Sudan Seasonal Monitor

Sudan Meteorological Authority
Federal Ministry of Agriculture and Forestry

Issue 6 November 2007

Summary

- **The rainfall season of 2007 is coming to an end; at this stage only Southern Sudan regions and the Eastern coastal regions of Red Sea are able to enjoy some rainfall.**
- **The period of mid-October to early November was markedly dry across most of Sudan, though with South Kordofan still enjoying some late rains. In Southern Sudan, dry conditions prevailed in a belt extending from North Bahr-el-Ghazal through Lakes into Central Equatoria. See** *Pages 1-2*
- **Seasonal vegetation development indicators summarise the diagnostics presented in this Bulletin throughout the season – maximum development was well above the average in particular across the semi-arid regions of Sudan (Darfur to Kassala and in East Equatoria). See** *Page 3*
- **Detailed examination of particular land cover units (pasture and agricultural domains) confirms a situation of earlier starts of the growing season (in places by as much as one month) and consistently above average vegetation levels. This is particularly more evident in the more marginal semi-arid regions, where levels reached this season are likely to be one of the highest in the recent record. See** *Pages 4-7*
- **In Southern Sudan the traditional crops are mostly in, but lack of late season rainfall can impact on the late maturing sorghum crop in Lakes and Upper Nile.**
- **The 2007 FAO/WFP Crop and Food Supply Assessment Mission for Southern Sudan largely confirmed the asessments made in this Bulletin during the season – one of the highest yields in recent years and significant expansion in cultivated areas. However, there was a negative impact from flooding and overall production levels are similar to 2005, a fairly good season. See** *Page 8*
- **In Northern Sudan, the GoNU led agricultural production surveys are taking place now and should produce preliminary results in early January. Meanwhile, State reports confirmed expectations defined in earlier issues - increases in planted area by traditional farmers (where land is available) and higher than average crop yields. In mechanized agricultural areas, a variable decrease in area planted for the major crop (sorghum) but yields at better than average levels, except for late planted crops which are expected to perform poorly. See** *Page 8*
- **All considered expectations are for increased production in the traditional sector relative to average and last year's and a stable or slight decreased production in the mechanized sector.**

October and early November Rainfall in Sudan

Southern Sudan – November brings the last rains across most of the region, with only the southernmost Greenbelt areas still expecting to enjoy some rainfall through December. October saw mostly drier than average conditions across the South, in particular in a belt extending from North Bahr-el-Ghazal through Lakes into Central Equatoria where rainfall was around 40% of the average. Jonglei was also in general drier than average.

Seasonal rainfall amounts in 2007 in Southern Sudan now range from close to 1600mm in the areas bordering Congo to more than 600mm in East Equatoria and 800mm in northern Upper Nile. The recent drier period hasn't changed the seasonal picture – total rainfall (March to present) remains above average (Fig 2) everywhere across the region, particularly so in the Southeast (Kapoeta region). This has had a very clear impact on vegetation levels as shown in the Vegetation Status section (see Fig 3).

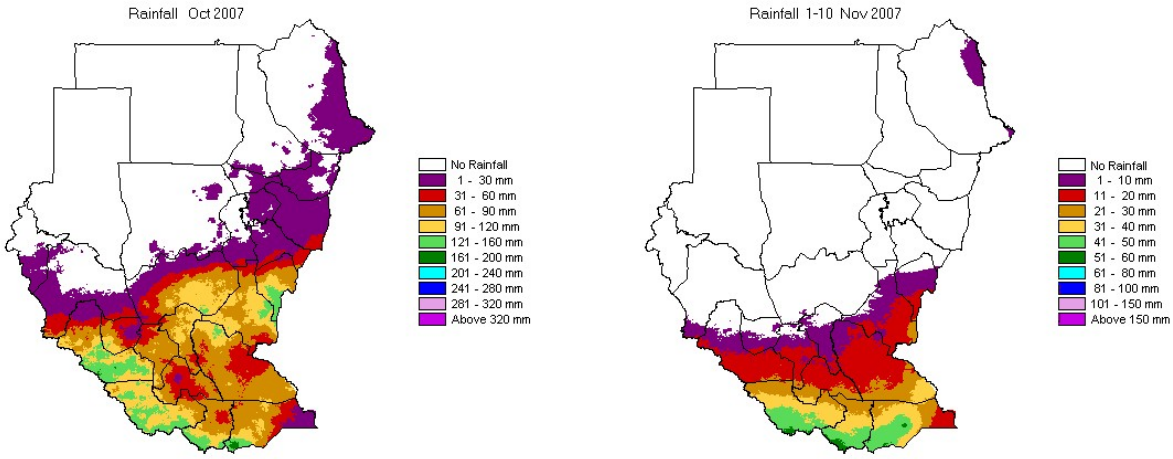

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Fig 1 – Rainfall amounts in October (a), and in the first ten days of November (b).

