WISER Western Project

Proposal for the development of seasonal, monthly and weekly weather forecasts for small-scale farmers in Western Kenya

(Final version)

Robert Powell

Communications Consultant

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1. Executive summary

Small-scale farmers constitute the majority of the population of Western Kenya. Their livelihoods are highly dependent on the weather.

Yet very few of them receive any useful weather or climate information from the Kenya Meteorological Department (KMD) at present.

This proposal seeks to develop a series of downscaled weather forecasts that are already being produced and disseminated by many of the County Directors of Meteorology (CDMs) in Western Kenya.

It also aims to disseminate these forecasts to small-scale farmers in a timely fashion through local radio stations and SMS messages sent to community representatives.

The information needs of other stakeholder groups which have regular and easy access to the internet are also addressed in this document.

However, its primary focus is the production of needs-based and demand-led weather forecasts for small-scale farmers.

Internet access through smart phones is likely to grow rapidly in rural areas of Kenya over the coming years. But internet penetration amongst small-scale subsistence farmers remains very low for the time being.

The internet is still primarily a channel for reaching the educated elites in government departments, business organisations and NGOs.

This document proposes that the WISER Western Project should focus on standardising and developing three types of county forecast which are already being produced by CDMs in Western Kenya:

- Weekly – every Monday night
- Monthly – one or two days before the start of each month
- Seasonal – at least three weeks before the onset of the rainy season

In order to make these forecasts more useful to farmers it is proposed that each bulletin include timely and relevant weather-related advice to farmers.

This advice would be provided by a panel of experts from the Ministry of Agriculture and the Kenya Agriculture and Livestock Research Organisation (KALRO) in each county.

Each CDM would share his/her downscaled forecasts with the local panel of experts before publication. Available members of the panel would immediately propose

between two and five bullet points of advice to local farmers in the light of the weather conditions forecast.

The CDM would add these points of advice to each weekly, monthly and seasonal forecast before publication.

The dissemination of downscaled weather forecasts via the internet should be enhanced by creating 47 county pages (one for each county in Kenya) and at least 15 regional pages on the KMD website. The WISER Western Project has already made budgetary provision to create these pages.

All the downscaled climate and weather information for each county would be posted on its own page on the KMD website. This would become a one-stop shop for people looking for climate information about that particular county.

Each CDM should also establish an official Facebook page where all of KMD's climate and weather information outputs for that county would also be published and shared on social media.

However, the main methods of communicating weather forecasts and hazard warnings to farmers would be:

- **Local and regional radio stations**. KMD should prepare forecasts for radio that cover two sub-regions of Western Kenya. One is the Luhya-speaking heartland (Vihiga, Kakamega, Bungoma, Busia and Trans-Nzoia) that was formerly known as Western Province. The other is the Luo-speaking heartland (Siaya, Kisumu, Homa Bay and Migori) that was formerly known as Nyanza. Forecasts for these two sub-regions would be disseminated by Luo and Luhya language radio stations based in Nairobi and Kisumu and by local radio stations in Western Kenya that broadcast in a mix of Swahili and local languages
- **SMS messages to community intermediaries communicated by partner organisations**. These partner organisations would supply the contact lists of intermediaries who would receive SMS forecasts. They would take responsibility for sending the SMS messages to these intermediaries. The intermediaries would in turn pass on the information by word of mouth to their immediate neighbours. The partner organisations would send SMS forecasts to the designated intermediaries through their own SMS portals and at their own expense. However, WISER Western would help those organisations which do not currently have an SMS portal to set one up using FrontlineSMS http://www.frontlinesms.com

.The SMS dissemination partners would include:

- County Commissioners – who would disseminate the forecasts to chiefs and assistant chiefs
- The Ministry of Agriculture – which would communicate the forecasts to agricultural extension officers
- NGOs engaged in rural development projects – which would send the SMS forecasts to their field workers and affiliated farmers' groups
- Sugar companies – which would send the SMS forecasts to their field staff and out-growers
- Churches – which would disseminate the SMS forecasts via their priests, pastors and catechists.

The Government of Kenya does not provide KMD with a generous budget to disseminate the information which it produces.

This proposal therefore seeks to establish a mass communication system which incurs little or no recurrent cost to KMD.

Removing the cost of dissemination should ensure that the information service remains financially sustainable in the long term.

Most local and regional radio stations in Western Kenya broadcast to audiences in more than one county.

To meet their needs, KMD should produce special weather forecasts for radio that amalgamate information from several different counties into two sub-regional forecasts. The geographic area covered by these forecasts would broadly match the broadcast footprint of the main regional radio stations.

This approach implies the inclusion of weather forecast information from five more counties in Western Kenya to supplement that provided by the four counties primarily targeted by the WISER Western Project. These five peripheral counties are Bungoma, Vihiga, Busia, Homa Bay and Migori. These are served by the same radio stations that are most widely listened to in the WISER Western core counties of Kisumu, Siaya, Kakamega and Trans-Nzoia.

.A total of nine counties in Western Kenya would therefore produce county forecasts using the WISER Western templates, rather than the four originally envisaged.

This expansion of the geographical coverage of WISER Western information products should be regarded as a bonus, rather than a dilution of project resources.

It will dramatically increase the number of farmers that can be reached at very little extra cost.

2. Introduction

This proposal responds to the mandate of the WISER Western Project to develop timely, useful and accessible climate information services for small-scale farmers in four pilot counties of Western Kenya – Kisumu, Siaya, Kakamega and Trans-Nzoia.

Small-scale farmers who cultivate between half an acre and five acres of land, constitute the majority of the population of the region. Their livelihoods are highly dependent on the weather. However, very few of them receive any useful weather or climate information from the Kenya Meteorological Department (KMD) at present.

This proposal seeks to develop a series of weekly, monthly and seasonal forecasts that are already being produced by most County Directors of Meteorology (CDMs) in Western Kenya.

It also seeks to ensure the timely and effective dissemination of these forecasts to farmers by radio and SMS.

The information needs of other stakeholder groups which have regular access to the internet are also addressed in this document.

However, the primary focus of this proposal is the production of needs-based and demand-led weather forecasts for small-scale farmers and the dissemination of these forecasts to farmers in a timely manner.

The small-scale farmers of Western Kenya can only be reached quickly by radio or through messages sent to their mobile phones.

Internet access through smart phones is likely to grow rapidly in rural areas of Kenya over the coming years. However, the penetration level of the mobile internet amongst small-scale subsistence farmers remains low for the time being.

The internet is still primarily a channel of communication whose reach is limited to the educated elites in government departments, business organisations and NGOs.

Donor-funding for projects like WISER Western are time-limited. When such funding is no longer available, KMD does not have a generous budget to disseminate the information which it produces.

If the proposed new KMD information outputs are to be sustainable in the medium to long term, their cost of dissemination must be kept very low.

This proposal therefore seeks to establish a system a mass communication of weather forecast information which incurs little or no recurrent cost to KMD.

In the case of radio, this implies the production of weather forecasts which serve the information needs of the entire target audience of each partner station. It is essential to meet this criterion if radio stations are to carry the forecasts free of charge.

This approach will create more work for KMD staff. They will have to produce separate versions of each weekly, monthly and seasonal forecast for the internet, for SMS and for radio.

However, this approach will solve an important financial problem which has prevented similar initiatives in the past from becoming sustainable once donor funding runs out.

3. What weather forecast information do farmers want?

Small-scale farmers in Trans-Nzoia , Kakamega, Kisumu and Siaya counties were consulted about what kind of weather forecast information they needed through a series of focus groups held in March and April 2016.

Overwhelmingly, the farmers asked for two types of forecast to be delivered to them in timely manner.

First and foremost, they wanted a reliable and locally accurate **seasonal forecast** to be delivered **at least three weeks before the start of each rainy season.**

This would require KMD to publish the seasonal forecast for each county much earlier than has been the case until now.

Farmers said that a reliable and locally accurate seasonal forecast, delivered to them in good time, would help them decide which crops to plant, which seed varieties to choose and when to sow their seed in the ground.

They wanted this seasonal forecast to contain the following essential elements:

- The date of onset of the rainy season
- Information about the amount of rainfall expected
- Information about the distribution of rainfall over the course of the rainy season, including the expected timing and length of any long dry spells
- The date of cessation (some expressed this as the length of the growing season)

Secondly, farmers wanted a regular and locally accurate **weekly forecast** to help them with day-to-day decision making. This weekly forecast should say where and

when rain was expected and how much rain was expected to fall on each day of the forecast period.

Farmers also wanted the weekly forecast to flag up any weather-related hazards expected, such as high winds, thunderstorms, hail storms and extremes of temperature.

They emphasised that each forecast should be communicated to them in plain language and terminology which they could understand easily.

The farmers also requested that each forecast be accompanied by practical advice from agricultural exper ts on how to respond to the weather conditions expected.

Such advice would help them to use the weather and climate information to take practical and timely decisions to protect their livelihoods.

4. The farmers' preferred channels of communication

Farmers said they would prefer to receive the seasonal and weekly forecasts by SMS and by radio.

Information transmitted by radio should preferably be broadcast during the peak listening period between 21.00 and 21.30 at night. Some - but not all – farmers also listen to radio in the early morning between 05.00 and 07.00.

The focus group participants appreciated that it would be difficult and very costly to send forecasts by SMS to individual farmers.

They identified the following categories of people as ideal community intermediaries who could receive the forecasts by SMS and pass it on to their neighbours by word of mouth:

- leaders of community-based organisations (CBOs)
- leaders of farmers' groups
- NGO outreach workers involved in rural development
- priests and pastors.

There were varying levels of enthusiasm about using chiefs and agricultural extension officers as intermediaries.

Agricultural extension officers were widely criticised for failing to be pro-active. Focus group participants said most did not leave their offices to go out to talk to farmers. They only gave information and advice if you went to see them in their office.

Chiefs were respected, but many farmers doubted that they would not pass on weather forecast information to the local community on a regular basis.

The farmers did not mention using business organisations such as banks, suppliers of agricultural inputs and bulk purchasers of crops as channels of communication.

However, many farmers have commercial relationships with these kinds of organisations and they constitute an obvious channel to develop in the future.

Sugar cane processors offer immediate potential as a channel for communicating climate information to farmers in Kisumu and Kakamega counties.

The large sugar factories in these two counties contract tens of thousands of out-growers to produce cane for them. The sugar companies have a close working relationship with these farmers and maintain regular contact with them through a network of field officers.

Television still has very limited penetration in the rural areas of Western Kenya. Furthermore, the small minority of farmers who do own a television set predominantly watch national channels. These are unsuitable vehicles for communicating local as opposed to national weather forecasts.

Regional TV stations do exist, but they are very small and produce limited amounts of original programming. They also command very small audiences in rural areas.

Very few small-scale farmers have regular access to the internet. Almost none have smart phones or computers.

Many teenagers and youths in rural areas use feature phones with small screens and slow download speeds to go online to chat with their friends on social media – especially Facebook. But few use the internet as a source of information to enhance the livelihoods of their families.

The internet is becoming increasingly accessible to lower income groups and mobile internet is likely to become a useful tool for communicating with poor rural communities in the not too distant future.

