like ANACIM), startups, and community radio. These efforts aim to provide farmers with timely, relevant, and actionable climate information to support their decision-making and improve agricultural productivity.

Key Initiatives and Actors

1. CGIAR Initiatives and Projects

- The AVENIR project collaborates with Mlouma to disseminate climate information and weather forecasts, while Jokalante handles the dissemination of CIS and agro-advisory services to farmers.
- The AICCRA project works in partnership with Jokalante to provide interactive voice response (IVR) systems for delivering climate information and agro-advisory messages directly to farmers (Worou et al., 2023). This interactive system ensures that even low-literacy farmers can access and understand climate updates.
- The Regional Study Centre for Improving Adaptation to Drought (CERAAS) supports the production of agrometeorological advice using the ISAT1 platform, ensuring that content is guided, validated, and adapted to local agricultural contexts.
- CGIAR Initiative on Climate Resilience (ClimBeR).
- CGIAR Initiative on Livestock and Climate (LCSR).

2. Multidisciplinary Working Groups (MWGs)

- Multi-Actor Working Groups (MWGs) play a critical role in improving coordination and ensuring that farmers receive accurate and timely agro-advisory services. MWGs use climate information from ANACIM, Jokalante, Mlouma, and other partners to produce a decadal agrometeorological bulletin.
- This bulletin serves as a vital source of information for national authorities, donors, technicians, the media, and local actors. It highlights weather forecasts, potential risks, and agro-advisory messages for each 10-day period.

- MWGs operate at the local level in 32 departments, facilitating coordination with farmers, local authorities, and decision-makers. They also collect feedback from farmers to refine CIS and agro-advisory content, ensuring that services remain demand-driven and context-specific (ANACIM, 2023).
3. Role of Startups and Digital Platforms
- Mlouma and Jokalante play pivotal roles in translating bulletin information into actionable advisory services for farmers. Mlouma focuses on disseminating weather forecasts, while Jokalante provides climate advisory content via voice messages and SMS.
 - These startups enhance the last-mile reach of CIS by using multi-channel dissemination, ensuring that even farmers in remote areas receive timely updates.

Coverage and Scope

Climate information and advisory services are provided throughout the agricultural campaign and cover all regions of Senegal supported by MWGs, CGIAR projects, and other stakeholder initiatives. The use of multiple communication channels (radio, SMS, voice messages) ensures a wider reach and accessibility for smallholder farmers, especially women and youth.

Impact and Improvements

The establishment of local MWGs in 32 departments represents a decentralized approach to CIS dissemination. It strengthens coordination, enhances communication flows between actors, and allows for two-way feedback from farmers and local authorities. This approach has improved the relevance, timeliness, and accessibility of climate information for farmers, leading to better decisions on planting, harvesting, and risk mitigation.

The dissemination of CIS in Senegal's crop sector is a collaborative effort involving ANACIM, CGIAR projects, startups, and MWGs. By leveraging interactive technologies, local working groups, and multi-channel communication, these actors ensure that farmers receive timely, localized, and actionable information. As MWGs expand their presence in 32 departments, they offer an effective platform for enhancing coordination, feedback, and the continuous improvement of agro-advisory services for farmers.

CIS dissemination in livestock sector

Under the AICCRA project, pastoralists and agro-pastoralists in Senegal receive climate information and advisory services through multiple channels, including Jokalante and local community radio stations. This multi-channel approach ensures that pastoral communities, especially those in remote areas, have access to timely, actionable information.

The Ecological Monitoring Centre (CSE) also plays a vital role in providing advisory services to pastoralists. Through its WENDOU geoportal, CSE offers real-time data on the availability of water, fodder, and other essential natural resources. This information is crucial for pastoralists making decisions on livestock movement and resource use. Before dissemination, climate data from ANACIM is processed and translated into actionable advisories with the support of the Community of Practice (CoP). Once the information has been converted, it is shared with Jokalante for dissemination to pastoralists via SMS, voice messages, and other communication channels (Houessionon et al., 2023).

However, an alternative approach exists through the Pastoral Warning and Information System (SPAI), managed by Agronomes & Vétérinaires Sans Frontières (AVSF). Unlike Jokalante, SPAI does not rely on

the Community of Practice (CoP) for converting climate data into advisory content. Instead, SPAI functions as a decision-support tool for a broad range of stakeholders, including:

- Farmers and livestock breeders – to inform their decision-making on livestock movement, grazing, and water access.
- Local elected representatives – to support local governance of natural resources.
- Technical services and administrative authorities – to facilitate timely response and management of natural resource issues.

