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Seasonal Monitoring in Namibia 2012/2013

Severe drought over the north and centre of the country

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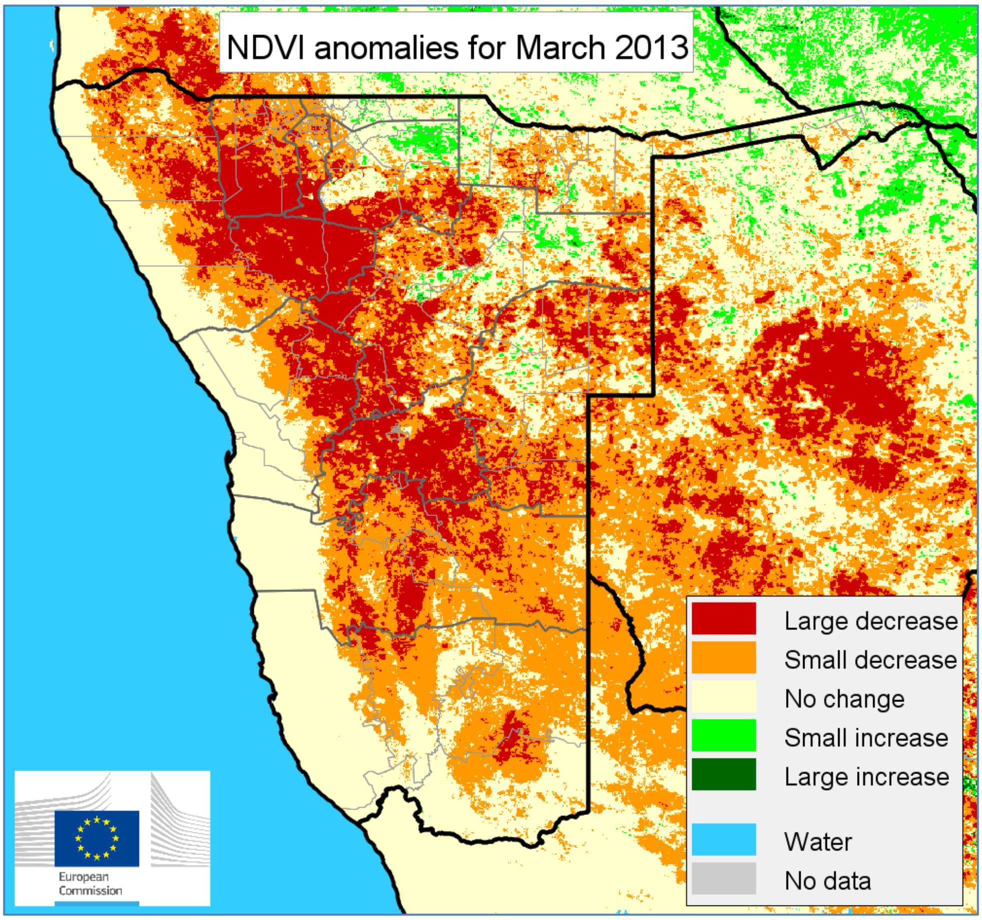

Absolute NDVI anomaly between current year and the long term average (1999-2012)
Source: JRC-MARS, SPOT-VGT

Joint Research Centre

1. BACKGROUND

Situated between the Namib and the Kalahari deserts, Namibia has the least rainfall of all sub-Saharan African countries. There are typically two rainy seasons: a small rainy season between September and November, and a bigger rainy season between February and April. The winter (June – August) is generally dry. Average rainfall varies from almost zero in the coastal desert to more than 600mm in the Caprivi Strip. Rainfall is also highly variable in time, and droughts are not uncommon, as experienced in 2006/2007 for example, when rainfall was far below the annual average.

Namibian agriculture contributed around 5% to Namibia's GDP between 2004 and 2009, and about half the population depends on agriculture for its livelihood. The agricultural sector comprises mainly crop farming and livestock rearing. Crops are limited to the north, whilst livestock farming is not confined to a specific region but occurs in various areas countrywide. Cattle and goats are more common in the northern and central regions, whilst goats and karakul sheep are more typical in more arid southern regions.