However, for now the internet is still a channel of communication which can only be accessed easily and regularly by the educated and relatively affluent urban elite. Rural penetration has not yet reached the stage where it can be regarded as an important channel of direct communication with small-scale farmers.

Local and regional radio stations and SMS messages sent to community leaders or direct to individual farmers still offer the best way of getting local weather information to large numbers of small-scale farmers rapidly.

5. The production of weather forecasts at the county level

The County Meteorological Directors in most counties of Western Kenya already produce and circulate downscaled weekly and seasonal forecasts for stakeholders who live and work in these counties.

Some CDMs also produce monthly and daily forecasts.

The demand from farmers is predominantly for weekly and seasonal forecasts, so WISER Western should concentrate primarily on developing these two products and improving their distribution.

However, the CDMs of nine counties in Western Kenya unanimously recommended at a workshop in April 2016 that an improved **monthly forecast** should also be communicated regularly to farmers as part of the WISER Western initiative.

They pointed out that the monthly forecasts would provide useful updates on the three seasonal forecasts that are currently produced. These seasonal forecasts cover the following periods:

- March, April, May “long” rainy season
- June, July, August rainy season (selected counties in Western Kenya only)
- October, November, December “short” rainy season

The weekly county forecasts that are currently produced vary greatly in their style and content. Until now, KMD has not provided any standard template which they should follow.

The weekly forecasts are created by downscaling KMD’s national seven-day forecast which is published every Monday in the afternoon.

The downscaled weekly forecast for each county forecast is therefore produced and distributed by CDMs on Monday night or Tuesday morning

Until now, the CDM’s in Western Kenya have only circulated their downscaled weekly, monthly and seasonal forecasts by email and WhatsApp to selected individuals and institutions who have requested them.

Typically, each CDM distributes his/her local forecasts to between 100 and 300 people by email. Most of the recipients are individuals who work in government or in NGOs. Some are leaders of community-based organizations.

Some CDMs also circulate their forecasts to one or more contact groups via the instant messaging service WhatsApp

However, these forecasts disseminated via the internet do not reach a wide audience at the grass roots level. They only reach educated and relatively affluent people in the towns who have regular access to the internet on a computer or smart phone. There is little evidence to suggest that these people regularly pass on the information to farmers in a timely manner.

KMD headquarters in Nairobi does not regularly monitor the county forecasts produced and distributed by CDMs. There is no oversight to ensure that they are published regularly or that they consistently meet an acceptable standard.

At the time field research was carried out for this proposal in March and April 2016, the production and dissemination of downscaled forecasts had been suspended in Kisumu and Siaya counties for a period of several months.

This lack of headquarters supervision should be rectified as soon as possible by the creation of a specialist unit within the KMD forecasting department in Nairobi to routinely monitor the local forecasts produced by all CDMs.

This regional forecasting support unit should ensure that all the downscaled forecasts are produced to an agreed minimum standard and are disseminated regularly.

It should help CDMs to gain easy and regular access to any KMD database information they may need to produce their local forecasts.

The regional support unit should also ensure the continuity of production and dissemination of county forecasts whenever a CDM is sick, on leave or away from his/her duty station for other reasons

So far, none of the weekly or monthly forecasts produced by CDMs have been accompanied by matching agricultural advice.

The seasonal county forecasts, on the other hand, are normally accompanied by agricultural advice which is generated at a Participatory Planning Scenario (PSP) meeting.

The PSPs are forums of government, NGO and community representatives that are organised by the Agricultural Sector Development Support Plan (ASDSP) at the county level at the start of each rainy season.

They normally take place between one and three weeks after KMD’s publication of the national seasonal forecast.

However, the PSPs are invariably held too late to influence the farmers' choice of crops, seed varieties and planting time. Many PSPs only meet after the first rains have fallen. By that time most farmers already have their seed in the ground.

6. Publish the seasonal forecasts earlier

Downscaled seasonal forecasts, accompanied by relevant advice from the Ministry of Agriculture, must be disseminated **at least three weeks before the onset of each rainy season** in order to influence the farmers' choice of crop and seed variety and in order to influence their time of planting,

To achieve this goal, KMD will have to publish its national seasonal forecast earlier than it does at present. This is technically possible, but political will is required to ensure that publication does not get held up by procedural issues.

Secondly, CDMs will have to consistently produce and publish their own downscaled county forecasts as soon as possible after the KMD national seasonal forecast has been made available to them.

The CDMs should not wait for the county Participatory Scenario Planning (PSP) meeting to take place before issuing their downscaled seasonal forecast, with advice to farmers published alongside it..

KMD headquarters should systematically publish the first version of the national seasonal forecast **before** the Inter-governmental Authority on Development (IGAD) Climate Outlook Forum (COF) is held to agree a common seasonal forecast for the whole of East Africa.

KMD's national seasonal forecast for the March, April, May rainy season cannot be finalised before sea surface temperature information for the Indian Ocean in January becomes available on February 11. However, the forecast is technically ready for release by about February 20.

Nevertheless, publication is normally delayed until the end of February or the beginning of March in order to allow the IGAD COF to take place first.

Even then, KMD does not always publish the national seasonal forecast as quickly as it might do.

In 2016, the IGAD COF for the March, April, May rainy season was held in Kigali on February 22 and 23, but the Kenyan national forecast was not publicly announced in Narirobi until March 1, a week later.

Similar delays also hold up the publication of KMD's national seasonal forecast for the October, November, December rainy season.

This is usually ready before the end of August. But its publication is usually delayed until after the IGAD COF meeting in September.

If the national seasonal forecast were routinely published before the IGAD COF meetings, CDMs would be able to produce and publish their downscaled county forecasts much sooner

Once the CDMs have produced their county forecast for the coming rainy season, they should publish it immediately.

Furthermore, **the county seasonal forecast should be accompanied by up to five bullet points of related advice to farmers** provided by agricultural experts from the local offices of the Ministry of Agriculture and the local KALRO research station (if there is one).

The advice given to farmers at this stage should:

- Recommend the most appropriate crop and seed types to choose in the light of conditions predicted in the forecast
- Recommend the most appropriate time to plant the main crops grown in the county.
- Identify the crop pests and diseases are most likely to occur in the weather conditions forecast and advise farmers how to prevent them or minimize the damage which they cause

Local agricultural experts who read the downscaled forecast should be able to say immediately which crops and which seed varieties are likely to do best in the different climatic zones of the county.

They do not need to wait for the PSP to give authoritative guidance on this.

It is worth noting that historically, much of the advice issued to farmers by the PSPs is unrelated to the content of the seasonal forecast.

The participants in these forums routinely repeat a lot of advice on good practice which agricultural and livestock extension officers and NGO outreach workers would normally be giving to farmers and livestock owners at this time of year in any case.

7. Improving the content, presentation and distribution of local forecasts

A key objective of the WISER Western Project is to make local weather forecasts much more widely available to small-scale farmers in a form that they can understand easily. Such forecasts should empower them to take timely practical decisions to protect and enhance their livelihoods.

It is therefore proposed that KMD improve the presentation, content and distribution of the existing county seasonal and weekly forecasts in the following ways:

- CDMs should adopt **standard templates** for the seasonal, monthly and weekly forecasts. These templates would simplify the presentation of the weather forecast, strip out information that is not essential for the end user and make the forecast easier for rural communities to understand.

- CDMs should publish **timely and practical advice to local farmers** alongside each weekly and seasonal forecast. This advice should be provided by a panel of technical experts from the local offices of the Ministry of Agriculture and the local KALRO research station (if there is one). The advice given by these experts should be based on the weather conditions predicted.

- KMD should produce three different versions of each downscaled forecast in order to adapt it for communication via the following channels:

    - **The internet** - email, WhatsApp messages and posts on the KMD website and the CDM's Facebook page
    - **Radio stations** that target local and regional audiences
    - **SMS messages** disseminated to community intermediaries by partner organisations

Kisumu, Kakamega, Siaya and Trans-Nzoia are predominantly agricultural counties where rural families rely first and foremost on the cultivation of crops for their livelihoods.

WISER Western should therefore focus on delivering advice about crop growing alongside the weekly and seasonal weather forecasts to begin with.

Domestic livestock plays a secondary role in providing food and cash income for rural households in Western Kenya. Most farmers have one or two cows for milking and some poultry. Some also keep a few sheep, goats and rabbits.

It is recommended that specialist advice on livestock husbandry from the Department of Livestock should only be added to downscaled weather forecasts at a later stage once their production and distribution has become firmly established.

It is important to keep the process of producing the forecasts as simple and as streamlined as possible during the launch phase.

Delays in publishing the forecasts while waiting for other government departments to provide inputs to them should be strenuously avoided.

KMD does not have a regular budget to meet the cost of disseminating the weather forecasts which it produces.

If the communication of weekly and seasonal forecasts to rural stakeholders by radio and SMS is to be sustainable in the long term without donor funding, the cost to KMD of communicating these forecasts to the general public must be close to zero.

KMD can display forecasts on its website and distribute them via email, WhatsApp and Facebook at virtually no cost.

However, KMD cannot afford to pay for radio air time to ensure that its forecasts are broadcast by radio stations.

Neither can it afford to bear the recurrent cost of distributing weather forecasts and hazard warnings to thousands of community intermediaries in each county by SMS.

WISER Western should therefore use project resources to create:

- **Permanent platforms on the internet for the communication of local climate information**. WISER Western should help KMD create 47 county pages and at least 10 regional pages on its website where downscaled climate information can be displayed. Additionally, each CDM should have an official Facebook page through which down-scaled climate information can be communicated easily to the public via social media.

- **Sub-regional weather forecasts for radio stations.** These will be created by amalgamating nine individual county forecasts into two sub-regional forecasts. These will cover the Luhya and Luo speaking heartlands of western Kenya respectively. The forecasts for radio should be written in the form of concise radio scripts. If KMD can provide regular and reliable weather forecasts that are tailor-made for the needs of a radio station's target audience and are easy for journalists to adapt for broadcast, the station manager will gladly air them free of charge as part of normal programming. Consultations with radio station managers in Western Kenya have confirmed their willingness to do this.

- **SMS versions of the county weather forecasts.** Ready-to-use SMS messages would be sent by email to KMD's SMS distribution partners in each county. These organizations would forward the messages by SMS to their

own networks of community intermediaries. The intermediaries would then relay the forecasts and their accompanying advisory messages by word of mouth to their immediate neighbours. In some cases, the SMS distribution partners may also send text forecasts directly to individual end users of the information. The distribution partners would fund the cost of disseminating the SMS forecasts because they appreciate the value of the information which these messages contain for their own rural stakeholders. The SMS distribution partners should include: government departments, NGOs engaged in rural development, churches with a strong presence in rural areas and large businesses involved in the agricultural value chain. Some of these organisations already operate their own SMS portals.

8. Sub-regional forecasts for radio

Radio stations will only carry downscaled KMD weather forecasts free of charge if these forecasts serve the information needs of their entire target audience.

KMD should respond to this demand from such an important channel of communication by adjusting the way that it creates weather forecasts for radio.

Most local and regional radio stations in Western Kenya, including those that are most popular in farming communities, broadcast to audiences in more than one county.

