

Real-time monitoring and forecasting of Rift Valley fever in Africa to drive preparedness and anticipatory actions

RVF Early Warning Decision Support Tool (DST)

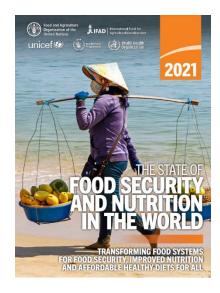
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Food security and nutrition in the world

- In 2020, between 720 and 811 million people affected by hunger
- **148 million more people impacted** since the outbreak of the COVID-19 pandemic
- 25% of animal production is lost because of disease
- FAO believes that Science, Technology and Innovation can accelerate the transformation of agrifood systems towards the Sustainable Development Goals
- And contribute to **better production, better nutrition, a better environment and a better life**, leaving no one behind.

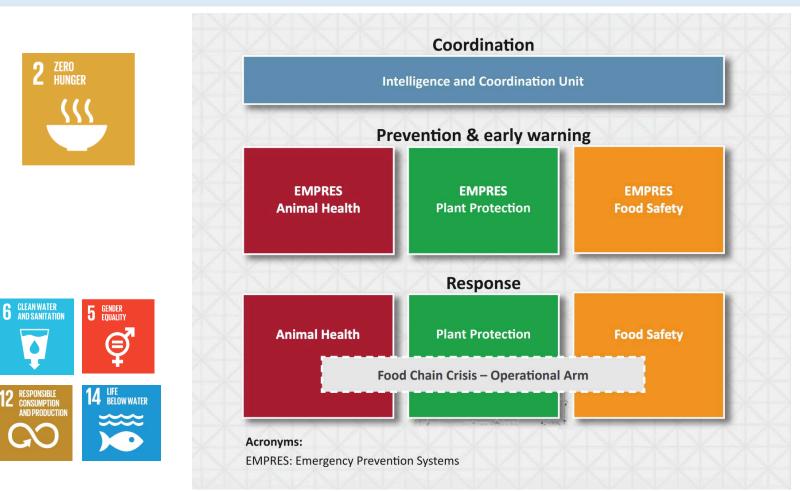








The Emergency Prevention System (EMPRES) for transboundary animal and plant pests



THE EMPRES MANDATE

Managing animal and plant health, natural resources, fisheries and forestry

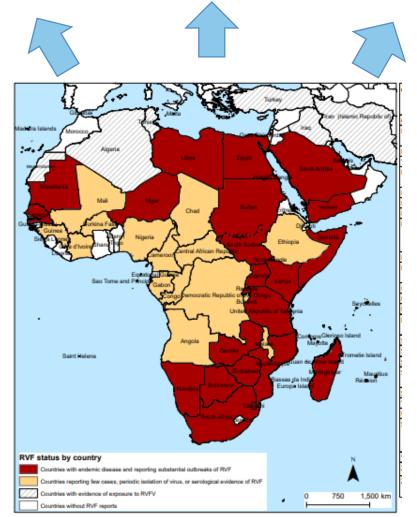
State of Play: animal health, plant health, forest health, fisheries/aquaculture health

Mapping of areas Early warning Risk assessment Surveillance Capacity development APPDs prevention and resilience Emergency preparedness and response Coordination and governance



Rift Valley fever (RVF): background

- Major zoonotic viral vector-borne disease
- Wild and domestic ruminants (cattle, sheep, goats, camels) and humans affected
- Transmitted by many mosquito's species (9 genera); through contact with infected animals
- Transovarial transmission in mosquitoes
- Spill-over from wild animals
- Driven by climate variability
- Significant economic losses, closure of markets, trade disruption
- **Risk of RVF introduction** into **EU** and other regions of the world due to climate change