Per capita GDP is five times that of Africa's poorest countries, but 25 – 40% of Namibians still live in rural areas and rely on subsistence farming and herding. Subsistence farming is mainly confined to communal lands in the north of the country, where roaming cattle herds are prevalent and the main crops are millet, sorghum, maize and groundnut.

Only 2% of Namibia's land receives sufficient rainfall to grow crops; most rivers flow only sporadically, and so irrigation is only possible in Oranje, Kunene, and Okavango valleys.

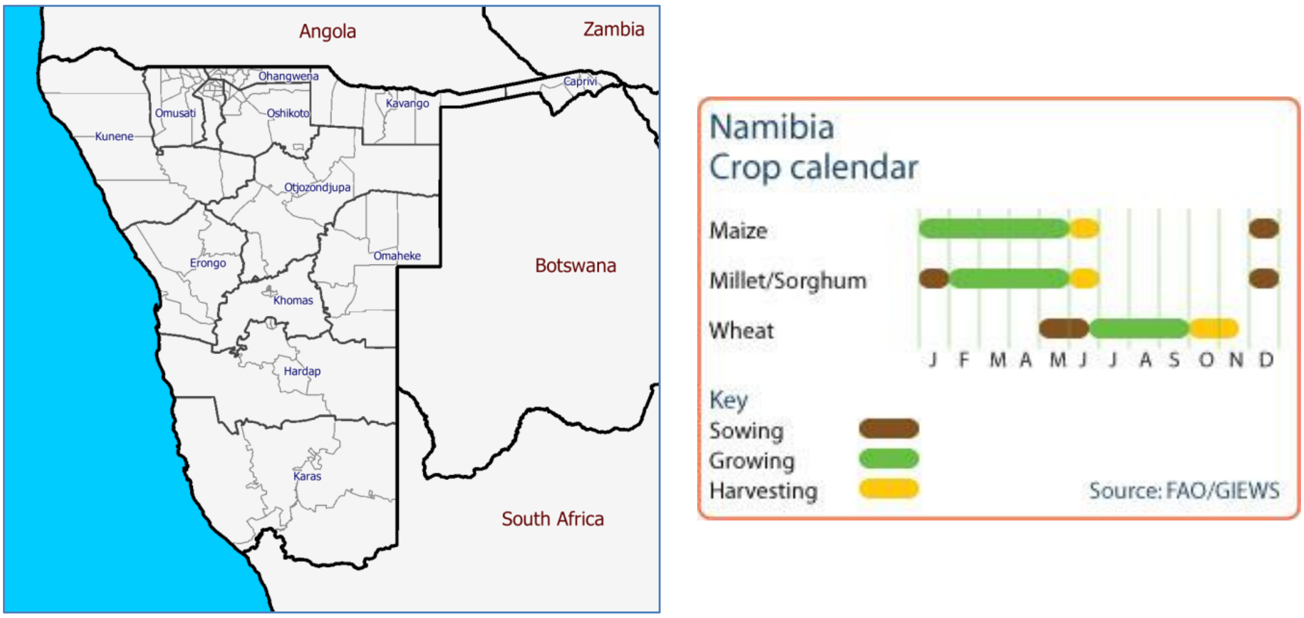

Figure 1. Regions within Namibia, and FAO-GIEWS crop calendar for main cereal crops.

2. PRESENT SITUATION

The summer season in Namibia (September 2012 - May 2013) has been the second driest of the last 25 years. Considering Namibia in its entirety, it can be seen that there was average rainfall until late December 2012, but there has been very little rain since (Figure 2).

