This *Africa RiskView* End of Season Report is a publication by the African Risk Capacity (ARC). The report discusses *Africa RiskView*’s estimates of rainfall, drought and population affected, comparing them to information from the ground and from external sources. It also provides the basis of a validation exercise of *Africa RiskView*, which is conducted in each country at the end of an insured season. This exercise aims at reviewing the performance of the model and ensuring that the country’s drought risk is accurately reproduced by *Africa RiskView* for drought monitoring and insurance coverage. The End of Season reports are also being continuously refined with a view to providing early warning to ARC member countries.

**Rainfall:**
- The performance of the 2017 long rains was poor with less than 50% of average rainfall received in both the marginal agricultural and rangeland areas of Kenya’s ASAL. Isiolo County particularly received less than 30% of average rainfall.
- Average to above average rains were only received in parts of the marginal agricultural areas such as Kwale and Kilifi and parts of Garissa, Wajir and Kitui counties. The spatial and temporal distribution of rainfall varied widely across the ASAL areas with significant rainfall of more than 10 mm received only in a total of six to seven dekads during the long rains season.

**Drought:**
- The end of season WRSI for the long rains was poor for vast areas of Kenya’s ASAL, with less than 50% of the rangeland water requirements met for about two-thirds of the ASAL areas. Severe vegetation deficits were faced by pastoralists in Isiolo, parts of Kajiado, Samburu and Turkana counties because of the poor rain performance.

**Affected Populations:**
- *Africa RiskView* estimates that over 3.4 million people were directly affected by drought at the end of the long rains season in 2017. The highest proportion of people affected by drought as modelled by *Africa RiskView* was in Turkana, Samburu, Tana River, Baringo, Marsabit and Wajir counties. Twenty seven sub-counties out of 98 in Kenya’s ASAL had 50% or more of their populations affected by drought.
- *Africa RiskView* estimates indicate that more than 600,000 people (over 74% of the county population) were affected by drought in Turkana county alone and more than 200,000 people are estimated to have been affected in each of Mandera, Makueni, Wajir and Baringo counties.

**RISK POOL**
- Unfortunately the government of Kenya did not participate in the 2016/17 ARC Ltd drought risk pool. If the Government had participated based on the recommended contract structures for the long rains, the government would have received a payout of USD 13 million to support its response efforts.

**Rainfall**
The in-country Technical Working Group (TWG) customised *Africa RiskView* to model the progression of the 2017 long rains season between February and July. During this period, the bulk of the rains in Kenya’s Arid and Semi-Arid Lands (ASAL) are usually received between March and May, which is the timeframe commonly used to assess the performance of the rainy season for crops. Based on the satellite rainfall estimates used in *Africa RiskView*, the performance of the 2017 long rains was poor in both the marginal agricultural and rangeland areas of Kenya’s ASAL.

The rangeland areas in the northern parts of the Rift Valley, Eastern and North Eastern regions received less than 50% of the 2001-2016 average based on RFE2 rainfall estimates (figure 1). Isiolo County in particular received less than 30% of the 2001-2016 average. Wajir, Mandera, Marsabit, Turkana, Samburu, Kajiado and Narok were the other counties where rainfall received was 50% below the 2001-2016 average in most parts. Marginal agricultural areas along the coast such as Kwale, Kilifi and parts of Kitui county received 70-90% of the normal rainfall, with only a few areas receiving average or above average rains (figure 2 and figure 3).

*Africa RiskView*’s estimates on the performance of the long rains in Kenya are consistent with the findings of the 2017 Long Rains Season Assessment undertaken by the Kenya Food Security Steering Group (KFSSG) in terms of identification of areas that experienced rainfall deficits and those that received normal rainfall. The KFSSG found that most parts of the country received 50-90% of normal rainfall, while western Kenya, the coastal counties of Kwale, Kilifi and Lamu, and parts of Wajir, Marsabit and Garissa

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received 90-125% of normal. Very low amounts of 25-50% of normal were received in parts of Turkana, Marsabit, Samburu, Meru, Kajiado, Taita Taveta, Isiolo and Tana River, while the lowest amounts of 5-25 percent were received in the central part of Isiolo. The KFSSG report is based on CHIRPS rainfall estimates while the Africa RiskView analysis is based on RFE2. The CHIRPS estimates of rainfall received are slightly higher than the RFE2 rainfall estimates.

The TWG customized Africa RiskView to assume that planting conditions for the reference crop (maize) in agricultural areas occurs if at least 10 mm of rain are received. Based on this setting, planting conditions were only reached in dekads 9 and 10 (late March, see figure 4). These modelled estimates are consistent with the KFSSG assessment report of July 2017, which indicated that farmers in marginal agricultural areas were only able to plant maize, the main staple, in late March. Rainfall of more than 10 mm was only received during six to seven dekads in the ASAL, far shorter than the average growing period of 9 dekads set for maize in Africa RiskView. Moreover, the spatial and temporal distribution of rainfall varied widely across the agricultural areas in the ASALs (illustrated in figures 5, 6, 7, 8 and 9). The obvious implication of this, confirmed by the KFSSG assessment, has been below average crop production and reduced livestock productivity.