It will therefore be necessary for KDM to produce special forecasts for radio that amalgamate the information received from CDMs in several different counties.

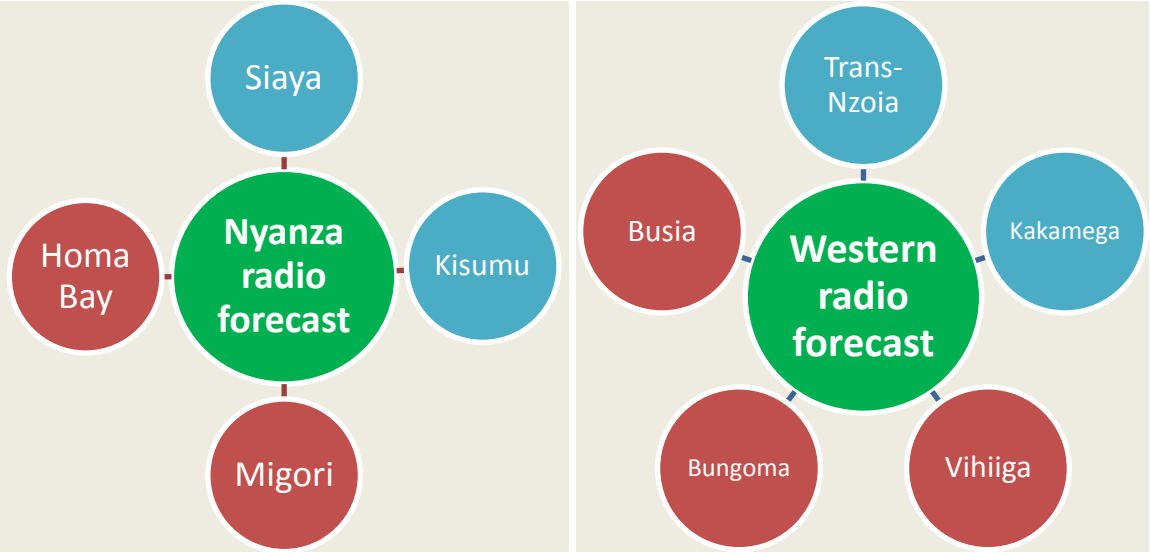
In order to match the coverage area of radio stations broadcasting to the Luhya sub-region, KMD should combine the weekly and seasonal forecasts from the following five counties into a single sub-regional forecast:

- Bungoma
- Kakamega
- Vihiga
- Trans-Nzoia
- Busia

Similarly, KMD should amalgamate the weekly and seasonal forecasts for the following four counties into a single sub-regional forecast for radio stations broadcasting in Luo to the Luo heartland:

- Kisumu
- Siaya

- Homa Bay
- Migori



- WISER Western core counties

-Neighbouring counties included in weather forecasts for radio

Composition of sub-regional radio forecasts for Western Kenya

This expansion of the geographical coverage to a total of nine counties should be regarded as a bonus, rather than a burden.

The number of farmers reached with timely, relevant and actionable information will be dramatically increased at very little extra cost.

However if these five additional counties were not included in the forecasts, there is very little chance that regional radio stations would carry the KMD forecasts free of charge since they would only benefit part of the target audience of each station.

KMD should produce weekly sub-regional weather forecasts for radio that fit in easily to the programme schedule of each station.

Ideally the weekly forecasts would be broadcast at a fixed time on the same day each week. Farmers would become familiar with this slot and would listen in specially.

KMD should also produce seasonal forecasts for radio covering the same sub-regions.

These would only be disseminated three times a year, but would constitute important local news items on the day of publication.

The seasonal forecasts would offer good material for discussion and phone-in programmes. The CDMs and the agricultural experts who provide the advice to farmers in each forecast should be encouraged to participate in such programmes.

There is a less obvious place for monthly forecasts on radio programme schedules. They could constitute minor news items and useful updates for inclusion in the weekly farming programme which many stations broadcast.

However, it is proposed that KMD leave the production of a monthly weather forecast for regional radio stations until a later stage, once the weekly and seasonal forecasts have become firmly established on the air waves.

The most popular radio stations in Western Kenya, whose collaboration is vital if the KMD downscaled forecasts are too reach a mass audience, are:

Luhya	**Luo**
Mulembe FM (Nairobi)	Ramogi FM (Nairobi)
Ingo FM (Nairobi)	Mayienga FM (Nairobi)
West FM (Bungoma)	Nam Lolwe FM (Kisumu)
Nyota FM (Bungoma)	Lake Victoria FM (Kisumu)
Mambo FM (Webuye)	

(Mulembe, Ingo, Ramogi and Mayienga also broadcast to Nairobi and other cities of Kenya, but their listeners in these urban areas all have close ties with the family home village in Western Kenya and are keen to have news and information about what is happening there).

The task of consolidating the nine weekly and seasonal forecasts into two sub-regional products should initially be undertaken by the WISER Western Field Coordinator Calistus Wachana.

However, before the end of 2016, responsibility for creating and communicating these specialist forecasts for radio should be transferred to the KMD National Meteorological Centre in Nairobi. It is essential that KMD produce and disseminate these forecasts regularly and on time. They should not remain dependent upon the availability of one individual.

The sub-regional forecasts for radio should be prepared in the form of short radio scripts in English that can be easily translated into local languages by radio station staff.

IKMD should prepare lists of standard translations into Luo and Luhya of meteorological terms in English that are commonly used in its weather forecasts. This would help to prevent unintended distortions of meaning as the forecasts are translated into these local languages by radio station staff.

KMD has already prepared similar lists of standard translations into Swahili and Kikamba.

The sub-regional forecasts for radio will be less detailed than the county forecasts on which they are based. In general, they will forecast the weather by county, rather than by the different climatic zones within each county.

However, radio versions of the forecasts should still include selected bullet points of advice to farmers from the Ministry of Agriculture.

CDMs should establish a cordial working relationship with all the local and regional radio stations broadcasting to audiences in their county. These should include popular regional stations whose studios are based outside the county.

The CDMs should alert these radio stations to upcoming events, such as the publication of the next seasonal forecast, and offer themselves for interview about the weather and climate of their respective counties.

9. Distribution method for SMS forecasts

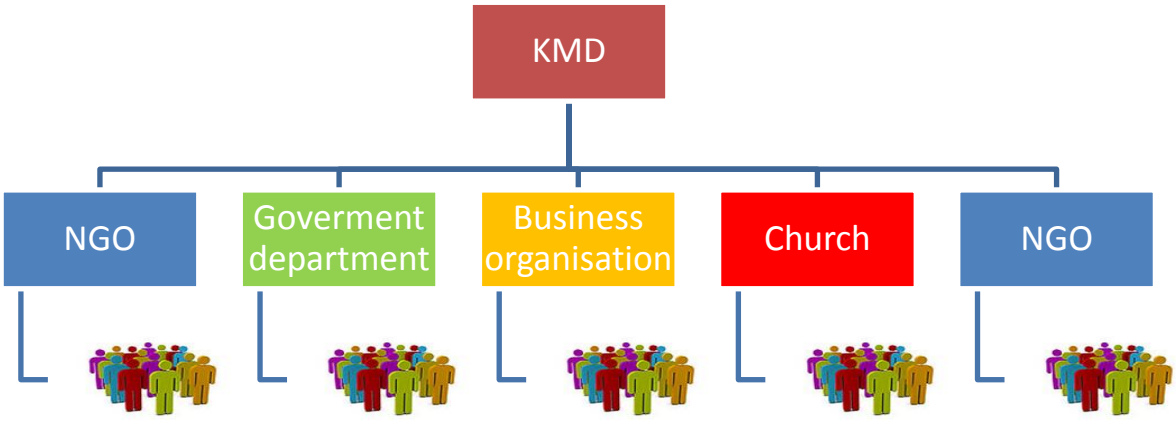
CDMs should produce a special condensed version of each weekly, monthly and seasonal forecast for distribution by SMS.

However, KMD would not disseminate these messages directly to community intermediaries.

This task would be undertaken by several partner organisations in each county, such as government departments, NCOs involved in rural development, churches with large rural networks and business organisation involved in the agricultural value chain,.

The CDMs would send the pre-formatted SMS messages by email to designated contact persons at each partner organisation which had a network of community intermediaries in their own county.

The partner organisations would then use their own SMS portals to send the messages to these intermediaries at their own expense.



Distribution system for SMS forecasts

To begin with, KMD should aim to recruit five or six SMS distribution partners in each of the four core WISER Western counties; Kisumu, Siaya, Kakamega and Trans-Nzoia.

However, several potential SMS dissemination partners in these four counties have networks of rural contacts that extend into other neighbouring counties as well.

For instance. One Acre Fund https://www.oneacrefund.org/, a rural development NGO active in Kakamega and Trans-Nzoia counties, also works with tens of thousands of farmers in Bungoma, Vihiga and Siaya as well.

As in the case of downscaled forecasts for radio, it would be useful to extend the production of weekly, monthly and seasonal forecasts in SMS format to all nine counties that constitute the Luo and Luhya heartlands in order to fully serve the needs of such partners. .

Vihiga, Busia, Bungoma. Homa Bay and Migori should therefore produce SMS versions of their forecasts for use by NGOs and agribusinesses with rural development operations in these counties

However, these five peripheral counties would not set up their own internal SMS dissemination networks during this phase of the WISER Western Project. A development of this nature could be funded and undertaken in a potential year two extension of the project.

Some of the organisations identified as potential SMS dissemination partners already operate their own SMS portals. But most do not.

WISER Western should assist those which do not already have their own SMS communication system to establish a simple portal capable of exchanging messages with up to 2,000 contacts, using the Frontline Cloud Starter tier plan of FrontlineSMS http://www.frontlinesms.com/.

This system uses a computer linked via the internet to an Android phone to send and receive SMS SMS messages. All outgoing and ingoing messages are displayed on the FrontlineSMS screen of the computer.

No separate internet connection is necessary to operate this system. The Android phone can use its own data connection to the mobile internet to create a local wi-fi spot that tethers it to the computer.

Any computer can be used to send and receive SMS messages this platform, since it is internet-based and all the client information is stored in the Cloud. Each partner organisation would have its own FrontlineSMS login and password.

The system is cheap to set up and operate. In addition to using the platform to disseminate weather forecasts, KMD partners could use and could use FrontlineSMS to exchange many other types of useful messages with their contacts.

WISER Western should provide the following assistance to help partner organisations set up and operate their own FrontlineSMS portal :

- **Purchase of a basic Android** mobile handset for each partner organisation. The Samsung J1 mini is recommended. It is widely available in Kenya at a retail price of about 9,000 Ksh (April 2016 prices). It has been tested by FrontlineSMS and has been certified as fully compatible with its FrontlineCloud software. Under test conditions in Nairobi in May 2016, the J1 mini consistently achieved a send rate of 40 SMS
- **Six months subscription to the Frontline Cloud Starter** tier plan. This allows the client to send or receive up to 10,000 SMS messages per month for a monthly fee of US$25. Robert Powell has negotiated a discounted subscription fee of US$20 per month for KMD and its associates. (In order to send or receive more than 10,000 SMS messages per month it is necessary to upgrade to Frontline Cloud's Pro Tier of service which allows up to 500,000 interactions for a monthly fee of US$100).
- **Two days of training in setting up and operating Frontline Cloud.** In addition, partner organisations would be trained how to interpret the standard abbreviations used in KMD SMS forecasts and hazard warnings. This training would be provided by communications consultant Robert Powell in July 2016.