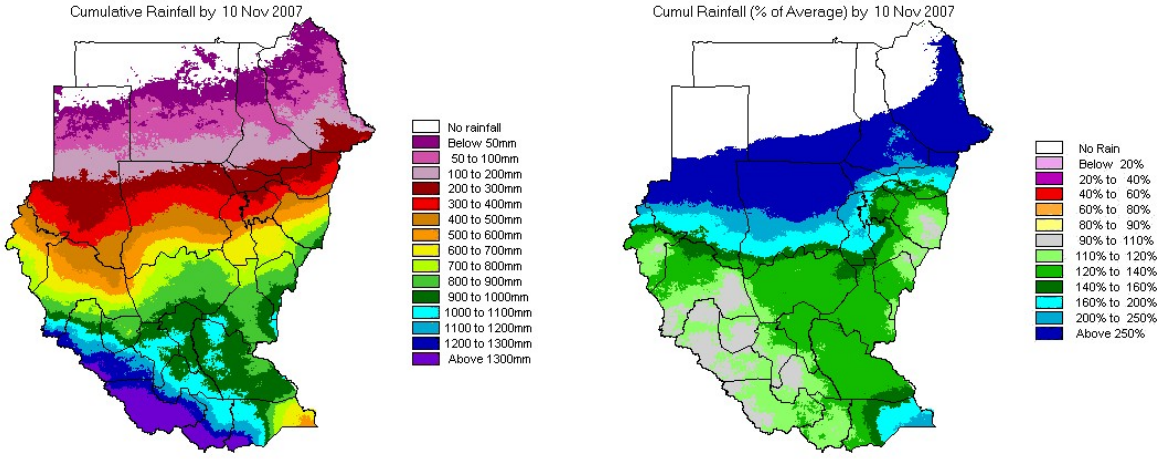

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Fig 2 (a) Seasonal rainfall amounts from March to early November 2007; (b) same but expressed as a ratio of the average seasonal rainfall over the same period – yellows and red for below average amounts, greens and blues for above average amounts

Northern Sudan – In this region, only South Kordofan and Blue Nile states registered significant rainfall in October with other regions (East mostly) experiencing small amounts. No more rainfall is expected this season in Northern Sudan. The exception is the Red Sea coastal regions which enjoy their main rainfall season in November-December.

Seasonal amounts exceeding 200mm (a minimum for sparsely planted early maturing crops) were registered further north than usual this season covering all of North Kordofan and extending into River Nile and Red Sea states. Across the region, total rainfall amounts are now 40% to 100% above average (Fig 2b) – in marginal northern areas levels can reach 300% or more but this is simply due to average rainfall in these regions being very low (and hence very high ratios can be easily obtained).

Acknowledgements
The above rainfall maps are derived from a combination of satellite and ground (raingauge) data. In Southern Sudan, the existing network is complemented by a number of raingauges whose data is gathered and provided by the Southern Sudan WFP VAM Unit. This extends data coverage over remote regions, greatly increasing local accuracy of the maps. Next season SIFSIA-South will support Southern Sudanese authorities to deploy their own network.
We are also thankful to the TAMSAT Group at the Dept Meteorology, University of Reading, UK who have been providing back up satellite data for these maps. SIFSIA-North is restoring satellite data reception capacity at the Sudan Meteorological Authority in Khartoum to introduce a monitoring system based exclusively on data available in Sudan.

Vegetation Status

Vegetation condition and development are assessed by means of the NDVI (Normalized Difference Vegetation Index) – this is a satellite derived parameter which responds (almost) uniquely to vegetation and is available on a global scale every ten days.

Across almost the whole of Sudan, the peak vegetation development has passed. One way to summarise the quality of the vegetation development throughout the season is by means of the seasonal maximum of the NDVI. Comparing the 2007 maximum NDVI with the average of the maxima for previous years, provides a simple but effective assessment of the quality of the 2007 season.

The result is shown in Fig 3. The overall conclusion is clearly evident – maximum NDVI levels in 2007 reached well above average values, in particular in a belt extending from Darfur across Kordofan and into the eastern regions from Sennar to Kassala.

These are semi arid areas of transition between the wetter regions of the South and the desert regions of the North and as such are typically subject to large variability in rainfall and vegetation from season to season. Here significant variations in rainfall have the greatest impact upon vegetation development.

In Southern Sudan, the situation is not so well marked – here vegetation levels are always high and it is difficult to get significant deviations from the average. However, note the much higher than average levels in the southeasternmost region of East Equatoria. Again this is a semi-arid region of transition between the wetter regions to its north and west and the desertic regions of northern Kenya and as such subject to high variability in rainfall and vegetation.

This vegetation response is clearly due to the to the widespread and consistently above average rainfall that has affected virtually the whole country throughout this season (with the exception of the last stages from mid September onwards). Note the correspondence between the map presented in Fig 2b (seasonal rainfall compared to average) and the one in Fig 3.