**Drought Index**
Africa RiskView uses the Water Requirements Satisfaction Index (WRSI), an index of crop and rangeland performance based on the availability of water for the plants during the growing season, as an indicator for drought. During the customisation of Africa RiskView for Pool 3, undertaken with the view to participating in the ARC Risk Pool, rangelands were retained as the reference crop in most of Kenya’s ASAL. In addition, crop production was identified as the main source of income in some marginal cropping areas in the coastal counties of Kwale, Malindi and Kilifi and in parts of Mwingi, Kitui and Machakos. As such, maize – the most important and widely grown staple – was set as the reference crop for these marginal cropping areas.

Following the Famine Early Warning Systems Network (FEWS NET) WRSI classification, the end-of-season WRSI as calculated by Africa RiskView showed a failure of the season for vast areas of Kenya’s ASAL (figure 10). Only very small parts of the coastal counties that received average or above average rainfall had a “good” WRSI at the end of the long rains season, based on this WRSI classification as shown in figure 11. Comparison of the Africa RiskView modelled end of season WRSI with the benchmark selected for Pool 3 customisation (median WRSI of the last five years) shows that the end-of-season rangeland WRSI was less than 50% of the benchmark in most of the ASAL (see figures 12 and 13). Only small areas of Garissa, Wajir, Kilifi and Kwale counties had an end-of-season WRSI above the benchmark.

The three-month Vegetation Conditions Index (VCI) produced by the National Drought Management Authority (NDMA) in July 2017 reveals that severe vegetation deficits are being faced by pastoralists in Isiolo, parts of Kajiado, Samburu and Turkana counties. Other counties in the semi-arid north were experiencing moderate vegetation deficits. These deficits are associated with the poor performance of the long rains in 2017. As a consequence of the spatial variability in the distribution of the long rains, the VCI is also highly variable even within the same county. Whereas some
Figure 4: Temporal distribution of rainfall in Kenya’s ASAL during the 2017 long rains season

Figure 5: Temporal distribution of rainfall in Kenya’s Marginal Agricultural Areas during the 2017 long rains season

Figure 6: Temporal distribution of rainfall in Mwingi Central (Mwingi) during the 2017 long rains season

Figure 7: Temporal distribution of rainfall in Lamu West (Lamu) during the 2017 long rains season

Figure 8: Temporal distribution of rainfall in Ganze (Kilifi) during the 2017 long rains season

Figure 9: Temporal distribution of rainfall in Magarini (Malindi) during the 2017 long rains season
sub-counties within a county were reported as having normal vegetation greenness, others were facing moderate or severe vegetation deficits (available at [link](http://www.ndma.go.ke/index.php/resource-center/early-warning-reports)). Based on the aggregate VCI index, Isiolo, Kajiado, Laikipia, Turkana and Tana River had the worst vegetation deficits at the end of July 2017. Counties having severe or moderate vegetation deficits based on the aggregate VCI values are located in the areas that met less than 50% WRSI compared to the benchmark (figure 12) based on the *Africa RiskView* modelling, clearly validating the accuracy of *Africa RiskView* in modelling drought impacts on the ground.

**Modelled Drought Impacts**

In order to put the modelled drought conditions into perspective, the district-level WRSI at end of a season is compared to the benchmark, which in the case of Kenya was determined as the median WRSI value of the previous five years. Drought conditions are triggered if the end-of-season WRSI falls below the benchmark. Both the severity of the drought (the extent of the deviation of the WRSI from the benchmark) and the vulnerability of the population in the affected area are used to determine the number of people affected.

As discussed in the previous section, the end of season WRSI was below the benchmark for large parts of the ASAL. The *Africa RiskView* model reveals that 72% of the sub-counties in Kenya’s ASAL had experienced drought of varying severity at the end of the long rains in 2017. Forty two percent of the population in the
ASAL was estimated by *Africa RiskView* as affected by drought. The total number of drought affected persons as a result of rain deficits experienced in the long rains season was estimated at around 3.4 million by *Africa RiskView*. This is slightly lower than the worst recorded historical drought of 2009/10 (4 million people according to *Africa RiskView*) during the 2001—2017 timespan – see figure 16.