10. Weekly forecast – internet version

The standard version of the weekly forecast will be distributed by email and WhatsApp to individuals and organizations who have regular direct access to the internet. It will also be posted on the relevant county page of the KMD website (once such county pages have been created) and on the official Facebook page of each CDM.

The weekly forecast for each county will be produced and disseminated by the CDM every Monday afternoon. It will be downscaled from the national seven-day forecast published by KMD headquarters earlier on the same day

Each county will forecast the weather by climatic zone. There will be a map showing the climatic zones of the county at the top of each forecast.

CDMs will forecast the weather for each climatic zone, day by day, from Tuesday until the following Monday.

The language used will be plain and simple and the amount of text in each forecast will be kept to a minimum.

Visual illustrations will be used to express information faster and more easily. A table illustrated with weather icons will be used to communicate the kind of weather expected in each climatic zone. For each day, this table will show the expected weather conditions for:

- Morning (sunrise to noon)
- Afternoon (noon to sunset)
- Night (Sunset to sunrise)

The weekly forecast will indicate how many places are likely to receive rainfall within each climatic zone on each day for which precipitation is forecast.

It will do this using the following categories of probability;

Few places – less than 33% of the area for which rain has been forecast

Many places – between 33 and 67% of the area for which rain has been forecast

Most places – more than 67% of the area for which rain has been forecast

However, the weekly forecast will **not** indicate the degree of probability that rain will fall on a particular day. Given the CDMs' varying levels of training and experience in weather forecasting and their limited direct access to computer-based forecasting

tools, it would be difficult for most of them to estimate accurately the percentage probability of rainfall occurring for more than a day or two ahead. .

The weekly forecast will indicate the maximum and minimum temperatures expected on each day of the seven-day period. Special icons will be used to highlight days that are unusually hot or nights that are unusually cold.

The forecast will also flag up any weather-related hazards that may be expected on a particular day, such as high winds, floods, flash floods and landslides.

Whenever the forecast weather conditions in two or more climatic zones of the county are similar, the forecast for these zones will be combined in a single table.

Each table will be followed by a commentary by the CDM. This will consist of two or three bullet points, highlighting the most important weather events expected.

The CDM's commentary will be followed by **two to five bullet points of advice to farmers.** This will be provided by a panel of technical experts from the county office of the Ministry of Agriculture and the local KALRO research station – if there is one in the county. This advice will always be directly related to the weather conditions forecast.

Once the CDM has prepared the weekly forecast, he/she will share it immediately by email or social media with a panel of at least five technical experts from the local Ministry of Agriculture and the local KALRO research station (wherever one exists). Each week, at least one member of the panel must be available to read the forecast immediately and formulate some actionable points of advice to local farmers in the form of two to five bullet points. The CDM will add this guidance to the weekly forecast before it is published.

All CDMs will use the same standard set of weather icons for the weekly forecast.

The next pages of this document contain:

- The standard template for the weekly county forecast
- a (fictitious) sample forecast for Trans-Nzoia County
- A list of the standard weather icons to be used in the weekly forecast tables and on WISER Western weather forecast maps

Kenya Meteorological Department

Weekly weather forecast for ……. County

Map of county
showing climatic zones
goes here

Date of issue:……

Period of forecast: …..(day and date)…..to…….(day and date)……

Table 1: ……climatic zone(s)

	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
Morning							
Afternoon							
Night							
Rainfall distribution							
Maximum temperature							
Minimum temperature							
Hazards							

Key to rainfall distribution symbols: rain likely to fall in few places (less than 33%), rain likely to fall in many places (33% -67%), rain likely to fall in most places (more than 67%)

Commentary of county weather forecaster:

- (Up to five bullet points)
-

Advice to farmers from Ministry of Agriculture:

- (Up to to five bullet points)
-

Table 2: ……climatic zone(s)

	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
Morning							
Afternoon							
Night							
Rainfall distribution							
Maximum temperature							
Minimum temperature							
Hazards							

Key to rainfall distribution symbols:  *rain likely to fall in few places (less than 33%),*  *rain likely to fall in many places (33% -67%),*  *rain likely to fall in most places (more than 67%)*

Commentary of county weather forecaster:

- (Up to five bullet points)
-

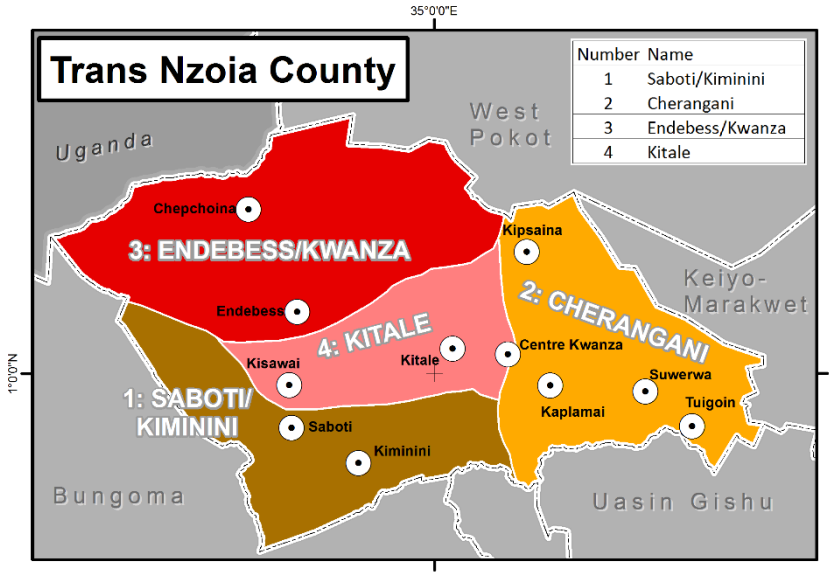
Advice to farmers from Ministry of Agriculture:

- (Up to to five bullet points)
-

For further information, please contact:
County Director of Meteorology ……(name)……..
Mobile:…(number)……..
Email: ……..(address)

Kenya Meteorological Department

Weekly weather forecast for Trans-Nzoia County



Date of issue: 15th March 2016
Period of forecast: Tuesday March 16th 2016 to Monday 21st March 2016

Table 1: Saboti/Kimini and Cherangani climatic zones

	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
Morning	Sunny	Sunny intervals	Sunny	Sunny intervals	Sunny intervals	Sunny intervals	Sunny
Afternoon	Sunny intervals	Sunny intervals	Sun/ showers	Moderate rain	Cloudy	Moderate rain	Sunny intervals
Night	partly cloudy	partly cloudy	Cloudy	Moderate rain	partly cloudy	Light rain	partly cloudy

Rainfall distribution							
Maximum temperature	33C	32C	31C	34C	32C	31C	33C
Minimum temperature	9C	17C	18C	16C Cool night	18C	17C	19C
Hazards				Thunderstorms			

Key to rainfall distribution symbols: rain likely to fall in few places (less than 33%), rain likely to fall in many places (33% -67%), rain likely to fall in most places (more than 67%)

Commentary of county weather forecaster:

- Moderate rainfall (5-15 mm) is likely in many places on Friday and Sunday
- Thunderstorms are likely to occur in many places on Friday

Advice to farmers from Ministry of Agriculture:

- Seriously consider planting maize and beans on Tuesday and Wednesday before the rain.
- It is probably best not plant out tomato seedlings this week. Wait for more rain.

Table 2: Endebess/Kwanza and Kitale climatic zones

	Tuesday	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**	**Monday**
Morning	Sunny	Sunny	Sunny	Sunny intervals	Sunny intervals	Sunny intervals	Sunny
Afternoon	Sunny intervals	Sunny intervals	Sun/ showers	Moderate rain	Cloudy	Moderate rain	Sunny intervals
Night	partly cloudy	Cloudy	Cloudy	Moderate rain	partly cloudy	partly cloudy	partly cloudy
Rainfall distribution							
Maximum temperature	35C	34C	36C	35C	34C	32C	35C
Minimum temperature	20C	18C	19C	17C Cool night	18C	18C	20C
Hazards				Thunderstorms			

Key to rainfall distribution symbols: rain likely to fall in few places (less than 33%), rain likely to fall in many places (33% -67%), rain likely to fall in most places (more than 67%)

Commentary of county weather forecaster:

- Moderate rainfall (5-15 mm) is likely in many places on Friday
- A few places are likely to get moderate rainfall Sunday
- Thunderstorms are likely to occur in many places on Friday

Advice to farmers from Ministry of Agriculture:

- Seriously consider planting maize and beans on Tuesday and Wednesday before the rain.
- It is probably best not plant out tomato seedlings this week. Wait for more rain.

For further information, please contact:
County Director of Meteorology: Rafael Mutiti.
Mobile: 0721 456 789
Email: Mutiti@meteo.go.ke

Icons for WISER Western weekly county weather forecasts (provisional set)

1. Bright sun, clear sky
2. Cloudy with sunny intervals 
3. Sunny intervals and showers 
4. Cloudy 
5. Light rain 
6. Moderate rain 
7. Heavy rain 
8. Very heavy rain 
9. Thunderstorms with lightning 
10. Lightning and cloud (without rain)
11. Hail storms 
12. Fog 
13. Rainfall distribution – no places 
14. Rainfall distribution – few places 

15. Rainfall distribution – some places 
16. Rainfall distribution – most places 
17. High wind (strong enough to flatten crops) 
18. Very high wind (strong enough to damage buildings) 
19. Dust storm 
20. Clear night sky 
21. Partly cloudy night sky 
22. Calm surface water 
23. Small waves 
24. Moderate waves 
25. High waves 
26. Cold – warm clothing 
27. Cool – light jacket 
28. Warm – short-sleeved shirt 
29. Hot – man in shorts only, sweating??? 
30. Floods 
31. Flash floods ???
32. Landslide 
33. Dry spell 
34. Good Visibility  ?
35. Moderate visibility  ?
36. Poor visibility  ?

37. Very poor visibility (almost)  ?

38. Water spout 

11. Weekly forecast – SMS version

SMS messages may contain a maximum of 160 characters, including spaces. Longer texts will be transmitted as two or more linked SMS messages with a corresponding increase in cost.

The information given in the SMS version of the weekly forecast must therefore be more concise and more limited in scope than the information provided in the standard version of the weekly forecast distributed via the internet.

The SMS version should focus on communicating the following two types of information:

- The expected timing, volume and distribution of any rainfall that has been forecast during the seven-day period
- Any severe weather warnings that may be applicable.

During the dry season when no rainfall is expected, the SMS forecast may comment on other aspects of the weather, such as cloud cover, wind and temperature.

The SMS forecast will use standard abbreviations to help condense more information into the limited space available.

It will also conform to a standard structure. The information for each day of the forecast will always be given in the same order.