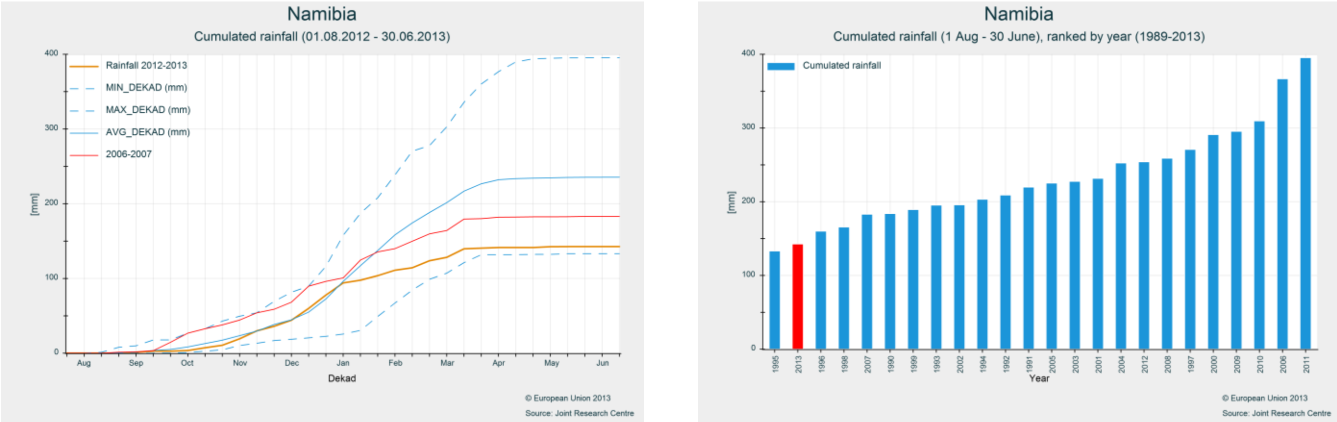

Figure 2. Cumulated rainfall in Namibia (01.08.2012 to 30.06.2013) compared to the long term average and 2006-2007 (a recent drought season), and compared to all years 1989-2013.

Maize, millet and sorghum are sown from December and grow through until the end of May (see the FAO-GIEWS crop calendar in figure 1). This is the period when rainfall is most important, and it can be seen that this rain has not fallen this year.