This confirms the picture of good all round conditions for crop and pasture development during 2007. On the negative side, there were significant (though difficult to quantify) impacts on crop production due to excessive rainfall, localised flooding and water logging. These are judged to have been more significant in Southern Sudan.

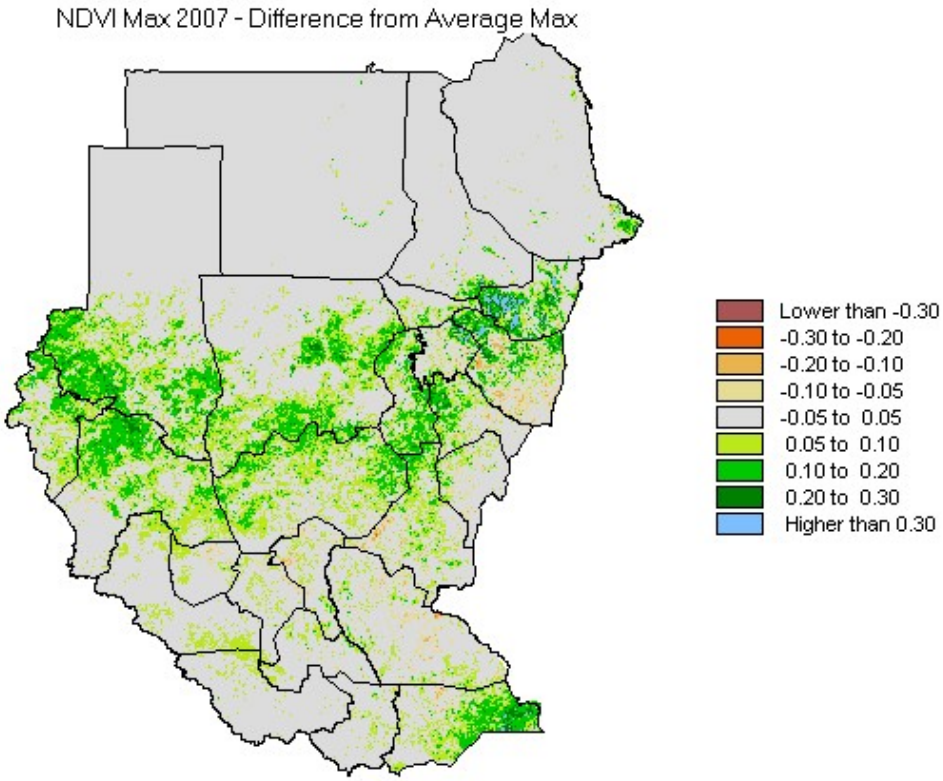


Fig 3 – Maximum NDVI in the 2007 season compared to the average seasonal maximum; Yellows and reds represent below average vegetation development, greens and blues represent above average vegetation development.

This illustrates the high levels reached by vegetation in the 2007 season as a consequence of the plentiful (ifnot excessive) rainfall across the country.

Regional Analysis

This section provides a more focused analysis, showing vegetation development profiles for specific land cover types, e.g. large agricultural fields, pasture areas.

Technical Note - NDVI Profiles :

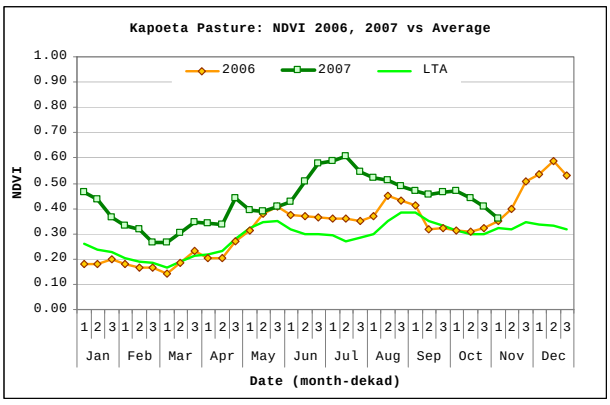
One problem with the analysis of NDVI profiles is that the NDVI alone cannot tell you what type of vegetation you are looking at. To overcome this problem you need land cover information. The plots presented in this section use a technique developed by the European Community's Joint Research Centre. This technique, C-NDVI (Crop-specific NDVI), integrates NDVI data with AFRICOVER, a comprehensive land cover data set for East Africa prepared by FAO.
In simple terms, NDVI values are extracted and averaged for specific land cover classes and subclasses, e.g. pasture (dry and wet), agriculture (clustered small fields, isolated small fields, large continuous fields, irrigated, etc). This allows users to analyse profiles which reflect the behaviour of the required type of land cover, while minimising interference from other land cover types.
The technique has recently been installed at the Sudan Meteorological Authority and is used in these Bulletins to provide region and agronomically specific information.