Standard terms with a fixed definition will be used to describe weather conditions.

These characteristics will make interpretation of the forecast simple, clear and straightforward.

Explanation sheets for the recipients of SMS forecasts will be prepared for each county. These sheets will help the SMS recipients to interpret the content of each message accurately.

The sheets will contain:

- A map showing all the climatic zones of the county and the code numbers used to refer to them in the SMS forecast An alphabetic list of all standard abbreviations used in SMS forecasts
- An alphabetic list of key terms used to describe the weather in SMS forecasts
- A brief explanation of how the weekly and seasonal forecasts are structured.

The SMS forecasts will only make full sense to individuals who have access to an explanation sheet or who have been trained to interpret correctly the standard abbreviations used in the messages.

SMS forecasts written in this way are only suitable for dissemination to suitably equipped or trained community intermediaries who can read English.

These people will be charged with passing on the information by word of mouth to their colleagues and neighbours.

In cases where SMS distribution partners wish to send information to individuals who do not have access to an explanation sheet, they should select the most important information and send it without abbreviations in normal English or Swahili.

Each weekly SMS forecast will begin with county name and the word *weekly.*

This will be followed by the dates of the seven-day period covered by the forecast.

Information about the weather on any day for which rainfall is expected will be given in the following order:

- Name of day
- Number(s) of the climatic zone(s) for which rain is forecast
- Description of the type of rainfall expected
- Period(s) of the day or night when rainfall is expected
- Probable spatial distribution of the rainfall within the climatic zone(s)

Any hazard warning that may be in force for a particular day or set of days will follow the rainfall forecast at the end of the message..

The forecast will conclude with the acronym KMD to indicate that the information comes from Kenya Meteorological Department.

During the rainy season, the SMS version of the forecast will not usually comment on the weather on days when no rainfall is expected.

Here is an example of what a typical weekly SMS forecast might look like:

Trans-Nzoia weekly Apr 19-25. Wed, 1,2, li rain PM few, 3,4, mod rain PM many, Thu 1,2,3,4, he rain AM/PM most, Fri 3,4, li rain PM many - KMD

(142 characters)

Expanded into normal speech, this means:

Here is the Trans-Nzoia County weekly forecast for the period April 19th to 25th.

Light rain is likely to fall in a few places within climatic zones 1 and 2 on Wednesday afternoon.

But moderate rainfall is likely in many places in climatic zones 3 and 4.

Heavy rain is expected across the whole county (climatic zones 1, 2, 3 and 4) throughout the day on Thursday. Most places will receive some rainfall.

On Friday, light rain is expected in many parts of climatic zones 3 and 4 during the afternoon.

Kenya Meteorological Department

If the SMS message goes beyond 160 characters, it will still appear as a single message on the mobile phones of recipients. However, the text will be transmitted as two separate SMS messages. This would double the cost of transmission for the distribution partner who forwards the message to a network of contacts.

It is therefore important for KMD forecasters to try to keep all SMS forecasts within the 160 character single message limit.

The bullet points of advice to farmers which accompany the weekly forecasts would be sent as separate SMS messages immediately after the forecast.

The advice messages will use free text rather than a rigidly structured format. They will make much more limited use of standard abbreviations. The information they contain would be sourced to the Ministry of Agriculture, not KMD.

Here is an example of what an advice message might look like:

Trans-Nzoia weekly advice Apr 19-25. 1,2,3,4, Top dress young maize plants with DAP after the heavy rain forecast for Thu - MinAgric

(132 characters with spaces)

Expanded into normal speech, this means:

Advice to farmers in Trans-Nzoia County for the period April 19th to 25th

Top dress young maize plants with diammonium phosphate (DAP) fertilizer after the heavy rain forecast for all areas of the county on Thursday.

Ministry of Agriculture

If possible, the explanation sheets distributed to recipients of the SMS forecasts should be laminated in plastic to help preserve them from damage.

Each set of sheets would be based on the following template:

12. How to read and interpret SMS weather forecasts

Reference guide for Climate Information Service (CIS) Intermediaries in ……. County

Map showing the climatic zones and main towns of the county goes here

Standard abbreviations used in SMS messages

Abbreviation	Meaning	Explanation
Apr	April	
am	Morning	Before 12.00 pm or noon

advisory	Advisory message	Message containing advice linked to the weather forecast
Aug	August	
C	Centigrade	Degrees Centigrade are used to measure temperature.Water freezes at 0 degrees Centigrade and boils at 100 degrees.
E	East	Wind coming from the east
Dec	December	
Feb	February	
few	few places	Rain will probably fall in less than 33% of places, less than one in three places in the district
flash	Flash Flood	Flash floods occur suddenly in river beds that are normally dry. They can appear within hours of heavy rainfall. Sometimes they occur in dry weather after it has rained further up the valley.
flood	Floods	Floods are often caused by rivers bursting their banks after heavy rain, when the sluice gates of dams are opened to release water, and when heavy rain falls on city streets and cannot drain away.
Fri	Friday	
Half1	First half	First half of the month.Roughly from the 1st to the 15th. Term used in monthly forecasts.
Half2	Second half	Second half of the month.Roughly from the 16th to the 30th. Term used in monthly forecasts
hail	Hail storm	Rain drops freeze to form pellets of ice that fall from the sky. Hailstorms can damage crops.
he rain	heavy rain	Between 20 and 50 mm of rain falls in 24 hours – puddles form, surface run-off occurs.
hi wind	High wind	Strong wind which may flatten crops, but is not powerful enough to damage buildings
Jan	January	
Jun	June	
Jul	July	
li rain	Light rain	Less than 5 mm of rain in 24 hours. Dust settles, but moisture does not penetrate the soil deeply when the rain falls on dry ground .
KMD	Kenya Meteorological Department	The government department which studies climate and weather and makes weather forecasts.
Mar	March	
many	Many places	Rain will probably fall in 33% to 67% of places, about half of all places in the district.
max	Maximum	Mostly used to describe the hottest temperature expected or recorded over a specific period of time – usually 24 hours.
min	Minimum	Mostly used to describe the lowest temperature expected or recorded over a specific period of time – usually 24 hours.
MinAgric	Ministry of Agriculture	
mm	Millimetres	Used to measure the depth of rain that falls on a small patch of ground. There are 1,000 mm in a metre, Most parts of Western Kenya receive 900 to 1,500 mm of rainfall each year
mo rain	Moderate rain	Between 5 and 20 mm of rain in 24 hours. Moisture penetrates the soil deeply when the rain falls on dry ground, but there is very little surface run-off,
Mon `	Monday	
Most	Most places	Rain will probably fall in more than 67% of places, more than two thirds of places in the district.

N	North	Wind coming from the north
NE	Northeast	Wind coming from the northeast
Nov	November	
NW	Northwest	Wind coming from the northwest
Oct	October	
pm	Afternoon	After 12 pm or noon
S	South	Wind coming from the south
Sat	Saturday	
Sep	September	
Sun	Sunday	
SE	Southeast	Wind coming from the southeast
SW	Southwest	Wind coming from the southwest
temp	Temperature	How hot or cold an object is. Usually expressed in degrees Centigrade. Weather forecasts indicate the air temperature in the shade, not the air temperature in direct sunlight.
Thu	Thursday	
thunder	Thunder storm	Clouds emit flashes of lightning and rumbles of thunder. Thunderstorms often bring sharp downpours of rain and high winds that can flatten crops.
Tue	Tuesday	
v he rain	Very heavy rain	More than 50 mm of rain in 24 hours. Flash floods and gully erosion are likely to occur.
v hi wind	Very high wind	Wind that is strong enough to flatten crops and, blow the roofs off houses.
Wed	Wednesday	
W	West -	Wind coming from the west

Explanation of other common terms used in weather forecasts

Above normal rainfall	Higher rainfall than the average amount received during the same rainy season over the last 30 years.
Below normal rainfall	Lower rainfall than the average amount received during the same rainy season over the last 30 years.
Cessation	The date of the last significant rainfall at the end of the rainy season.
Dew	Condensation of moisture in the air into droplets of water that form on the ground at night. Dew is a useful source of moisture for plants.
Drought	Abnormally dry weather in a region over an extended period that causes water shortages, pasture shortages and crop damage. Some rain may fall during a drought, but it will be less than usual.
Dry spell	An unusually long period of several days or weeks during the rainy season when no rainfall occurs. A prolonged dry spell may damage crops and cause water sources to dry up.
El Niño	The unusual warming of the surface waters of the Pacific Ocean along the coast of South America. This causes changes in weather patterns across the globe. In Kenya, El Niño frequently increases the likelihood of heavy rainfall, especially during the October, November, December rainy season.
Evaporation	The processes of liquid water becoming absorbed into the air as water vapour. Evaporation speeds up when temperatures are high and humidity is low and there is a wind.
Flood Plain	Flat land by a river that frequently may become covered by water when the

	river rises and bursts its banks.
Fog	Ground level cloud that reduces visibility to less than 1km. Fog lowers the air temperature and provides moisture to plants.
Humidity	The level of moisture in the air. It is usually expressed as the percentage of air saturation with water, Warm air can hold more moisture than cold air. High humidity reduces water evaporation from the soil and dams.
La Niña	A widespread cooling of the surface waters of the eastern Pacific Ocean off the coast of South America. It is the opposite of El Niño. In Kenya, La Niña is often associated with depressed rainfall in October, November and December, followed by drought
Normal rainfall	The average amount of rainfall received in the same rainy season over the last 30 years.
Onset	The date of the the first significant rainfall at the start of the rainy season.
Probability	The likelihood that an expected event will actually occur. Weather forecasters can never be completely certain that the weather will be what they expect. Sometimes they can indicate the degree of probability that a forecast event will happen.
Rain Gauge	An instrumental used to measure the amount of rain that has fallen during a period of 24 hours. The standard rain gauge is a round cylinder, usually made of metal, with a funnel at the top to catch rain water.
Thermometer	An instrument to measure temperature. Weather forecasts express temperature in degrees centigrade. 0 Centigrade is the temperature at which water freezes to become ice, 100 Centigrade is the boiling point of water.
Warning	An urgent message advising that severe weather is likely to occur soon which may endanger life or damage property.