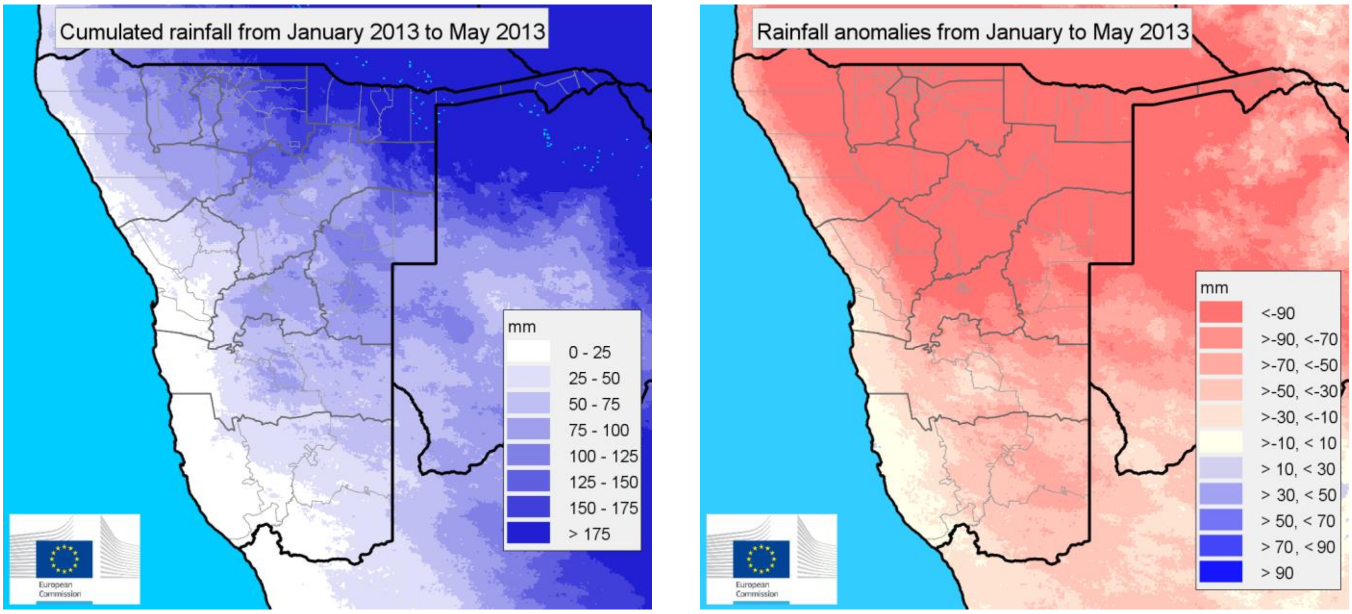

Figure 3. Cumulated rainfall in Namibia 01.01.2013-31.05.2013 (TAMSAT rainfall estimate); difference between this cumulated rainfall and the long term average cumulate (TAMSAT, 1983-2012).

Whilst there has been some rainfall in the far north-east of Namibia, this still represents more than 90mm less than the average amount of rain that might be expected over the same period. Most other parts of northern and central Namibia have received much less rain over this period, and again more than 90mm less than might otherwise have been expected. This is a significant deficit in areas that usually receive less than 400mm per year.

This rainfall deficit has influenced the growth of vegetation (an important indicator of both crop growth and pasture condition). Satellite-derived measures of NDVI (normalised difference vegetation index) represent how 'green' the vegetation is (i.e. how much the crop is actually growing, or how much food is available to animals). Figure 4 shows how the vegetation in 2013 compares to the long term average (1999-2012).