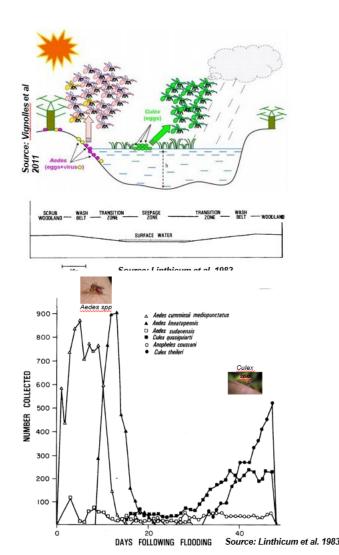


Source: RVF Action Framework (FAO 2022) https://www.fao.org/3/cb8653en/cb8653en.pdf



Climate variability, vector dynamics and RVF outbreaks

- RVF outbreaks are triggered by climate anomalies (e.g., heavy rains and prolonged flooding) that increase habitat suitability for vector amplification
- A dynamic prediction model by NASA captures and monitors RVF vector dynamic under flooding conditions using precipitation and NDVI anomalies over the past 3 consecutive months, precipitation forecasts, SST and ENSO (Anyamba et *al.* 2009)
- The innovative part of FAO's work consists in its calibration and implementation in an early warning tool for near-realtime monitoring and forecasting of RVF at-risk areas in Africa.





RVF Early Warning Decision Support Tool (DST) – Anticipate and mitigate the risk of RVF

- DST identifies climatic anomalies to forecast areas at risk of RVF vector amplification
- Prediction capacity: 1-2 months before the first case is observed
- Integrated in FAO Hand-in-Hand geospatial platform / RVF events from EMPRES-i
- Facilitate real-time data sharing, consultation among experts, risk interpretation
- Scalable to other regions and diseases
- Cost effective
- Disease-specific
- Easy to monitor

Monitor

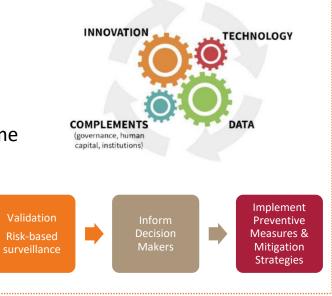
environmental

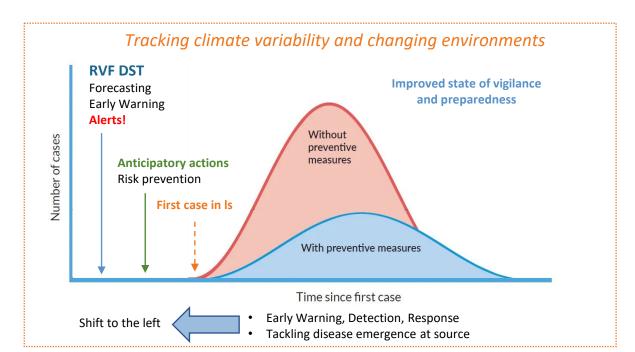
conditions

• Available on near real-time

Forecast High

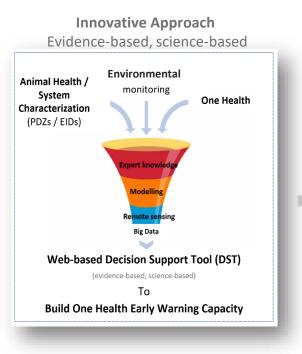
Risk areas







Web-based RVF Early Warning Decision Support Tool (DST)



RVF Decision Support Tool



Monitoring, prevention and control



Alerts and RVF Monthly Updates





Capacity building

Suitability for RVF vector amplification

- Risk maps/forecast (based on NASA model)
- Precipitation
- Temperature
- Vegetation
- Soil type
- Humidity
- Land cover
- Elevation

KNOWLEDGE

EXPERT

- Irrigation areas
- Flooding/dambos
- Seasonality (ENSO)

RVF endemic areas

- RVF core areas
- RVF events

Risk of exposure

- Livestock species
- Human population

Risk of spread (infrastructure)