Structure of weekly forecast

1. *(name of county)* weekly
2. *(Dates for which weather is forecasted)*
3. *(general weather outlook – optional information)*
4. *(first day(s) of the week on which rainfall is expected)*
5. *(area(s) of the county where rain is expected)*
6. *(type of rainfall expected)*
7. *(time of day when rain is expected – optional information)*
8. *(spatial distribution of rainfall with the area where it is expected to fall)*
9. *(hazard warning – optional information)*
10. *Day(s) of the week on which the hazard is expected)*
11. *(area(s) of the county where the hazard is expected)*
12. *(nature of hazard)*
13. *KMD*

Example of weekly forecast

Kakamega weekly Apr 5-11.Thu,1,2,mo rain pm many,3,li rain pm few.Fri 1,2,he rain pm most 3,mod rain pm many.Sat 1,2,3,li rain few.Warning Thu1,2,3,thunder-KMD

(160 characters)

Example of advisory message accompanying weekly forecast

Kakamega advisory April 5-11.Top dress maize and spray pesticide Tue, Wed before rain starts. Inspect tomatoes for black spot Sun, Mon after rain-MinAg

Structure of seasonal forecast forecast

1. *(name of county)*
2. seasonal
3. *(area(s) of the county to which the forecast applies)*
4. *(volume of rainfall expected during the season compared with the 30-year average)*
5. Onset *(period when onset is expected to occur)*
6. Cessation *(expected period when cessation is expected)*
7. Distribution *(description of expected distribution of rainfall during the season)*
8. Dry spells *(guidance on expected length and timing of dry spells)*
9. *KMD*

Example of seasonal forecast

Siaya seasonal,1,2,normal to above normal rain.Onset Oct 8-15. Cessation Dec 15-20.Irregular distribution. Most rain Nov. Dry spells less than 10 days-KMD

Example of advisory message accompanying seasonal forecast

Siaya seasonal advisory 1,2. Plant high-yielding maize hybrids such as KH600-23A H614D and KH600-16A-MinAgric

13. Weekly forecasts – radio version

The weekly forecast for radio should, generally speaking be about 300 words long. The text should include up to 100 words of advice to farmers.

A text of this length would take about three minutes to read out on air.

During the first weeks of publication, the forecast should give the contact details of the WISER Western field coordinator (Calistus Wachana). He will be the person responsible for producing these bulletins in the early months of production.

Responsibility for creating and disseminating the weekly forecast for radio should subsequently be assumed by the forecasting department in Nairobi.

Two sub-regional forecasts would be produced for radio stations in Western Kenya each week.

One would serve the Luo heartland of Kisumu, Siaya, Homa Bay and Migori counties.

The other would serve the Luhya heartland of Vihiga, Kakamega, Bungoma, Busia and Trans-Nzoia counties.

The weekly forecasts for radio should be written and disseminated by email to radio stations on Monday nights or as early as possible on Tuesday mornings.

The proposed template for the weekly forecast for radio stations and a sample bulletin are given below:

Weekly weather forecast for the highland area of Western Kenya/Nyanza area of Western Kenya *(delete as appropriate)* **for the period February 23 to 29 2016**

Kenya Meteorological Department

Here is the weekly weather forecast for the highland area of Western Kenya/the Nyanza region of Western Kenya *(delete as appropriate)* It covers the counties of *(names of counties covered by the forecast)*

The forecast is followed by some messages of advice to farmers from the Ministry of Agriculture.

The general outlook for the period from Tuesday *(followed by the date)* until Monday *(followed by the date)* is as follows…….:

(Insert two or three short paragraphs here to give a general overview of the weather expected in this region over the next seven days).

Today (Tuesday)……*(summarize briefly the weather conditions expected on the first day of the forecast period, noting differences between counties where applicable. Focus on rainfall and any hazards that may be expected. Do not mention temperatures unless extremes of hot or cold temperatures are expected)*

On Wednesday…….*(summarize briefly the weather conditions expected on this day of the forecast period)*

On Thursday……*(summarize briefly the weather conditions expected on this day of the forecast period)*

On Friday……*(summarize briefly the weather conditions expected on this day of the forecast period)*

*On S*aturday……*(summarize briefly the weather conditions expected on this day of the forecast period)*

On Sunday……*(summarize briefly the weather conditions expected on this day of the forecast period)*

On Monday……*(summarize briefly the weather conditions expected on this day of the forecast period)*

The weather highlights of this week will be…….*(repeat the most significant weather feature(s) expected during the seven-day period, including any warnings of severe weather)*

Here are some messages of advice to farmers issued by the Ministry of Agriculture in the light of this forecast:

Farmers in *(name the counties where this advice applies)* should seriously consider……

Farmers in *(name the counties where this advice applies)* should seriously consider……

Farmers in *(name the counties where this advice applies)* should seriously consider……

That was the weekly weather forecast for …….County for the next seven days, accompanied by advice to farmers from the Ministry of Agriculture.

For further information, please contact:

(Job title of person responsible for issuing the forecast) ……(name)……..

Mobile:…(number)……

Email: ……..(address)……

Weekly weather forecast for the highland area of Western Kenya for the period February 23 to 29 2016

Kenya Meteorological Department

Here is the weekly weather forecast for highland area of Western Kenya for the period Tuesday February 23 to Monday February 29 2016.

It covers the counties of Vihiga, Kakamega Bungoma, Busia and Trans Nzoia

The forecast is followed by some messages of advice to farmers from the Ministry of Agriculture.

The general outlook is for dry weather in most parts.

But heavy clouds will build up towards the end of the week.

These could lead to some light showers of rain on Saturday and Sunday.

Today (Tuesday) and Wednesday will be dry and sunny almost everywhere.

However, cool night time temperatures of around 14 degrees in areas above 1,500 metres will lead to heavy dew on Wednesday and Thursday mornings,

Thursday and Friday will start off sunny, but cloud cover will develop during the afternoon.

However, most areas will remain dry.

Saturday could see the clouds become thick and heavy enough to give some scattered showers of rain in the afternoon, particularly in Bungoma and Kakamega counties.

But Busia County, the central plateau of Trans-Nzoia and the southern parts of Vihiga County are likely to remain dry,

Sunday is likely to bring some more afternoon rain showers to a few lucky villages.

Bungoma and Kakamega counties and the slopes of Mount Elgon in Trans-Nzoia are likely to see the best of any rainfall.

But Monday will see a return to sunny dry weather almost everywhere with largely clear skies and rising daytime temperatures.

So, to sum up the week ahead:

Expect cloudy conditions to develop in most places from Thursday onwards.

Some light and very localized showers of rain could fall almost anywhere on Saturday and Sunday.

But don’t be fooled into thinking that the rainy season is already starting. Next Monday will see a return to clear skies and dry weather everywhere.

Kenya Meteorological Department will issue its national forecast for the March, April May rainy season on Monday February 22.

Here are some messages of advice to farmers issued by the Ministry of Agriculture in the light of the weekly forecast:

Start ploughing your land in preparation for maize planting, if you have not already done so.

Delay seed purchases until Kenya Meteorological Department's seasonal forecast gives an indication of expected rainfall during the coming rainy season. This forecast will be published next Monday.

That was the weekly weather forecast for the highland region of Western Kenya for the next seven days, accompanied by advice to farmers from the Ministry of Agriculture.

For further information, please contact:

Bernard Chanzu - Assistant Director of Meteorology, KMD

Mobile : 0721 345 678

Email: shanzu@meteo.co.ke

14. Seasonal forecast – internet version

Seasonal forecasts for each county should be issued by all CDMs three times a year at the following times:

- **at least three weeks before the onset of the March, April, May rainy season**
- **at least three weeks before the start of the June, July August rainy season**

- **at least three weeks before the onset of the October, November December rainy season.**

These forecasts should be downscaled from the national seasonal forecast published by KMD headquarters in Nairobi.

The standard version of the seasonal forecast should be distributed by email and social media to individuals and organizations who have regular access to the internet. It should also be posted on the Facebook page of each CDM and on the relevant county page of the KMD website.

The county seasonal forecast will focus on the four key elements of information sought by farmers for each climatic zone:

- The date of onset of the rainy season (a range of five to seven days)
- Information about the amount of rainfall expected (a range of expected rainfall in millimetres followed by one of the three possible descriptions: above normal, normal or below normal)
- Information about the distribution of rainfall over the course of the rainy season (regular or irregular). The forecast will also predict the periods when most rainfall can be expected and when least rainfall is likely to occur.
- The date of cessation (a range of five to 10 days)

The internet version of the forecast should also show the tercile forecast in the form of a pie chart and explain what the most likely rainfall scenario identified by KMD actually means.

In addition, the forecast should contain bullet points of advice about recommended crops and seed varieties from the Ministry of Agriculture. It should also contain advice on when to plant.

This forecast and its accompanying advice will be a lot more concise than the guidance documents which are generally issued by PSPs. It should reach farmers up to two weeks before the PSPs are actually held. The proposed template for this forecast and a sample seasonal report for Kakamega County are given below:

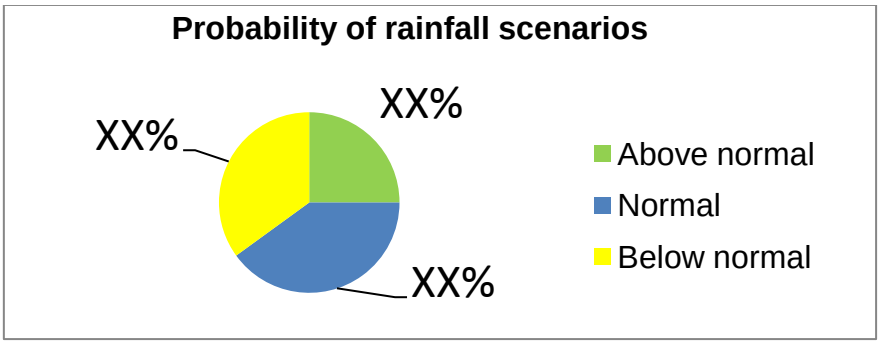
Kenya Meteorological Department

Seasonal weather forecast for ..*…(names of months*)….20*XX*
rainy season in …….County

Map of county
showing climatic zones
goes here

Name(s) of climatic zone(s).....

Onset……
Cessation……
Probable volume of rainfall……
Probable distribution of rainfall during the rainy season……
……..



Normal rainfall is the average volume of rainfall that fell during this rainy season in this area of the county over the past 30 years

Commentary of County Meteorological Director:

- (Up to five bullet points)
-

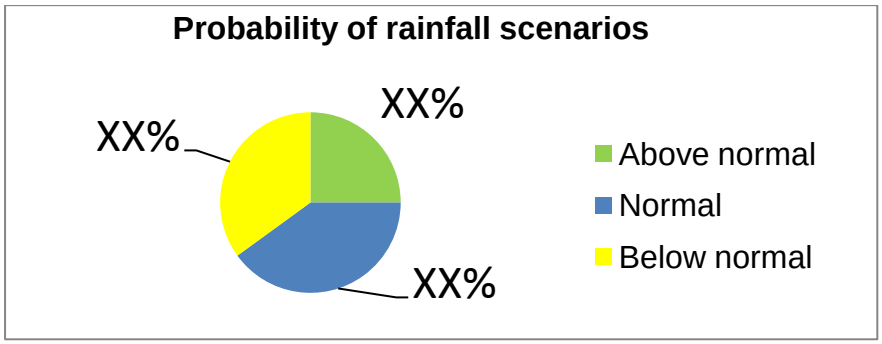
Advice to farmers from Ministry of Agriculture:

- (Up to to five bullet points)
-

Name(s) of climatic zone(s).....

Onset……
Cessation……
Probable volume of rainfall……
Probable distribution of rainfall during the rainy season……..

……..