SPAI serves as a real-time alert system for natural resource management in Ferlo, a key pastoral region in Senegal. It provides alerts and advisories on the status of pastures, water resources, and livestock movements, empowering stakeholders to make informed, proactive decisions. The system also supports early warning mechanisms to mitigate risks related to climate variability, droughts, and other climatic shocks.

In summary, while Jokalante relies on the CoP for advisory content development, SPAI operates as an independent decision-support tool. Together, these initiatives ensure that pastoralists, agro-pastoralists, and other stakeholders have access to the climate-smart information they need to safeguard livestock, manage natural resources, and strengthen climate resilience.

Private sector and CIS dissemination.

In Senegal, two prominent startups—Mlouma and Jokalante—play a critical role in the dissemination of Climate Information Services (CIS) and agro-advisory services to farmers and pastoralists. By leveraging Information and Communication Technologies (ICTs), these startups ensure that climate information reaches farmers in timely, accessible, and user-friendly formats, tailored to the specific needs of projects, partners, and end-users.

Mlouma: Pioneering CIS Through SMS and USSD Technology

Founded in 2012, Mlouma initially focused on climate information dissemination through SMS and internet-based platforms. Its flagship platform, “Météo Mabay”, was developed in collaboration with the USAID Naatal Mbay project, marking a significant step in bringing climate information to Senegalese farmers. However, due to challenges related to low literacy rates and limited internet access among farmers, Mlouma adapted its strategy to enhance accessibility and inclusivity.

To address these challenges, Mlouma introduced:

- Voice messages in local languages to ensure that farmers with limited literacy can receive and understand climate advisories.
- USSD technology, which allows farmers to access climate information via simple, text-based mobile commands, even on basic feature phones without internet access.

Mlouma's ability to adapt its dissemination approach has enhanced its impact, especially in rural and remote areas, where farmers face significant barriers to accessing climate-smart advisory services.

Jokalante: A Comprehensive Multi-Channel SAAS Platform

Established in 2016, Jokalante takes a more comprehensive approach by using a Software-as-a-Service (SAAS) platform to facilitate interactive and user-driven communication. Jokalante's system enables the delivery of customized climate advisory services through a multi-channel dissemination approach, including:

- Interactive Voice Response (IVR), allowing farmers to navigate advisory services using simple voice prompts in local languages.
- Voice and SMS messaging, providing timely updates on weather forecasts, planting advice, and pest alerts.
- Social media integration, enabling advisory services to reach younger, more tech-savvy farmers.
- Data collection and feedback tools, allowing for two-way interaction where farmers can provide feedback on the relevance and usability of the advisories they receive.
- Feedback mechanisms, ensuring continuous refinement of the advisory services based on farmer needs and partner expectations.

Jokalante's platform is particularly valued for its capacity to provide real-time, context-specific advice. By allowing users to interact directly with the system, farmers can access customized information and give real-time feedback, which is used to improve service delivery and content.

Strategic Partnerships and Collaboration

Both Mlouma and Jokalante have established strong partnerships with a range of stakeholders, enhancing their capacity to deliver effective CIS dissemination services. Key partnerships include:

- CGIAR Centres: Collaborations with initiatives like AICCRA, AVENIR, and ClimBeR have expanded the startups' capacity to deliver context-specific, climate-smart advisory services.
- International Development Agencies: These include partnerships with USAID (via Naatal Mbay) and other international development actors, which provide financial and technical support.
- Non-Governmental Organizations (NGOs): NGOs support the customization of advisory services and help co-design culturally relevant content for local communities.
- Private Sector Partnerships: Collaboration with telecommunications companies has enabled the development of USSD services and SMS delivery channels, essential for reaching rural, off-grid communities.

Through Mlouma and Jokalante, Senegal has established a dynamic, multi-channel climate information dissemination system. These startups have adapted to the local context by addressing challenges related to literacy, internet access, and language barriers. By using a combination of SMS, USSD, IVR, voice messages, and social media, they ensure inclusive access for farmers and pastoralists across rural Senegal. Their strong partnerships with CGIAR centers, development agencies, NGOs, and private sector entities have significantly enhanced the capacity to deliver timely, actionable climate information. Collectively, Mlouma and Jokalante are essential pillars in Senegal's CIS ecosystem, driving agricultural productivity, resilience, and food security.