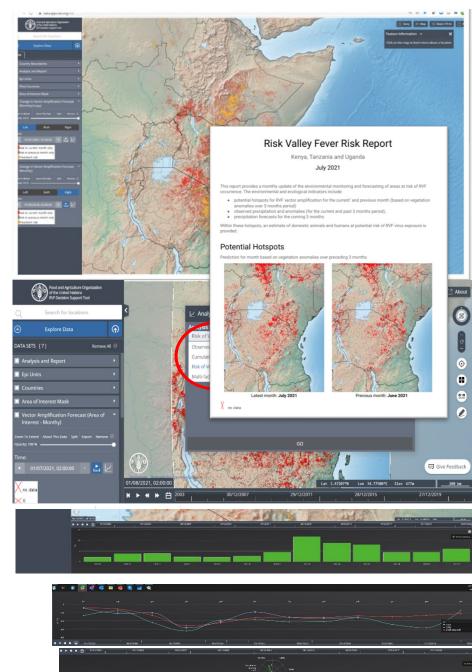
- Markets
- Villages
- Roads
- Livestock routes ...

Supportive documents

- RVF FAO Manuals
- FAO/ILRI Decision Support Framework
- RVF dynamic model for VA
- FAO RVF Action Framework

RVF DST functionalities

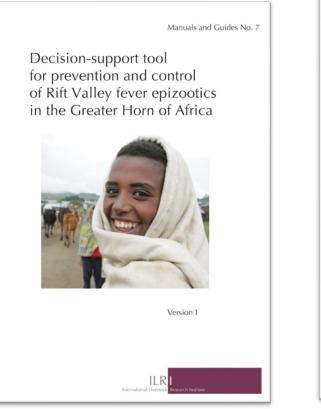
- Password protected, online interactive maps for
 - Near real-time RVF VA Hotspots and historical archive (> 2002)(monthly)
 - **RVF Outbreaks** (sourced from EMPRES-i) and heat map
 - Historical, real time and forecasted rainfall and anomalies (CHIRPS)
 - Climatic and environmental factors (e.g., soil, NDVI, EVI, T, water bodies, ...)
 - o Infrastructure (e.g., roads, markets, main livestock routes)
 - ENSO forecast (updated on a monthly basis)
 - Animals (FAO GLW 2010) and humans at Risk
- Upload and visualization of own data
- Analysis per polygon (e.g., epi-unit, and drawn on map or uploaded shp):
 - \circ trend/evolution of RVF risk over the past 12 months
 - o observed and cumulative rainfall in average, current and previous year
 - Multi-radar chart of the risk factors
- Easy comparison of risk factors and RVF hotspots (with the split screen function)
- Printfriendly report for selected items and risk factors at national level
- Link to metadata record (Catalogue), download of maps (in GeoTiff format)
- Real-time data sharing (maps, project, story) with users
- **Storymap** of main outputs of the analysis for real-time sharing and early warning
- Links to the main RVF documents for ease of reference

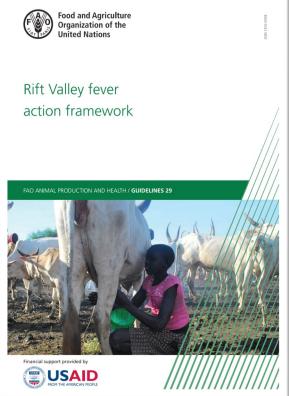




Integrated approach to guide informed early actions for prevention and control

- Real-time consultation among experts for risk interpretation, assessment, monitoring
- Data-sharing of geospatial data, risk maps, supporting documents for capacity building

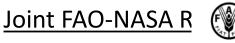


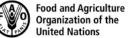






Joint FAO-IGAD (May 2021, July 2021, February 2022)





preparedness for Rift Valley fever







FAO and IGAD alert countries in eastern Africa to enhance



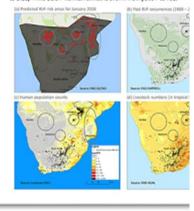
fever (RVF) According to a climate mor and Space Administration (heavy rains during the last conditions for the emergen

Based on the risk maps preperiod October-December 2 amplification are located i

Botswana, south-western and northern Zimbabwe and wide generated from remotely-sensed data on precipitation and veg amplification.

Considering that precipitation forecasts for February and Mard FAO advises that the veterinary services and livestock farms occurrence of RVF outbreaks in human and/or animal popula

Map 1: (a) Predicted RVT risk areas are shown in red and highlighted b 1969-2014 overlaid on (b) the vector suitability areas (green); (c) the (in tropical livestock unit). (e) Predicted precipitation anomalies for # to blue, while below-normal rainfall is shown from yellow to red.