Southern Sudan

The indications provided by the satellite data about the 2007 agricultural season were confirmed in a definitive way by the Crop and Food Supply Assessment Mission for Southern Sudan which visited extensive areas of the territory during late October.

Pastoral Areas - East Equatoria and Upper Nile

a



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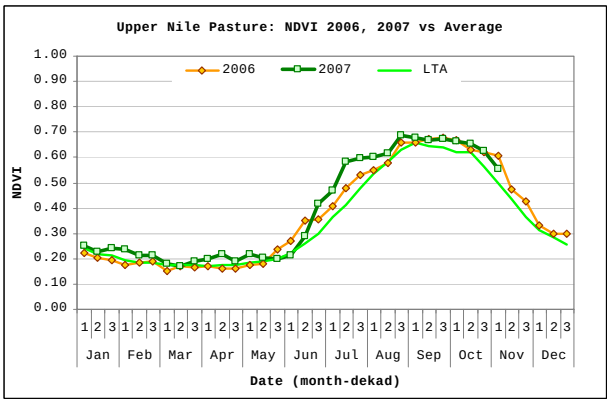


Fig 4 a, b – NDVI for 2007, 2006 and average (LTA) NDVI for pastoral areas in East Equatoria, Kapoeta locality (a) and Upper Nile (b). Note in (a) exceptional vegetation levels and persistence of higher than average vegetation throughout 2007. In (b) current season conditions more favourable than average and 2006

In the semi-arid lowlands of easternmost East Equatoria, current pasture conditions still remain above average though in drying trend (Fig 4a). The regions usually enjoys some Winter rainfall which should lift up vegetation levels again. It has nevertheless been a record year for pasture and water, key resources for livestock.

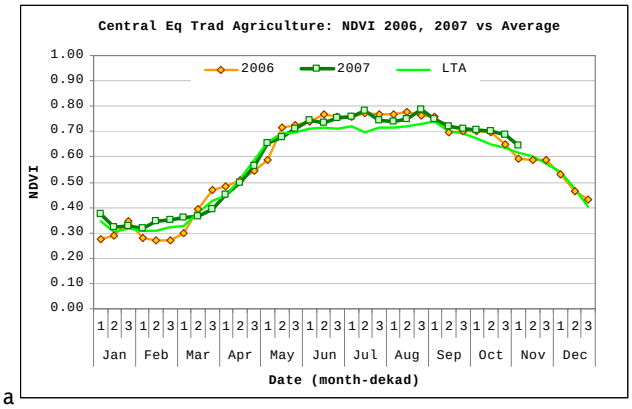
In Upper Nile (Fig 4b), pasture conditions in 2007 were also very favourable, though less exceptional. Greenness has been consistently above average, after a timely start of the season in mid June, indicating good pasture development at levels comparable or better than last season's.

The status of pasture for these two widely separated regions are representative of the pasture situation across most of Southern Sudan during the 2007 season.

Agricultural Areas - Central Equatoria and Warap.

In Central Equatoria, vegetation developed according to usual timings and its levels have been very close to average and similar to the 2006 season (Fig 5a). Rainfall has been good and well distributed and in accordance, 2007 turned out to be a good agricultural season coming after 2006 (itself a very good season).

The agricultural regions of central Warap state (largely growing sorghum and groundnut) have (like most of Southern Sudan) benefited from early or timely arrival of the rains. The satellite data revealed the earlier start of the season and steady above average vegetation development throughout the season (Fig 5b) and from the middle of the year made clear that 2007 would be a fine agricultural season for farmers in Warap, broadly similar to the very good (if not exceptional) 2006 season.



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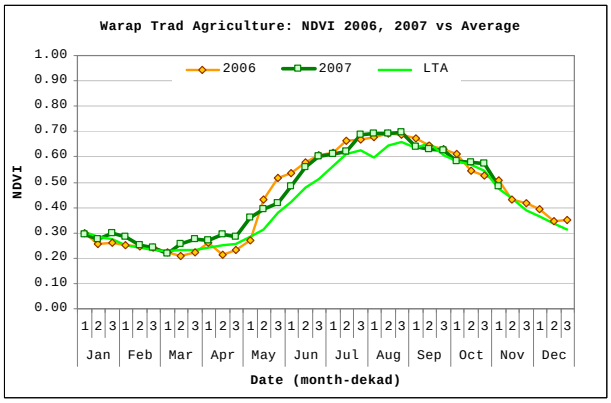