Challenges for CIS dissemination

The dissemination of weather and agropastoral advisory services is crucial for both farmers and pastoralists in Senegal. Evidence from the AICCRA project (2023) indicates that 100% of pastoralists interviewed expressed their willingness to continue receiving agro-weather messages (AICCRA, 2023, unpublished). This highlights the demand for reliable, timely, and actionable climate information to support decision-making for farming, livestock rearing, and natural resource management.

Key Challenges

Despite notable progress, several key challenges remain:

1. Capacity Building of Key Actors
 - Capacity enhancement is required for critical actors such as Multi-Actor Working Groups (MWG), Communities of Practice (CoP), and local community organizations. These groups are pivotal for effective CIS dissemination, but their technical and operational capacities must be strengthened to improve coordination and message delivery.
2. Collaboration and Partnerships
 - Enhanced collaboration among development partners, government institutions, CGIAR centers, and the private sector is essential to streamline the dissemination process.
 - Partnerships should be formalized to ensure consistent messaging, avoid duplication of effort, and increase coordination at the local and national levels.
3. Strengthening Local MWGs
 - Local MWGs play a central role in converting weather forecasts from ANACIM and other actors into actionable advisory bulletins. These groups facilitate the production of agrometeorological bulletins every 10 days, which are essential for guiding farmers and pastoralists on issues related to agriculture, livestock, and markets.
 - Ensuring that MWGs are well-funded, have access to better data collection and processing tools, and receive technical support is crucial for increasing the reach and effectiveness of CIS.
4. Financial Support
 - The dissemination of climate information through MWGs and private startups requires sustainable financial support. MWGs need funding to produce and disseminate bulletins during both rainy and dry seasons, while also enhancing data collection, processing, and analysis tools.
5. Coordination Across Private Sector Startups
 - While the participation of startups like Jokalante and Mlouma offers opportunities for innovation, it also raises challenges related to coordination and overlap.
 - Farmers in the same region often receive CIS from multiple start-ups and projects, resulting in confusion and message overload. Without coordination, these multiple touchpoints may reduce farmers' trust in CIS and undermine the effectiveness of advisory services.

Opportunities and Solutions

To address these challenges, the following solutions and strategies are recommended:

1. Operationalization of a National CIS Framework

- There is an urgent need to establish and operationalize a national framework to harmonize the roles, responsibilities, and interventions of all stakeholders involved in CIS dissemination.
 - While Senegal is ahead of its West African counterparts in the production and dissemination of CIS, significant gaps remain, with some farmers and pastoralists in remote areas still unreached.
 - The existing national and local MWGs offer a strong platform for coordination, and their strengthening and efficient use could enhance the reach and effectiveness of CIS.
2. Role of MWGs in CIS Dissemination
- MWGs are essential for promoting multi-stakeholder collaboration. They facilitate the exchange of ideas and information between ANACIM, CERAAS, development partners, and CGIAR initiatives.
 - The MWGs play a critical role in the production of 10-day agrometeorological bulletins, which are disseminated to farmers, pastoralists, local authorities, media, and NGOs.
 - According to Chiputwa et al. (2020), the presence of MWGs significantly increases farmers' access to weather forecasts, their knowledge of CIS, and the likelihood of behavioral change. Therefore, strengthening MWGs would lead to better decision-making on farming activities, livestock movement, and input procurement.
3. Digitalization and Simplification of CIS Bulletins
- The bulletins produced by MWGs are highly valuable but not always accessible to farmers and pastoralists, especially those with low literacy levels.
 - To improve usability, there is a need to simplify, digitize, and diversify bulletin formats.
 - Digital bulletins could be shared via mobile apps, SMS, USSD codes, and interactive voice response (IVR) systems, making them accessible to a broader audience, particularly youth and low-literacy farmers.
4. Financial and Technical Support for MWGs
- Providing consistent financial support to MWGs would enable them to sustain their activities, especially during the dry season, when CIS is critical for pastoralist decision-making.
 - Investments in data collection tools, processing software, and technical capacity-building are necessary to increase the robustness and timeliness of advisory content.
5. Coordination Among Private Sector Startups
- To prevent the confusion caused by multiple startups targeting the same farmers, it is essential to map and align service areas and farmer beneficiaries.
 - Each startup (like Jokalante, Mlouma, and SPAI) should provide services in a way that complements rather than duplicates the efforts of MWGs and other project-driven initiatives.
 - Private sector actors should collaborate with MWGs to ensure that farmer lists are updated and that beneficiaries are not overburdened with conflicting advisory messages.
6. Foster Multi-Stakeholder Synergy
- Stakeholders, including CGIAR initiatives (AICCRA, ClimBeR, AVENIR, and CCAFS), must improve inter-project coordination to avoid duplication of advisory services.
 - Projects and startups should harmonize dissemination schedules to ensure that climate information is consistent and does not create confusion among farmers and pastoralists.
 - By leveraging the MWGs as a unifying platform, stakeholders can create synergies that maximize the impact of CIS dissemination at the community, district, and national levels.