The overall effect is improved state of vigilance and preparedness

2. The disease has been observed in sheep goats, cattle, buffaloes, camels, and humans and is spread primarily by mosquitoes and the movement of animals

May ant 2024

- 3. Heavy rains and prolonged flooding increase habitat suitability for vector populations, determining massive hatching of RVF competent mosquitoes (e.g. Aedes and Culex), thus influencing the risk of RVF emergence, transmission and spread.
- The dynamic prediction model calibrated by FAO builds upon the work by Anyamba et al. (2009; 2010), which utilizes vegetation and rainfall anomalies as a proxy for ecological dynamics to map areas at potential risk of **RVF** in Eastern Africa.
- The FAO RVF Early Warning panel of experts verifies the risk areas with the experts on the ground and assesses if conditions warrant an RVF alert (FAO 2019).

RVF outbreaks can disrupt the livestock sector in depleting the future generation of affected herds and therefore constitutes an important socio-economic and food security threat to vulnerable households. In addition, it can also affect the funds directly available to households through their animals and impact their capacities to access health care and child education. Moreover, it results trade ban and affect national and regional economy.

developed and maintains a web based RVF Early Warning Decision Support Tool (RVF DST) for near real-time RVF forecasting based on precipitation and vegetation anomalies, among other environmental factors. To this end, FAO, in partnership with the Intergovernmental Authority on Development (IGAD), has been alerting the countries in the region through joint alert messages about the increased risk and what needs to be done to mitigate the risk.

On 12 May 2021, the FAO Animal Health Service, based on the analysis of data available through the FAO web-based RVF Early Warning Decision Support Tool (RVF DST), Global Livestock Early Warning System (GLEWS+), Global Animal Disease Information System (EMPRES-i) and expert knowledge, concluded that the risk of RVF occurrence in the region remains high both in animals and humans in the next three months (June-August 2021), either due to favorable environmental conditions and/or through potential movement of infected animals, and highlighted the urgent need to ensure adequate preparedness for potential disease outbreaks, in particular through the One Health coordination.

Despite diverse climatic conditions in the region over the past four months. with heavy rains and floods in some countries and below-average rains and dryness in others, large suitable hotspots for RVF vector amplification persist in the region. Concerns remain for large, predicted hotspots in central-southern Kenya, South Sudan, northern Tanzania and localized hotspots in Uganda, Sudan, Somalia, Rwanda, Burundi, Ethiopia, as well as in eastern Saudi Arabia and Yemen. Suitable areas are predicted in proximity to irrigated lands, swamps and/or high density of susceptible livestock (Figure 1). The rainfall forecast for the period June-August 2021 highlights above-average rains in the region, particularly in July and August, suggesting that the risk remains high in those countries.

Useful Links

955-959

Useful Information

odf

Rift Valley fever surveillance (FAO Manual 2018) www.fao.org/3/I8475EN/i8475en.pdf

► Recognizing Rift Valley fever (FAO Manual 2003) www.fao.org/3/y4611e/y4611e00.htm

Preparation of Rift Valley fever contingency plans (FAO Manual 2002) www.fao.org/3/Y4140E/Y4140E00.htm

Figure 1. Confirmed RVF outbreaks (2020 - 2021) and forecasted risk of RVF vector amplification for June 2021

Decision-support tool for prevention and control of Rift Valley fever epizootics in the Greater Horn of Africa (ILRI and FAO, 2009) Version I, ILRI Manual

www.pnas.org/content/pnas/106/3/955.full.

▶ FuEMD in collaboration with EMPRES-

Animal Health and FAO Regional Offices,

first' course on efficient recognition,

launched a new online, open-access 'mobile

surveillance, prevention and control of Rift

Valley Fever (RVF). The course will soon be

available in a "iust in time" basis in the field.

offline use as needed. For more information,

and also in a downloadable version for

please contact eufmd-training@fao.org.