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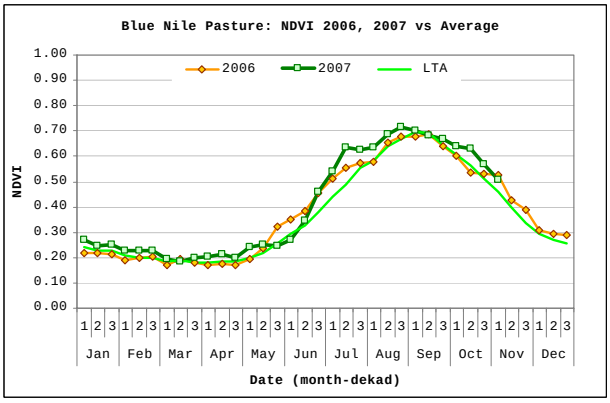
Fig 5 a, b – NDVI for 2007, 2006 and average (LTA) NDVI for agricultural regions in (a) central Warap state (NW of Warap town) and (b) agricultural regions in Central Equatoria state (region SW of Juba town)

Northern Sudan

Pastoral Areas - Blue Nile, Gedaref, North Kordofan, West Darfur



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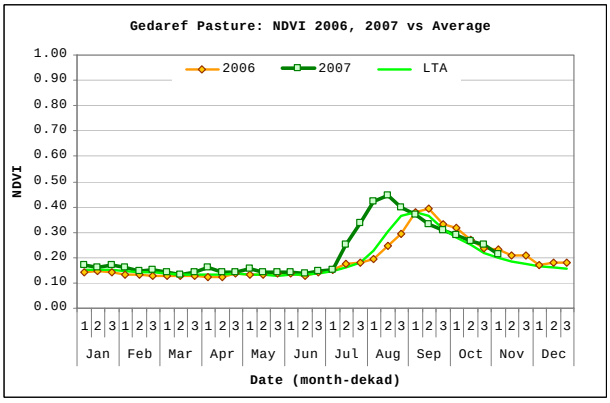

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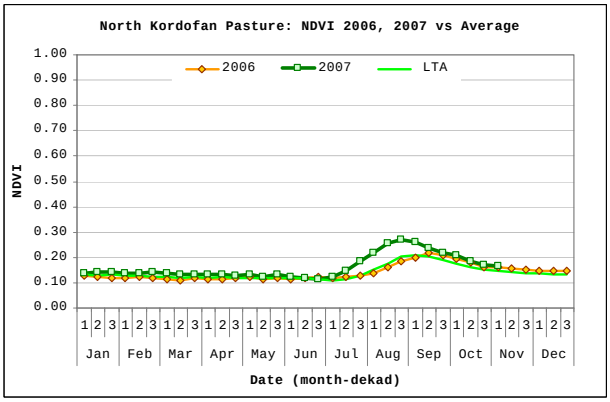

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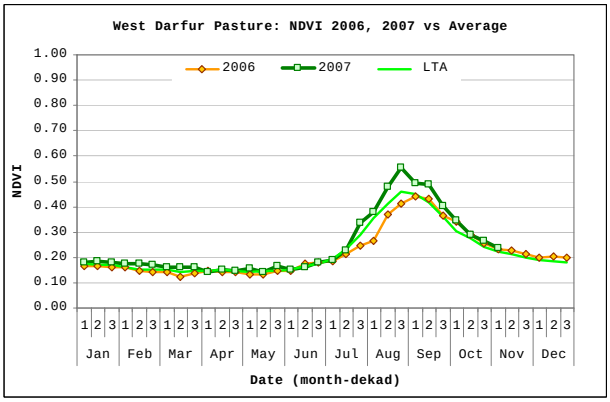

d

Fig 6 a, b, c, d – NDVI for 2007, 2006 and average (LTA) NDVI for pasture areas in (a) Blue Nile, (b) Gedaref, (c) North Kordofan and (d) West Darfur. Note earlier and stronger than average vegetation development across all regions, specially in the more arid ones.

During 2007, pasture areas across Northern Sudan displayed exceptional development, both ahead of time and at well above average levels, in particular in the more northern areas from West and North Darfur, Kordofan to Gedaref and Kassala (see Fig 6 for examples).

At this stage of the season, vegetation levels are back to or heading towards dry season conditions following the end of the rainfall.

The high seasonal peak of this season clearly indicates high green biomass production and fine pasture conditions. The high rainfall that lead to this, will also have resulted in enhanced water resources for livestock.