Further analysis reveals that the highest modelled number of people affected by the poor performance of the 2017 long rains is in Turkana county, estimated at over 600,000 (figure 14) - which is more than 74% of the county’s population. Mandera, Makueni, Wajir and Baringo are the other counties with more than 200,000 people modelled by *Africa RiskView* as affected by drought. At the sub-county level, 27 sub-counties out of 98 in Kenya’s ASAL had 50% or more of their populations affected by drought. The most severe drought impacts based on the proportion of the affected population by sub-county were recorded in Turkana West, Turkana South, Loima, Turkana East, Samburu East and Tarbaj – more than 75% of the population in these sub-counties is estimated to have been affected by drought (see figure 15). Although Kajiado county also registered very high drought impacts (less than 30% of WRSI met compared to the benchmark), its relatively less vulnerable population based on the vulnerability profiles used for Pool 3 customisation meant that the proportion of drought affected persons was much lower than Turkana, for instance.

The KFSSG long rains assessment of July 2017 estimates 2.6 million people at or above crisis level of food insecurity (IPC Phase 3) and another 0.8 million as stressed (IPC Phase 2) - a total of 3.4 million as in need of assistance. The counties with the highest proportion of their population requiring assistance were reported as Isiolo, Tana River, Marsabit and Samburu. The *Africa RiskView* model of areas affected by drought is comparable to the areas identified as in need of assistance by the KFSSG assessment of July 2017. Whereas differences exist between the *Africa RiskView* and KFSSG estimates of the number of people in need of assistance, this is because the *Africa RiskView* estimates exclude other drivers of food insecurity. As mentioned earlier, *Africa RiskView*’s estimates of numbers of people affected by drought only consider the impact of rainfall deficits during the insured season (February to July 2017 for the long rains season in this case). People who are in a state of food insecurity, either for reasons other than drought (plant pest outbreaks such the Fall Armyworm infestation, soaring food prices, insecurity, etc.), or as a result of a previous drought with long-term impacts, are not taken into account. In several ASAL counties such as Isiolo and Tana River, the effects of the two or three consecutive failed seasons could have driven the population to higher levels of vulnerability and food insecurity, thus the higher estimates by KFSSG of persons in need of assistance in some cases. The food insecure population was therefore expected to increase above the *Africa RiskView* modelled estimate as a consequence of these other confounding factors.

**Modelled Drought Response Costs**
Based on the response costs selected by the in-country *Africa RiskView* customisation TWG, the Modelled Drought Response Cost (MDRC) for the long rains season was estimated at USD 102.6 million (figure 17). Compared with the historical drought response costs, the MDRC of 2017 is the second highest in the last 16 years.
only surpassed by the MDRC of 2009/10.

Based on the selections/recommendations made by the TWG regarding the structuring of the contract for the 2016/17 policy year for the long rains, a payout would have been due to the Government of Kenya had a contract been in place. This would have been because the number of people affected, as estimated by Africa RiskView would have exceeded the attachment point recommended/selected by the TWG. The rainfall deficits experienced during the long rains season would have triggered a payout of about USD 13 million. This is only slightly lower than the payout that would have been triggered had the rainfall patterns been equal to the worst modelled drought event, the 2009 drought.
The African Risk Capacity (ARC) is a specialised agency of the African Union designed to improve the capacity of AU Member States to manage natural disaster risk, adapt to climate change and protect food insecure populations.

The Africa RiskView software is the technical engine of ARC. It uses satellite-based rainfall information to estimate the costs of responding to a drought, which triggers a corresponding insurance payout.

The ARC Insurance Company Limited is the financial affiliate of the ARC Agency, which pools risk across the continent through issuing insurance policies to participating countries.

**About ARC:**

**Note on Africa RiskView’s Methodology:**

**Rainfall:** Africa RiskView uses various satellite rainfall datasets to track the progression of rainy seasons in Africa. Countries intending to participate in the ARC Risk Pool are required to customise the rainfall component by selecting the dataset which corresponds the best to the actual rainfall measured on the ground.

**Drought:** Africa RiskView uses the Water Requirements Satisfaction Index (WRSI) as an indicator for drought. The WRSI is an index developed by the Food and Agriculture Organisation of the United Nations (FAO), which, based on satellite rainfall estimates, calculates whether a particular crop is getting the amount of water it needs at different stages of its development. To maximise the accuracy of Africa RiskView, countries intending to take out insurance customise the software’s parameters to reflect the realities on the ground.

**Affected Populations:** Based on the WRSI calculations, Africa RiskView estimates the number of people potentially affected by drought for each country participating in the insurance pool. As part of the in-country customisation process, vulnerability profiles are developed at the sub-national level for each country, which define the potential impact of a drought on the population living in a specific area.

**Response Costs:** In a fourth and final step, Africa RiskView converts the numbers of affected people into response costs. For countries participating in the insurance pool these national response costs are the underlying basis of the insurance policies. Payouts will be triggered from the ARC Insurance Company Limited to countries where the estimated response cost at the end of the season exceeds a pre-defined threshold specified in the insurance contracts.

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