RVF sylbreaks 2000 - 2021 (Confirmed) ndt

Valer bodies

status of the Abyei area is not yet determined.

on-going risk of RVF outbreaks.

More specifically, FAO and IGAD recommend

increase its preparedness to RVF outbreaks.

Tool, June 2021 (RVF DST).



8 107.5.275 860

New areas at risk (June 2021

Source: UN, 2020 modified with the data from the web based RVF Early Warning Decision Support

Disclaimer: The boundaries and names shown and the designations used on these map(s) do not imply

the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundarie

Dashed lines on maps represent approximate border lines for which there may not yet be full

agreement. Final boundary between the Sudan and South Sudan has not yet been determined. Final

Therefore, FAO and IGAD are advising the countries to increase awareness,

improve preparedness at national, subnational and community levels to

safeguard livestock, livelihoods and public health, especially for exposed

and vulnerable communities (farmers, pastoralists), and improve

coordination with public health and environment services around the

National Veterinary Authority to increase awareness about the disease,

assess the current situation and the specific risk to the country

regarding RVF, and identify the actions to support the country to

National Veterinary Authority to get in touch with their public health

counterparts to coordinate joint preparedness activities, especially in

countries where there is no One Health platform; to ensure a

coordinated One Health and humanitarian approach to this threat.

Areas previously at risk (till May 2021

intents at this (since April 5)



r, May, July 2020)

hich coincide mostly with the rainy season in in the United Republic of Tanzania, Kenva and on, particularly in northwestern Kenva, eastern a. This suggests that the region will continue to 020 is still high for the region, particularly for ionia

k between June and July 2020 highlighted the

high risk of RVF occurrence due to persistent ling and development; rectors with an overall increase of the risk areas

(potential for June 2020) is now at low risk of

I to occur in Tanzania (28% increased), Ethiopia 0% increased) and Kenya (9% increased).

Somalia Water bodies Subsational boundaries ange Risk Detection from June to July 2020 Diek dermanad Low risk New areas at ris Parsistanty of Ris T 245 - 244

FAO RVF Monitoring, Early Warning and Decision Support Tool)

[·]eported in Kenya

May 2018: RVF rep

- Challenge
 - ✓ Getting unified alert across the region, and averting unnecessary rumours and consequences
 - ✓ Inadequate political support for unified action/s
- Solution
 - ✓ FAO-IGAD quarterly RVF alerts (July 2020) <u>https://www.fao.org/3/cb8651en/cb8651en.pdf</u>
 - □ Primary objective
 - Political buy-in
 - Safeguard trade and livelihoods
- Expected results
 - ✓ Countries remain vigilant
 - Preemptive action taken
 - ✓ Improved cooperation
- Specific examples of actions taken following the alert
 - ✓ Oct'19/Apr'20 preventative vaccination Kenya
 - ✓ Jan' 22 preemptive sero-surveillance Kenya
 - ✓ Apr'22 Rwanda
 - Proactive sero-surveillance
 - \Box Vaccination \approx 600 animals
 - **RCCE**

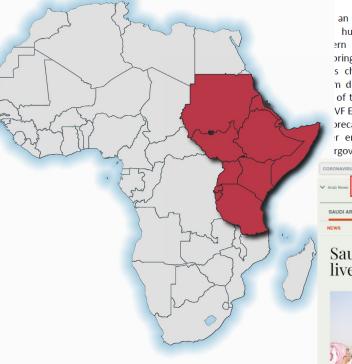






FAO AND IGAD ALERT COUNTRIES IN EASTERN AFRICA TO REMAIN VIGILANT FOR RIFT VALLEY FEVER

15 February 2022



an endemic vector-borne zoonotic disease that human health, animal health and livestock ern Africa region. The epidemiology of RVF is oring of RVF risk and carrying out efficient and s challenging. To increase knowledge on RVF n disease management policies, the Food and of the United Nations (FAO) has developed and VF Early Warning Decision Support Tool (RVF DST) precasting based on precipitation and vegetation r environmental factors. To this end, FAO, in rgovernmental Authority on Development (IGAD),