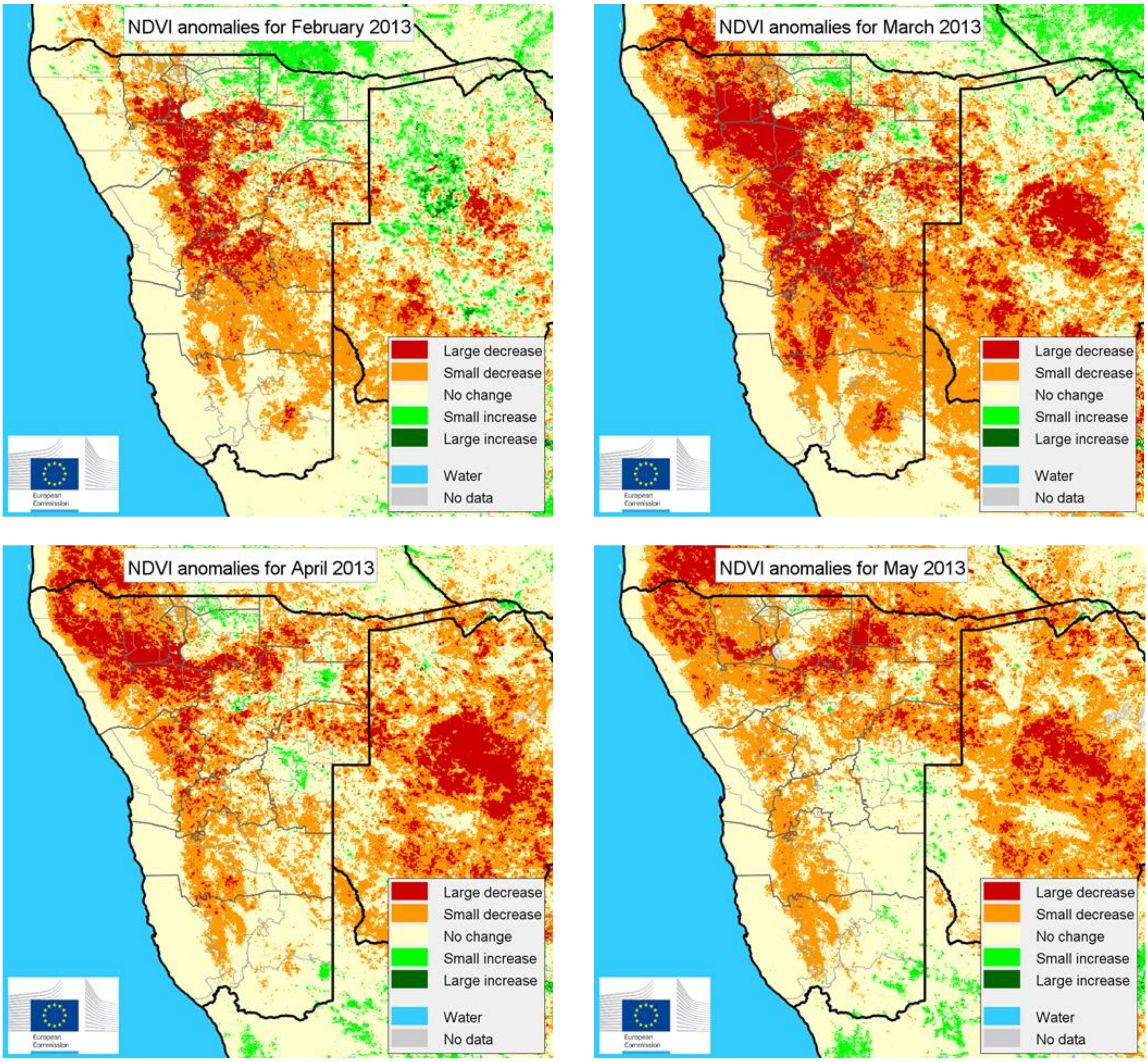

Figure 4. Difference between monthly NDVI and the corresponding long term average for the period from February to May 2013 (SPOT-VGT NDVI, 1999-2012).

By March 2013 this reduced rainfall has strongly negatively influenced the vegetation condition in large parts of Namibia, especially northern and central Namibia. Having said this, there are still areas in the north and northwest that show positive anomalies, that is, better vegetation condition than the long term average (though these are relatively few).

By May 2013, these positive anomalies have largely disappeared. Note that although there are many fewer parts of Namibia showing orange and red in the May 2013 map, this does not mean that the effects of drought are diminishing by this point. Rather, the vegetation condition is still poor, but is now approaching the long term average, which at this time of year is largely reduced anyway (as the rainy seasons have by now finished, and most areas are dry once again).

3. Temporal analysis of NDVI and rainfall estimates profiles at constituency level

We can also show temporal, as well as spatial, pattern in rainfall and NDVI (and further refine the analysis to look only at rainfall and NDVI profiles over known crop and pasture areas). Combined profiles of rainfall and NDVI have been computed for all constituencies in Namibia. A selection of those from some of the most affected areas is shown in figure 5.