Mechanized Agriculture Areas

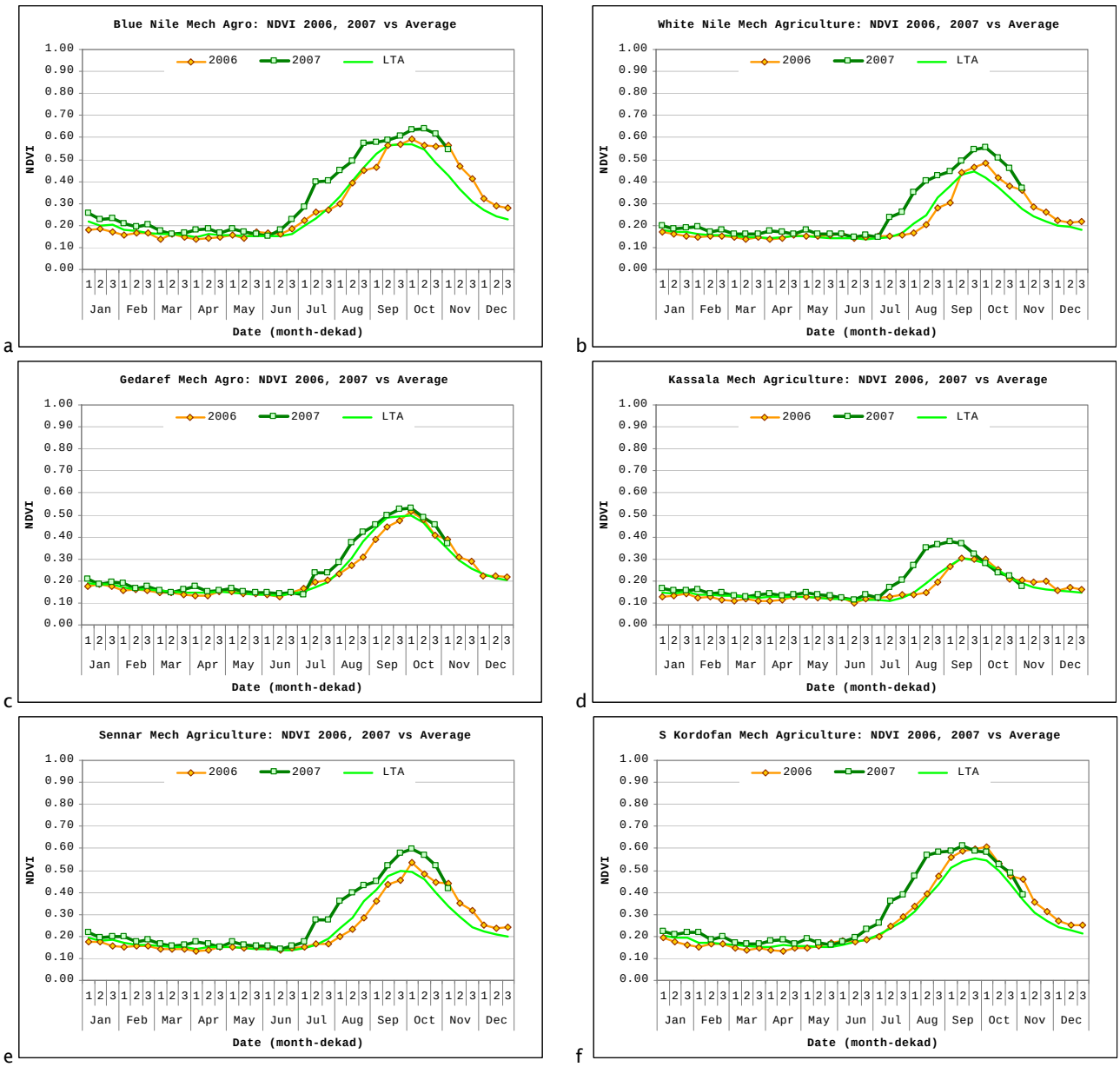

Fig 7 a, b, c, d – NDVI for 2007, 2006 and average (LTA) NDVI for all major mechanized agriculture regions of Sudan : (a) Blue Nile, (b) White Nile, (c) Gedaref, (d) Kassala, (e) Sennar and (f) South Kordofan. Note earlier and stronger than average vegetation development across all regions.

Mechanized farming areas across Sudan are displaying fairly similar patterns of vegetation development, since rainfall has been plentiful and above average across all of Northern Sudan. On all locations analysed, vegetation development took off around mid July in most cases in an unprecedented way to levels well above average and 2006.

The initial development is due to natural vegetation responding quickly to first rainfalls; land preparation and seeding took place slightly later (about 20 days). All data and derived indicators point as well as spot checks in the East of the country point in the same direction : crops have developed favourably across all mechanized agricultural regions with yields expected to be above average and similar if not higher than 2006 levels – see the curves in Figure 7 for all major mechanized regions. Kassala (and also White Nile) is expected to see the larger positive differences in yield, while in Gedaref yields should be closer to the average.

The factor yet to be quantified is how much area has been planted and will be harvested. Reliable figures will be available in early January 2008 when the results of the agricultural production surveys come in while preliminary figues from State authorities may be available somewhat sooner. Expectations are for a reduction in area planted/harvested which will contribute to balance out the better than average yields.