Normal rainfall is the average volume of rainfall that fell during this rainy season in this area of the county over the past 30 years

Commentary of County Meteorological Director:

- (Up to five bullet points)
-

Advice to farmers from Ministry of Agriculture:

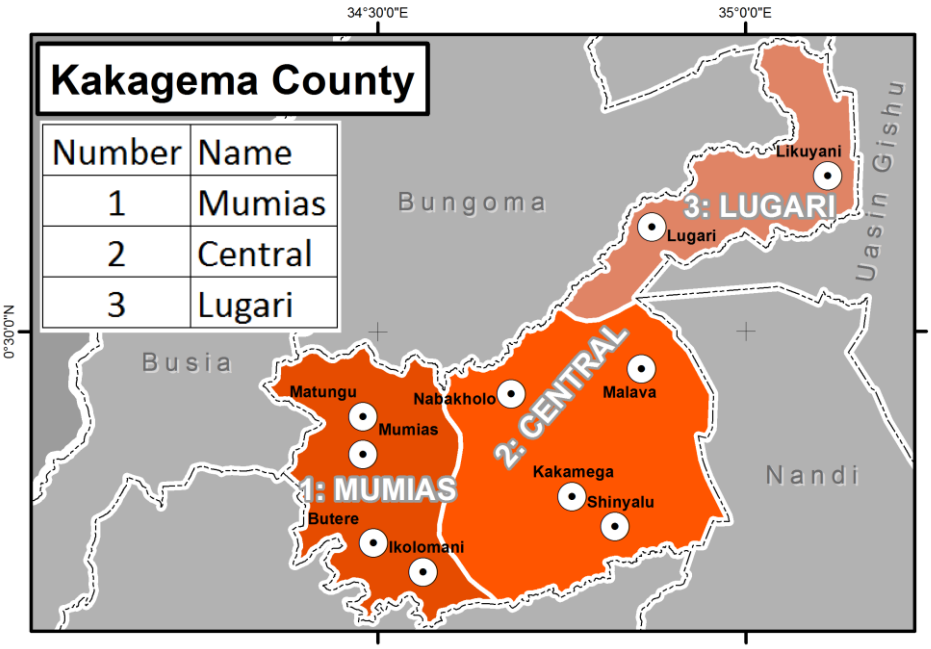
- (Up to to five bullet points)
-

Date of issue:……

For further information, please contact:
County Director of Meteorology ……(name)……..
Mobile:…(number)……
Email: ……..(address)……

Kenya Meteorological Department

Seasonal forecast for the March, April, May 2016 rainy season in Kakamega County



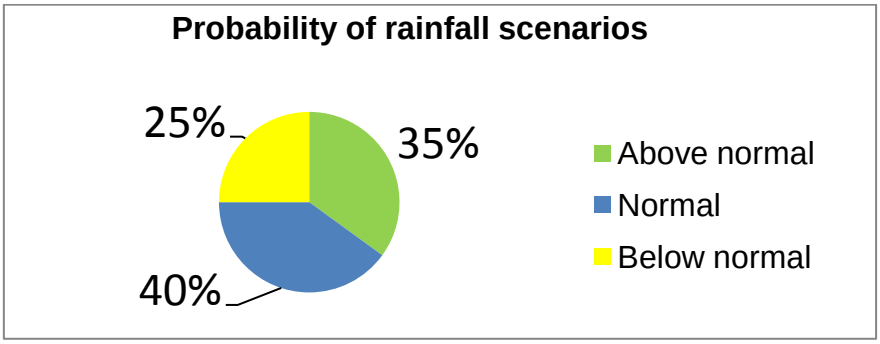
Mumias and Central (zones 1 and 2)

Onset: March 8th -14th

Cessation: June 1st-7th

Probable volume of rainfall: 700-800 mm. Above normal (higher than the average rainfall received during the March, April and May rainy season over the last 30 years)

Probable distribution of rainfall during the rainy season: Rainfall is likely to occur irregularly in heavy showers. Most rain is likely to fall in late April and early May. The driest period is likely to be in late May



"Normal rainfall" is the average volume of rainfall that fell during this rainy season in this area of the county over the past 30 years

Commentary of County Meteorological Director:

- Dry spells are unlikely to exceed 10 days
- Flooding may damage crops planted near river banks

Advice to farmers from Ministry of Agriculture:

- Plant high-yielding maize hybrid varieties such as KH600-23A and WH507
- Plant cabbage and kales in preference to sweet potatoes

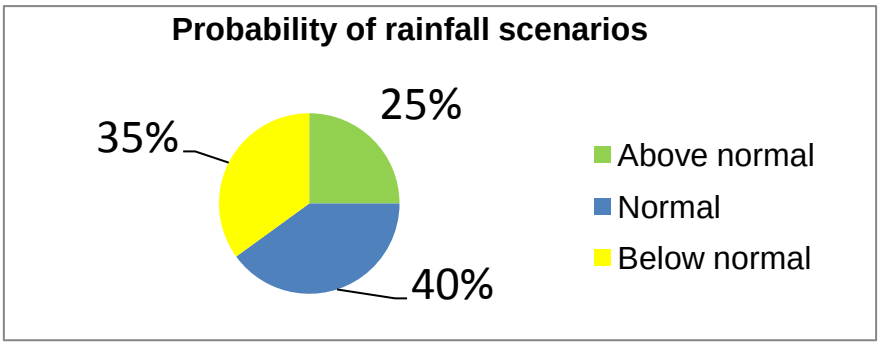
Lugari (zone 3)

Onset: March 10th-20th

Cessation: May 15th-20th

Probable volume of rainfall: 550-650 mm. Near normal (close to or slightly lower than the average rainfall received during the March, April and May rainy season over the last 30 years)

Probable distribution of rainfall during the rainy season: Rainfall is likely to occur irregularly in heavy showers. Most rain is likely to fall in mid to late April. The driest priod is likely to be in mid to late May.



"Normal rainfall" is the average volume of rainfall that fell during the March, April, May rainy season in this area of the county over the past 30 years

Commentary of County Meteorological Director:

- Expect dry spells that last more than 10 days

Advice to farmers from Ministry of Agriculture:

- Plant maize varieties that are resistant to dry spells, such as WE2109 and UH5354
- Plant tomato varieties that are tolerant to water logging, such as OXLY and FAULU

Date of issue: February 29th 2016

For further information, please contact:

County Director of Meteorology - Vincent Sakwa

Mobile : 0722 999 888

Email: vincent.sakwa@meteo.go.ke

15. Seasonal forecast – SMS version

The SMS version of the seasonal forecast will be customised – where appropriate – for each climatic zone within the county.

The essential elements of the forecast for a given zone will be transmitted in a single SMS message and will be sourced to KMD.

The related advice to farmers will be transmitted in a series of follow-on messages and will be sourced to the Ministry of Agriculture (MinAgric)

The SMS forecast version of the forecast will be structured as follows:

1. *(name of county)*
2. seasonal
3. *(area(s) of the county to which the forecast applies)*
4. *(volume of rainfall expected during the season compared with the 30-year average)*
5. Onset *(period when onset of rainy season is expected to occur)*
6. Cessation *(expected period when rains are expected to end)*
7. Distribution *(description of expected distribution of rainfall during the season)*
8. Most rain *(guidance on the period when most rainfall is expected to occur)*
9. Least rain *(guidance on the period when the least rainfall is expected to occur)*
10. *KMD (Kenya Meteorogological Department – the source of the information)*

Example :

Siaya seasonal,1,2, above normal rain.Onset Oct 8-15. Cessation Dec 15-20.Irregular distribution. Most rain Nov. Least rain early Dec-KMD

(137 characters)

Spelt out in full, this means:

Siaya seasonal forecast for climatic zones 1 and 2.

Normal to above normal rainfall is expected.

The first significant rainfall is likely to occur between October 8 and 15.

The distribution of rainfall throughout the season is expected to be irregular.

Most rainfall is likely to occur in November.

The period with least rainfall is likely to be early December..

Kenya Meteorological Department

Here is an example of what an advisory message linked to this forecast might look like:

Siaya seasonal advice 1,2. Consider planting high-yielding maize hybrids such as KH600-23A, H614D and KH600-16A-MinAgric

(120 characters)

Note that the advisory message is specifically linked to climatic zones 1 and 2, the same zones referred to in the forecast. The maize varieties recommended for zones 3 and 4 of Siaya County might well be different if the seasonal forecast for these areas is less favourable.

16. Seasonal forecasts - radio version

Each seasonal forecast for radio will combine the highlights from several county forecasts in order to create a sub-regional forecast.

One sub-regional forecast will cover the four Luo-speaking counties of Nyanza: Siaya, Kisumu, Homa Bay and Migori.

The other will cover the five Luhya-speaking counties immediately to the north Vihiga, Kakamega, Bungoma, Busia and Trans-Nzoia.

The seasonal forecasts for radio should be written and disseminated no later than 24 hours after the seasonal county forecasts have been produced.

The radio version of the seasonal forecast will use words to describe the rainfall outlook for the coming rainy season.

But it will not express the percentage probability of different scenarios occurring in each zone. That would be too complicated.

It is difficult for radio listeners to take in and retain many numbers in a single broadcast. The use of numbers in all radio forecasts should be kept to the absolute minimum.

The radio version of the seasonal forecast will include up to five bullet points of advice to farmers from the Ministry of Agriculture.

Since maize is the dominant staple food crop throughout Western Kenya, one of these messages should consist of advice on which maize varieties to plant.

Another should advise farmers when to plant their maize.

The proposed template for radio version of the seasonal forecast is given below, along with an example of what such a forecast might look like.

The total length of the radio forecast, including the preamble and the standard closing sentences, should be no more than 500 words.

The template for the radio version of the seasonal forecast and a sample seasonal forecast for the Luhya-speaking area of Western Kenya are given below:

Seasonal weather forecast for the highland area of Western Kenya/Nyanza area of Western Kenya *(delete as appropriate)* for the March, April, May/ October, November, December/ June, July, August *(delete as appropriate) (year)* rainy season

Kenya Meteorological Department

Here is the seasonal weather forecast for the highland area of Western Kenya/the Nyanza region of Western Kenya *(delete as appropriate)* for the March, April, May/June July, August, October, November, December *(delete as a appropriate)* rainy season.

This forecast covers the counties of *(names of counties covered by the forecast)*

It is followed by some messages of advice to farmers from the Ministry of Agriculture.