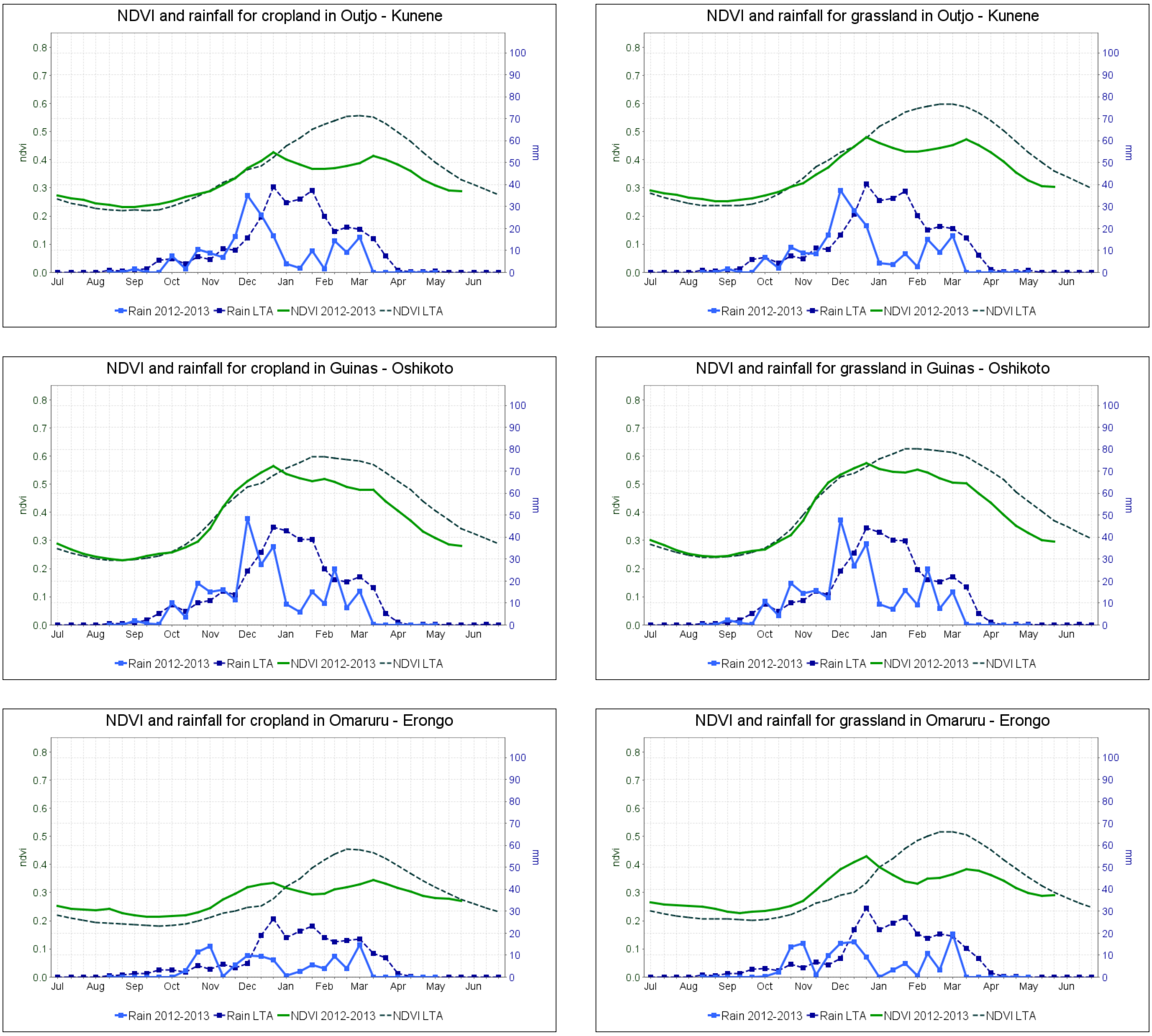

Figure 5. Rainfall and NDVI profiles over cropland and pasture for some of the more seriously affected constituencies in Namibia.

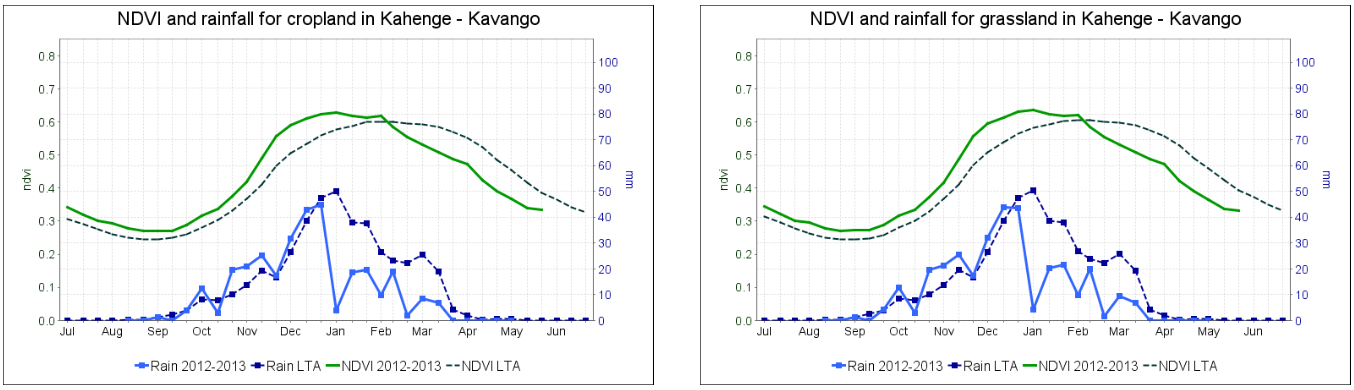

Figure 5 (ctd). Rainfall and NDVI profiles over cropland and pasture for some of the more seriously affected constituencies in Namibia.