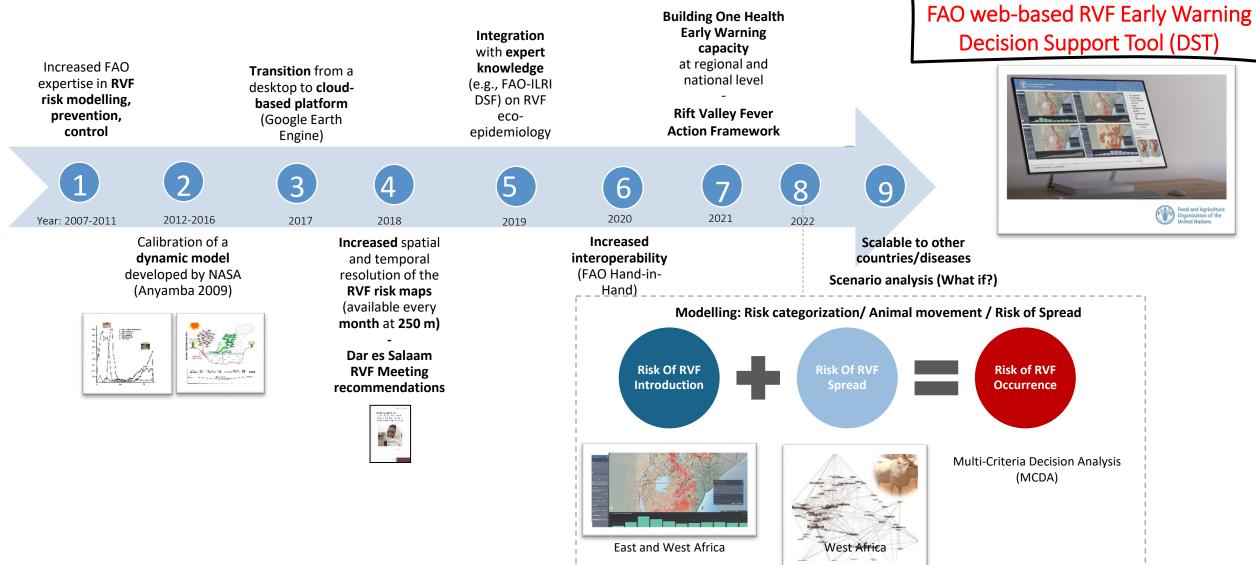


Saudi Arabia lifts ban on Sudan's livestock imports





RVF Risk Modelling and DST: major milestones and way forward



Thank you

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Tracking climate variability and changing patterns

- Near real-time RVF monitoring and forecasting tool (observed cumulative vegetation anomalies over the past 3 consecutive months; builds upon the dynamic environmental model by NASA)
- Observed precipitation anomalies (over the past 3 consecutive months)
- Forecasted precipitation (over the coming 3 months)
- ENSO forecasts (up to six months)
- Past and current RVF outbreaks (linked to FAO EMPRES-i)
 Comparison with risk maps of reference years
 Livestock distribution/density (linked to FAO GLW)