Despite the progress made in CIS production and dissemination in Senegal, key challenges persist. These challenges include capacity gaps, coordination issues, and financial constraints affecting actors such as MWGs, start-ups, and local government authorities. Start-ups like Jokalante and Mlouma offer new opportunities for innovative dissemination, but uncoordinated approaches may lead to message duplication and confusion among farmers and pastoralists. The solution lies in establishing a national framework for CIS coordination, with MWGs serving as a central platform for stakeholder alignment and coordination. Their ability to bring stakeholders together, produce 10-day agrometeorological bulletins, and facilitate farmer feedback makes them a critical pillar of Senegal's CIS ecosystem. According to Chiputwa et al. (2020), MWGs have a significant and positive impact on farmers' knowledge, access, and use of weather forecasts. However, their operations must be better financed, digitized, and streamlined to ensure consistency in advisory messaging. By strengthening the roles of MWGs and promoting collaboration among CGIAR projects, development partners, private sector startups, and government authorities, Senegal can create a harmonized CIS system that improves the resilience, productivity, and livelihoods of farmers and pastoralists.

Key recommendations for Enhancing Climate Information Services (CIS) Dissemination in Senegal

1. Avoid Contradictory Information Across Channels
 - Establish a centralized coordination mechanism to ensure farmers and pastoralists do not receive conflicting climate information or advisory services from different channels at the same time.
 - Foster collaboration and streamline the flow of information between public institutions (e.g., ANACIM, SDDR), community radio stations, private organizations, and development projects.
 - Develop a unified communication strategy with a “single source of truth” for all CIS-related content.
2. Develop a Consensus-Based Dissemination Framework for Livestock CIS
 - Create a standardized framework to guide the dissemination of CIS for the livestock sector, ensuring that advisory messages are consistent, timely, and non-duplicative.
 - Promote coordination between public and private sector actors, such as community radios, NGOs, and private advisory firms, to avoid duplication of effort and information overload for pastoralists.
 - Implement a mechanism for joint validation of CIS content before it is shared with end users.
3. Ensure Year-Round Climate Information Services for Livestock
 - Move beyond the traditional focus on the rainy season and develop year-round CIS tailored to the specific needs of livestock farmers.
 - Incorporate climate forecasts, early warnings, and resource availability updates (e.g., water and pasture) for pastoralists, especially during the dry season, when transhumance requires strategic movement of livestock.
 - Enable season-specific advisories to support key pastoral activities such as vaccination, movement planning, and risk reduction.
4. Enhance the Efficiency of CIS Dissemination via Startups and Key Actors
 - Leverage the capacity of startups, digital platforms, and private service providers to efficiently disseminate CIS and agro-advisory services to both farmers and pastoralists.

- Encourage innovative technologies, such as mobile apps, SMS services, and voice message platforms, to bridge the information gap for hard-to-reach rural communities.
 - Promote the use of multi-channel approaches (radio, mobile apps, community meetings, and farmer field schools) to ensure inclusivity and accessibility for women, youth, and pastoralist communities.
5. Establish a Comprehensive CIS Dissemination Framework for Crops and Livestock
- Develop an interconnected CIS dissemination framework that fosters collaboration between the Multi-Actor Working Group (MWG), government bodies, NGOs, and project owners.
 - Promote cross-sectoral coordination to ensure that both the crop and livestock sectors receive harmonized advisory services that are context-specific and user-centered.
 - Create a central CIS knowledge hub where partners can share climate data, advisory content, and dissemination schedules to prevent redundancy and ensure coherence.