These profiles all show a similar pattern. There is some rainfall at the beginning of the season, at which point vegetation begins to respond and NDVI begins to rise. Then, from around the end of December, the rainfall is very much reduced, and the NDVI drops.

In the central and north-eastern regions where most of communal agriculture is located, good rains were recorded until December 2012; crops and pastures performance was better than the average over the last 14 years. Dry spells of the January affected badly the central constituencies where the vegetation index shows a sharp decrease. It's highly likely that in those areas the cereal crops totally failed as the drought occurred early in the season. The rainfall deficit effect was observed later in the central north and north-eastern constituencies (in *Kavango* and part of *Caprivi* regions).

But once the rainfall is reduced (from the end of December) the NDVI drops and the difference between the vegetation condition that might be expected for the time of year, and the vegetation condition that is actually present, is seen to increase.

Kabe constituency (in *Caprivi* region) shows positive anomalies throughout the year, and so we show its profiles here as a counter-example.

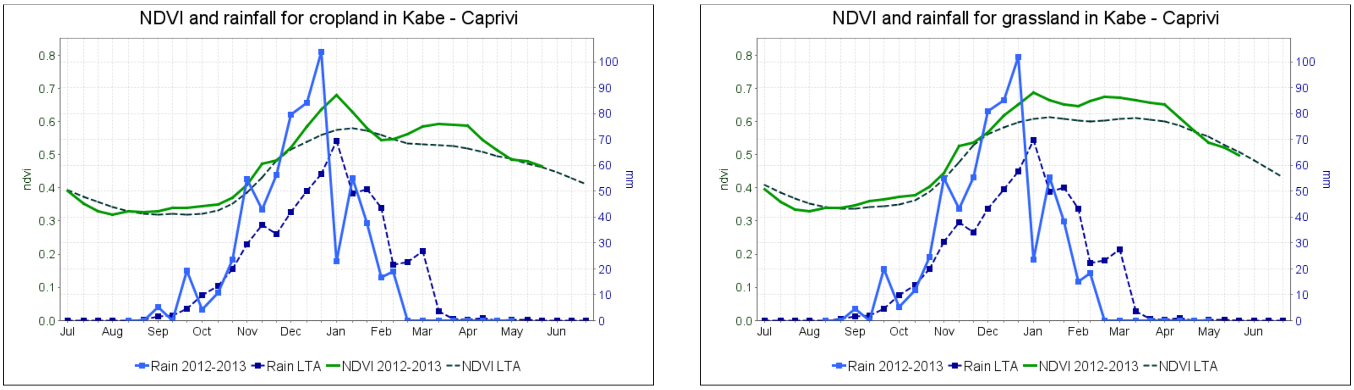

Figure 6. Rainfall and NDVI profiles over cropland and pasture in Kabe, Caprivi.

Rainfall is much more abundant than usual in the first part of the season, and whilst there is a reduction in rainfall from the end of December, the reduction is not as serious as in other regions. There remains sufficient moisture for the vegetation, and NDVI indicates above average vegetation condition until the very end of the time series.

4. CONCLUSIONS

Following the analysis of rainfall estimates and vegetation indices provided by low resolution satellite images, it can be concluded that a number of regions in Namibia, especially in the north and centre of the country, have been directly affected by a severe rainfall deficit starting in late 2012 and showing a strong impact on agricultural and natural vegetation from March through to May 2013. The most affected provinces are Omusati, (eastern) Kunene, (eastern) Erongo, (western) Otjozondjupa, Khomas, and later Kavango.

Maize and sorghum, and even the more 'drought resistant' millet, are very likely to have been affected, in some places perhaps resulting in failure. Pasture will not support the livestock it does in more average years.

These findings are based on the analysis of low resolution satellite images and on satellite-derived rainfall estimates, and should be validated by ground observations such as measured meteorological data and ground surveys. It is recommended that detailed field surveys are carried out in the most affected municipalities for a quantitative impact assessment.

NDVI and rainfall estimate profiles, available for all constituencies in Namibia, can be used to aid prioritisation and planning of field visits.