Traditional Agriculture Areas – Gezira, North Kordofan, North Darfur and South Darfur

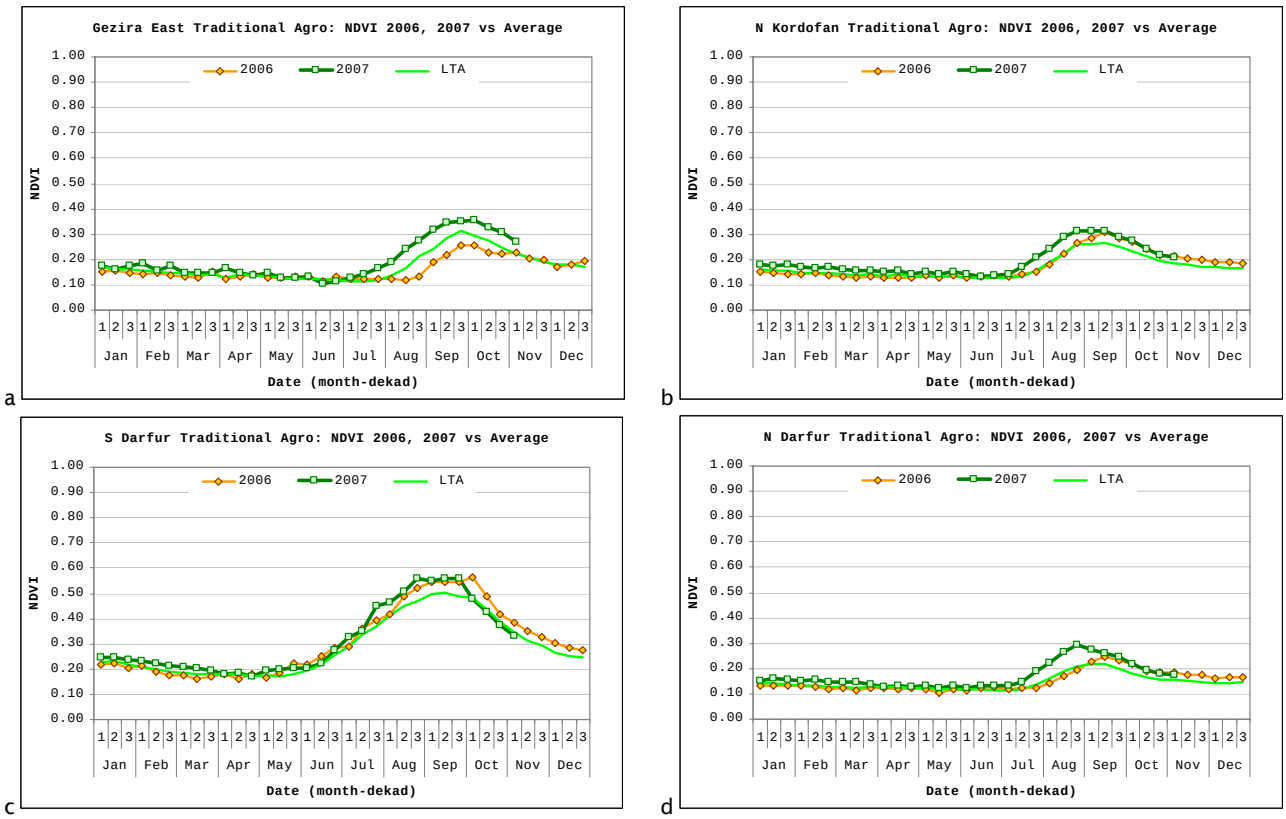

Fig 8 a, b, c, d – NDVI for 2007, 2006 and average (LTA) NDVI for traditional agricultural areas in (a) Gezira, (b) North Kordofan, (c) South Darfur and (d) North Darfur. Note earlier and stronger than average vegetation development across most regions.

This season, traditional agriculture across northern Sudan enjoyed exceptional conditions – Fig 8 shows that vegetation/crop development started early and reached levels well above average and in most cases above last season. This will translate into better than average production levels. This arises because the better than usual rainfall leads not only to increased yields but also to increases in area planted by traditional farmers (where land for expansion is available).

This increase was more marked in the more marginal areas, where there is more room for increases in production. It is expected that small farmer production this season reach levels close to the potential that can be achieved under predominant practices and level of inputs.