*General outlook for the coming rainy sea*son…….*(two or three short paragraphs summarising whether the rains are likely to be good or bad. Any major differences in outlook between different parts of the region should be noted here).*

Kenya Meteorological Department expects the volume of rain in the coming rainy season to be normal/slightly higher than normal/above normal/slightly below normal/below normal *(delete as appropriate).*

This means that rainfall is likely to be *(choose one of the following options. If there are major differences in the seasonal forecast between different parts of the region, give the appropriate description for each of the main areas)*

- *In line with the average received over the last 30 years*
- *Higher than the average received over the last 30 years*
- *Lower than the average received over the last 30 years*

The rains are expected to arrive between……and……..(insert the *range of expected onset dates. Note any variation in the expected range of onset dates from one part of the region to another)*

Most areas can expect between xxx mm and xxxx mm of rain between *(month of onset)* and *(month of cessation).*

(Where there is likely to be a major difference in rainfall between different parts of the region, give a separate range of figures for:

1. *Most of the region*
2. *The part of the region which is likely to receive the lowest rainfall*
3. *The part of the region which is likely to receive the highest rainfall)*

The rains are likely to end…… ……..(insert the *range of expected cessation dates. Note any variation in the expected range of dates from one part of the region to another)*

during the seven-day period, including any warnings of severe weather)

Insert here any other important information, such as:

- *A comment on whether the rainfall is likely to be well distributed, or whether much of it is likely to fall in irregularly spaced heavy showers*
- *A comment on the period when most rainfall is expected.*
- *A comment on the expected timing and duration of dry spells*

*Repeat here the general outlook for the coming rainy sea*son…….*(two or three short paragraphs summarising whether the rains are likely to be good or bad. Any major differences in outlook between different parts of the region should be noted here).*

Here are some messages of advice to farmers issued by the Ministry of Agriculture in the light of this forecast *(Insert here up to five important messages for farmers in the region from the Ministry of Agriculture. One of these should advise which varieties of maize to plant. If different rainfall conditions are expected in different parts of the region, this advice may vary according to district. Another message should advise farmers when to plant maize. Again this advice may vary from district to district, depending on the expected date of onset)*

Farmers in *(name the areas where this advice applies)* should seriously consider……

Farmers in *(name the areas where this advice applies)* should seriously consider……

Date of issue ……..(date)……

For further information, please contact:

(Job title of person responsible for issuing the forecast) ……(name)……..

Mobile:…(number)……

Email: ……..(address)……

Seasonal weather forecast for the highland area of Western Kenya area of Western Kenya October, November, December 2016 rainy season

Kenya Meteorological Department

Here is the seasonal weather forecast for the highland area of Western Kenya October, November, December rainy season.

This forecast covers the counties of Vihiga, Kakamaga, Bungoma, Busia and Trans-Nzoia.

It is followed by some messages of advice to farmers from the Ministry of Agriculture.

Kenya Meteorological Department expects the rains to be quite good in most of the region, but they may start later than usual.

The heaviest rainfall is expected Bungoma and Kakamega counties.

However, a few areas, including Lugari, southern parts of Busia County, are expected to receive slightly less rain than usual.

Kenya Meteorological Department expects the volume of rain in the coming rainy season to be higher than normal in most places.

This means that rainfall is likely to be higher than the average received over the last 30 years in most of the region.

However, in Lugari and the south of Busia County it may be slightly lower.

The rains are expected to arrive between October 15 and 20.

Most areas of Vihiga, Kakamega and Bungoma counties can expect between 700 mm and 800 mm of rain between October and the end of December.

Trans-Nzoia is likely to receive between 500 and 550 mm.

But Lugari and the south of Busia County may only get 450 to 500 mm

The rains are likely to end after Christmas in the last week of December.

The heaviest rainfall is expected in late November and early December.

Dry spells in most places are unlikely to last more than eight days.

Kenya Meteorological Department expects the rains to be quite good in most of the region, but they may start later than usual.

The heaviest rainfall is expected Bungoma and Kakamega counties.

However, a few areas, including Lugari, southern parts of Busia County, are expected to receive slightly less rain than usual.

In summary, Kenya Meteorological Department expects the rains to be quite good in most of the highland region of Western Kenya, but they may start later than usual.

The heaviest rainfall is expected Bungoma and Kakamega counties.

But a few areas, including Lugari, southern parts of Busia County, are expected to receive slightly less rain than usual.

Here are some messages of advice to farmers issued by the Ministry of Agriculture in the light of this forecast.

Farmers in most areas should seriously consider planting high-yielding maize hybrids to take advantage of the high rainfall expected.

But farmers in Lugari and the south of Busia County, where lower than usual rainfall is expected, should consider choosing drought tolerant varieties of maize seed instead.

Farmers should plan to plant maize between October 10 and 15, a few days before the rains are expected to start.

That was the seasonal weather forecast for the highland area of Western Kenya.

It was accompanied by advice to farmers from the Ministry of Agriculture.

For further advice about on how to prepare your farm for the coming rainy season, please contact the nearest Ministry of Agriculture extension officer.

Date of issue: August 31st 2016

For further information, please contact:

WISER Western Project Field Coordinator – Calistus Wachana

Mobile: 0711 222 333

Email: calistus.wachana@meteo.go.ke

17. Monthly forecasts

The monthly forecasts produced by CDMs until now have been quite general in nature. They have also been rather vague in terms of predicting when expected weather conditions will actually occur during the 30-day period.

Additional training in forecasting technique provided by the WISER Western Project should enable the CDMs of all nine counties covered by the project to start producing monthly forecasts in which weather conditions are forecast on a week by week basis. This would make the forecasts a much more useful information tool for farmers and other users.

Until then, the monthly forecast will normally forecast the weather separately for the first half of the month – roughly speaking the first two weeks – and the second half of the month – roughly speaking the second two weeks.

It remains to be seen whether the CDM's will be able to produce a reliable monthly forecast for each climatic zone within their respective counties. So far, most have just produced a single set of predictions for the county as a whole.

The monthly forecasts should focus mainly on:

- expectations of rainfall occurrence and distribution
- The length and timing of dry spells
- Expected temperatures, particularly whether they are likely to be hotter or colder than usual for the time of year
- hazards.

Rainfall amounts may be difficult to predict with any accuracy so far in advance. However, the CDMs should be able to give an indication of whether or not rain is expected in a particular fortnight.

If rain is forecast, some CDMs may be able to give an indication of whether it is likely to be light, moderate or heavy.

They may also be able to say whether the rainfall is likely to be scattered or widespread.

The CDMs should also be able to flag up the probability of unusually cold or hot temperatures occurring during any given week

It would also be useful if they could forecast the approximate timing and duration of any dry spells that may be anticipated in the midst of a rainy season.

Other hazards, such as floods, flash floods, thunderstorms and high winds, may be too difficult to forecast reliably so far in advance.

Like the weekly and seasonal forecasts, the monthly forecasts should be accompanied by two or three bullet points of advice to farmers provided by local experts from the Ministry of Agriculture.

The monthly forecast would be disseminated via the internet and SMS.

However, production of a radio version would be postponed until 2017.

By then, the content of the forecast will hopefully have stabilised and its reliability will have become firmly established.

Furthermore, the process of amalgamating weekly and seasonal county forecasts to produce sub-regional forecasts for radio will be well established and the National Meteorolical Centre in Nairobi will have taken over responsibility for creating this forecasts from Calistus Wachana, the WISER Western Field Coordinator.

The proposed template for the standard internet version of the county monthly forecast and a sample forecast for Siaya County are given below:

Robert Powell

August 9th 2016

Kenya Meteorological Department

Monthly weather forecast for ……. County for ….*(month and year)*

Map of county showing climatic zones goes here

Date of issue:……

Period of forecast: ……*(date)***)……..to……***(date)* **……**

	Week 1	Week 2	Week 3	Week 4
Rainfall volume				
Rainfall distribution				
Sunshine/cloud cover				

Maximum temperature				
Minimum temperature				
Hazards				

Commentary of county weather forecaster:

- (series of up to five bullet points)
-
-
-
-

Advice to farmers from Ministry of Agriculture:

- (series of up to five bullet points)
-
-
-
-

For further information, please contact:

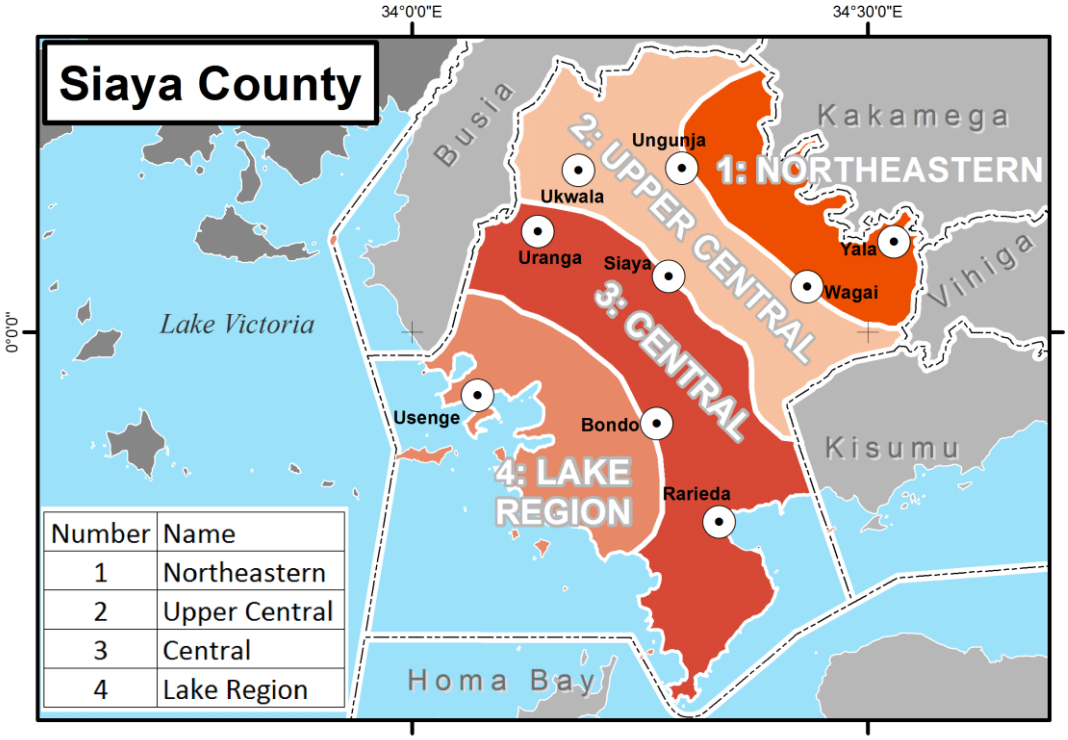
County Director of Meteorology ……(name)……..

Mobile:…(number)……..

Email: ……..(address)

Kenya Meteorological Department

Monthly weather forecast for Siaya County for July 2016



Date of issue: June 30th 2016

Period of forecast: July 1st to July 30th 2016

	Week 1	Week 2	Week 3	Week 4
Rainfall volume	none	Light rain	Light rain	Light rain
Rainfall distribution		Few places	Many places	Few places
Sunshine/cloud cover	Clear skies	Sunny intervals	Sunny intervals	Sunny intervals
Maximum temperature	39	37	35	36
Minimum temperature	20	18	17	19
Hazards	Dry spell		Thunderstorms	

Commentary of county weather forecaster:

- Rainfall will mainly occur in northern areas of Siaya County. Southern areas near the lake shore are likely to remain dry throughout the month.
- The dry spell at the end of June is likely to continue unbroken until June 8th-10th, when the first showers are expected in northern parts of the county.
- Thunderstorms may occur in central and northern areas of Siaya between June 15th and 25th .

Advice to farmers from Ministry of Agriculture:

- Mulch all crops to conserve soil moisture, until the next rain falls in mid-June.
- Watch out of signs of maize lethal necrosis. Uproot and burn any plants that show signs of mottled colouring at the base of leaves or deformed leaf tips.

For further information, please contact:

County Director of Meteorology – Dominick Arodi

Mobile: 0723 444 555

Email: Dominick.Arodi@meteo.go.ke