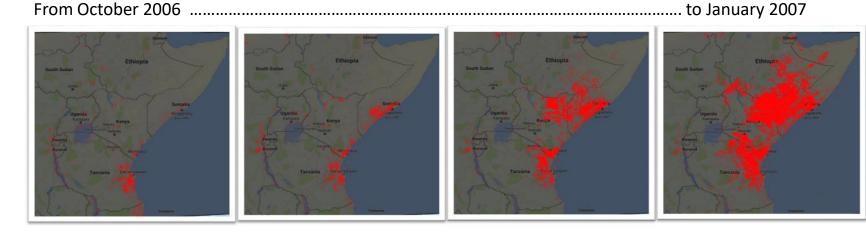
• Expert knowledge

Prediction capacity

FAO Forecasted RVF events	Date of FAO Risk Assessment / Alert	Reporting date (EMPRES-i)	Observation date (EMPRES-i)
The Gambia	15 Sept 2017	19 Jan 2018	10 Dec 2017
Senegal	15 Sept 2017	01 Mar 2018	28 Feb 2018
South Africa	5 Feb 2018	16 May2018	28 Apr 2018
Kenya	Mar 2018	06 Jun2018	11 May 2018
Rwanda	Mar 2018	18 May 2018	06 May 2018
Kenya	10 Oct 2018	14 Feb 2019	31 Dec 2018
Sudan	10 Oct 2018	21 Nov 2018	04 Oct 2018
Mauritania	10 Oct 2018	26 Nov 2018	04 Nov 2018
Sudan	9 Sept 2019	06 Oct 2019	19 Sep 2019
Horn of	16 Oct 2019	02 Dec 2019	15 Nov 2019
Africa		(in Uganda)	
Mauritania/ Senegal	24 June 2020	16 Sept 2020	04 Sep 2020
Kenya	15 Jan 2020 2 Apr 2020 15 May 2020 10 July 2020 7 Oct 2020	22 Dec 2020	15 Mar 2020 19 Aug 2020 19 Nov 2020

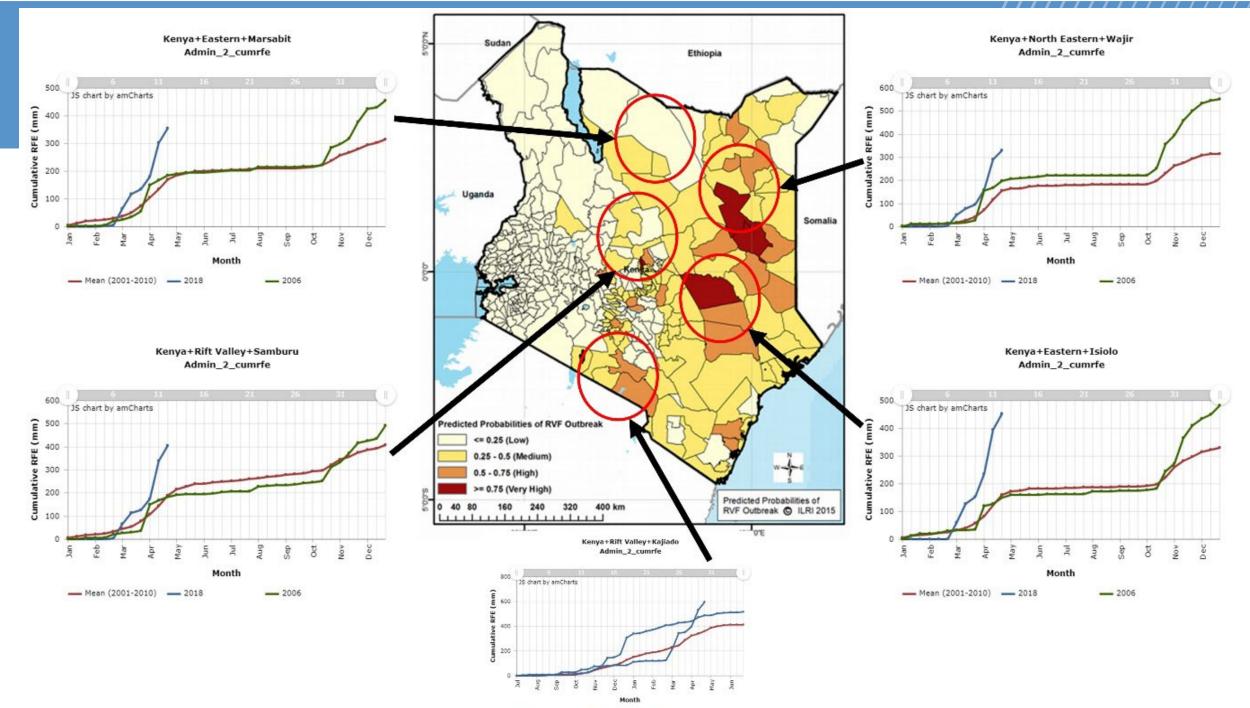


Comparison with risk maps of reference years



Similar patterns between:

- Oct 2006 Jan 2007
- Feb May 2018



- Mean (2001-2010) - 2017-2018 - 2006-2007