Irrigated Areas – Sennar and Kassala

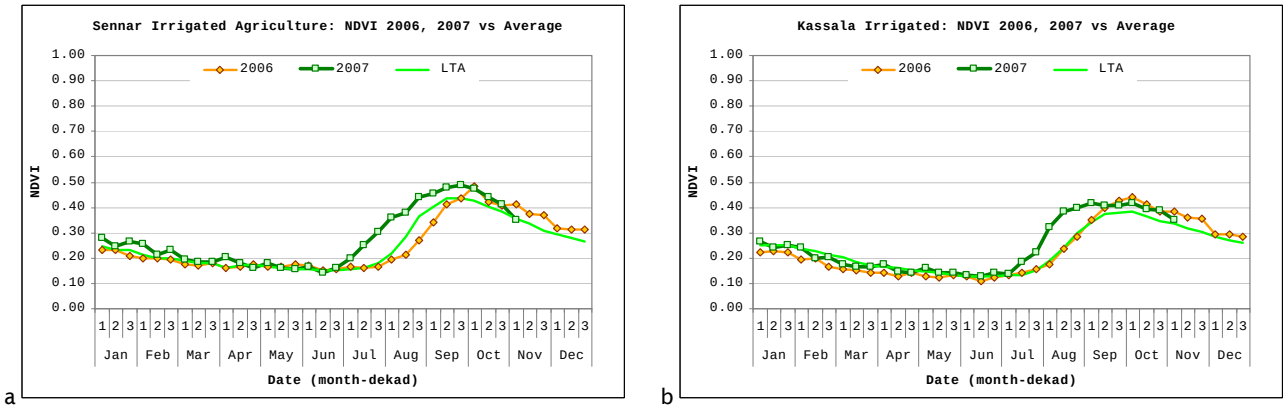

Fig 9 a, b – NDVI for 2007, 2006 and average (LTA) NDVI for irrigated areas in (a) Sennar and (b) Kassala. Note once again earlier than usual green-up and much higher than average values.

In the irrigated sector the panorama is again one of early starts and well above average vegetation levels. This is evident in the two examples presented in Fig 9 for Sennar and Kassala (Halfa el Jadida), but it is also the case across all irrigated perimeters of Sudan (Gezira, Suki, Rahad). High rainfall levels have minimised supplementary irrigation demands. So far expectations are for high yields and reduced irrigation costs.

Preliminary Indications for Agricultural Production

Southern Sudan

The 2007 Crop and Food Supply Assessment Mission for Southern Sudan has concluded its work in early November.

Most of the cereal harvest in Southern Sudan is concluded except for very late maturing sorghum varieties in Upper Nile, Lakes and East Equatoria which will be harvested in late December – early January, and for which suitable rainfall is still required.

Favourable rainfall amounts and distribution had been clearly identified in the rainfall and vegetation maps presented in this Bulletin throughout the season and the CFSAM confirmed its favourable consequences – increases in yield and area all across the region. On the other hand, there was considerable impact of flooding on production – indications are up to 56,000ha from 89,000 households across 6 states may have been affected. Other crops such as groundnut and cassava have also done very well.

Summary results indicate that cereal (mostly sorghum, some millet) production levels are similar to those of 2005, with 848,000ha producing 859,000MT – the estimated yield (1.01ton/ha) is the highest in the recent years but comes from a smaller area due to flooding. This leads to an aggregated deficit of 101,000MT for an estimated population which includes spontaneous and organized returnees. This excludes the crop production from the mechanized sector in northernmost Upper Nile (Er Renk area) estimated at 159,000 MT. Grain from this area which is now administratively part of Southern Sudan is by and large marketed in the North.

As far as livestock is concerned, a favourable situation is also reported. Pasture levels are good or very good as had been identified in this Bulletin, and ground spot checks by the Mission revealed a generalized improved livestock body condition.

Northern Sudan

Production estimates will be soon available from two major sources – State Ministries of Agriculture assessments and the Federal Agricultural Production Estimates Surveys (APES). The former have varying degrees of accuracy ranging from surveys based on proper sampling schemes and crop cutting (e.g. Gezira state rainfed agriculture), to cursory overviews and visual estimates. State MoA results are now being collected for presentation in the final issue of this Bulletin for 2007.

The Federal APES have started in mid November, with a first phase dedicated to the sampling frame preparation for the mechanized sector and to the estimation of the traditional sector production by means of either crop cutting or farmer interviews. A second phase will begin in mid December with the field work in the mechanized sector by means of crop cutting.

Preliminary results are expected in mid January and final results by the end of the same month. All field samples are being geo-located so as to undertake experimental analysis involving integration of field data with remote sensing information (NDVI and rainfall derived parameters).

Harvest in the more marginal traditional agriculture areas (Gezira, North Kordofan, Kassala) is close to ending. In the mechanized sector, harvests have just started and will extend well into January, given the wide spread of planting dates in this sector. Yields from the late planted crops are expected to be fairly poor.

The favourable rainfall regime this season will lead to yields mostly higher than average and higher than last year's across both traditional and mechanized sectors. To evaluate production levels, it is necessary to know how area planted/harvested will respond to good rainfall. The impacts are different for the traditional and the mechanized sector – in the traditional sector farmers tend to increase the planted area when rainfall is favourable, assuming there is land for expansion; higher production can be easily absorbed by the traditional household either to fully/better cover household needs and/or to generate extra income (by sale in local markets). In the mechanized sector, the price that the grain is likely to fetch is the main determinant.

Expectations are that area planted/harvested in the traditional sector will have increased specially so in the more marginal regions, while it will have reduced to varying degrees in the mechanized sector. All considered we expect increased production in the traditional sector relative to average and last year's and a stable or slight decreased production in the mechanized sector.