By addressing these key recommendations, Senegal can establish a more efficient, inclusive, and harmonized climate information system. This system will empower farmers and pastoralists with timely, actionable, and context-specific information, ultimately improving agricultural productivity, food security, and climate resilience.

Conclusion

In Senegal, farmers and pastoralists receive Climate Information Services (CIS) through multiple actors and communication channels, including radio broadcasts, SMS alerts, voice messages, community forums, and mobile applications. While the National Meteorological Agency (ANACIM) is responsible for generating and providing weather and climate information, the dissemination of CIS—often combined with agro-advisory messages tailored to farmers and pastoralists—relies on a variety of actors, including development projects, private sector companies, NGOs, community radio stations, and governmental institutions.

This fragmented system of CIS dissemination presents several challenges:

1. Duplication of messages: Multiple actors may send the same type of climate information or advisory messages to farmers through different channels, resulting in inefficiencies.
2. Conflicting messages: Farmers and pastoralists sometimes receive contradictory information from different actors, leading to confusion and uncertainty in decision-making.
3. Lack of coordination: Limited collaboration and synchronization among CIS providers means that advisory messages are not always harmonized, resulting in lost opportunities for impact.

Proposed Solutions for Effective CIS Dissemination

1. Establish a Unified CIS Dissemination Framework
 - Develop a centralized coordination mechanism to regulate how climate information and agro-advisory services are communicated to farmers and pastoralists.
 - Standardize communication protocols for CIS dissemination, ensuring that content is clear, concise, and context-specific, and that it addresses the unique needs of both farmers and pastoralists.

- Promote an interconnected system where public (ANACIM, SDDR) and private actors (NGOs, development projects, private service providers) share information through a unified platform.
- 2. Foster Collaboration and Partnerships
 - Encourage collaboration between ANACIM, development projects, private service providers, and farmer organizations to align CIS dissemination activities.
 - Create a multi-stakeholder coordination platform where actors meet regularly to discuss advisory content, share communication schedules, and avoid message duplication.
 - Promote Memorandums of Understanding (MoUs) between actors to define roles, responsibilities, and information-sharing protocols.
- 3. Harmonize Messaging to Avoid Contradictions
 - Introduce a content validation system where advisory messages are jointly reviewed and approved by key stakeholders before dissemination.
 - Design a "single source of truth" for CIS messaging, with ANACIM providing the base weather forecasts, and all actors tailoring agro-advisories based on standardized guidelines.
 - Ensure that farmers and pastoralists receive consistent, coherent messages that are context-specific and time-sensitive.
- 4. Promote Multi-Channel Dissemination
 - Utilize a mix of communication channels (radio, SMS, mobile apps, voice messages, and community meetings) to increase the reach and accessibility of CIS.
 - Tailor the choice of channel based on the literacy levels and accessibility of the target audience (e.g., voice messages for low-literacy communities and SMS for tech-savvy youth).
 - Leverage existing platforms like digital advisory apps and climate-smart agriculture apps to reach more farmers and pastoralists in remote areas.
- 5. Build the Capacity of CIS Actors
 - Train radio broadcasters, extension agents, and community organizations on how to convert weather forecasts into actionable advisory messages.
 - Build the technical capacity of local farmer cooperatives and community-based organizations to ensure last-mile dissemination of CIS in local languages.
 - Strengthen the capacity of ANACIM to produce highly localized weather forecasts that can be tailored for specific communities.
- 6. Monitor, Evaluate, and Learn
 - Establish a feedback mechanism for farmers and pastoralists to report inconsistencies, errors, or areas of confusion in the information they receive.
 - Conduct periodic impact assessments to measure the effectiveness of CIS dissemination and identify areas for improvement.
 - Use insights from evaluations to continuously improve coordination, content quality, and dissemination channels.

For CIS to effectively support decision-making for farmers and pastoralists, it is crucial to address issues of message duplication, conflicting information, and lack of coordination. By harmonizing the roles and responsibilities of actors, establishing a unified framework, and promoting collaboration across stakeholders, Senegal can ensure that farmers and pastoralists receive timely, accurate, and actionable climate information. This, in turn, will enhance agricultural productivity, livestock management, and resilience in the face of climate change.

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