



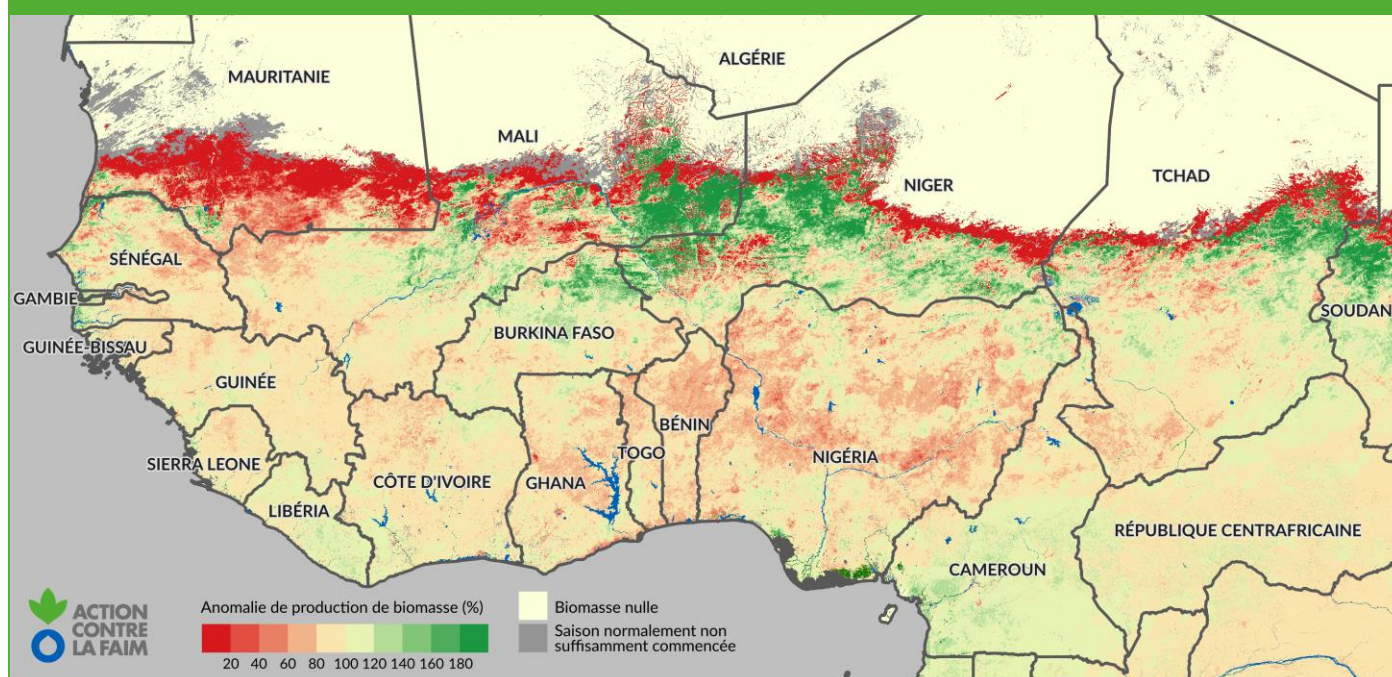
BIOMASS PRODUCTION AT RAINY MID-SEASON 2021

SAHEL REGIONAL BULLETIN

**CÉDRIC BERNARD
ERWANN FILLOL**

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MAP 1: ANOMALY OF BIOMASS PRODUCTION AT END OF AUGUST 2021



HIGHLIGHTS

- Contrasting rainy season in the Sahel with rainfall breaks in the west and normal to surplus in the central part
- Normal to surplus biomass production in Niger, Chad, Northern Burkina Faso and Eastern Mali
- Below normal biomass production over central and Western Mali, central Senegal
- Much lower than normal biomass production over the whole of Mauritania
- Much lower than normal biomass production in the coastal countries of Ghana, Togo, Benin and Nigeria
- Difficult economic context due to restrictions following the COVID pandemic¹⁹
- Security context strongly hampering herd mobility and access to pasture and water resources in the Central Sahel

INTRODUCTION

This publication provides an assessment of the quality of the vegetation growing season in the Sahelian zone of West Africa at the mid-wintering season in late August.

The year 2021 follows a positive wintering in all parts of the Sahelian zone, and the lean season was facilitated by abundant grazing stocks throughout the West African pastoral zone.

Biomass production in the Sahel for the 2021 season, measured at the end of August, is mixed, with a sharp contrast between the western part, which is in

marked decline, and the central part, which is generally positive.

The economic context in the region is made more difficult by the restrictions following the COVID-19 pandemic.

Security incidents, such as robberies, murders, threats to people, destruction of property, are reported in the tri-border region of Burkina Faso, Mali and Niger and are very heavily disrupting the activities of pastoralists by hindering transhumance movements and access to pastures.

DESCRIPTION OF THE SYSTEM

WHAT IS BIOMASS AND HOW IS IT MEASURED?

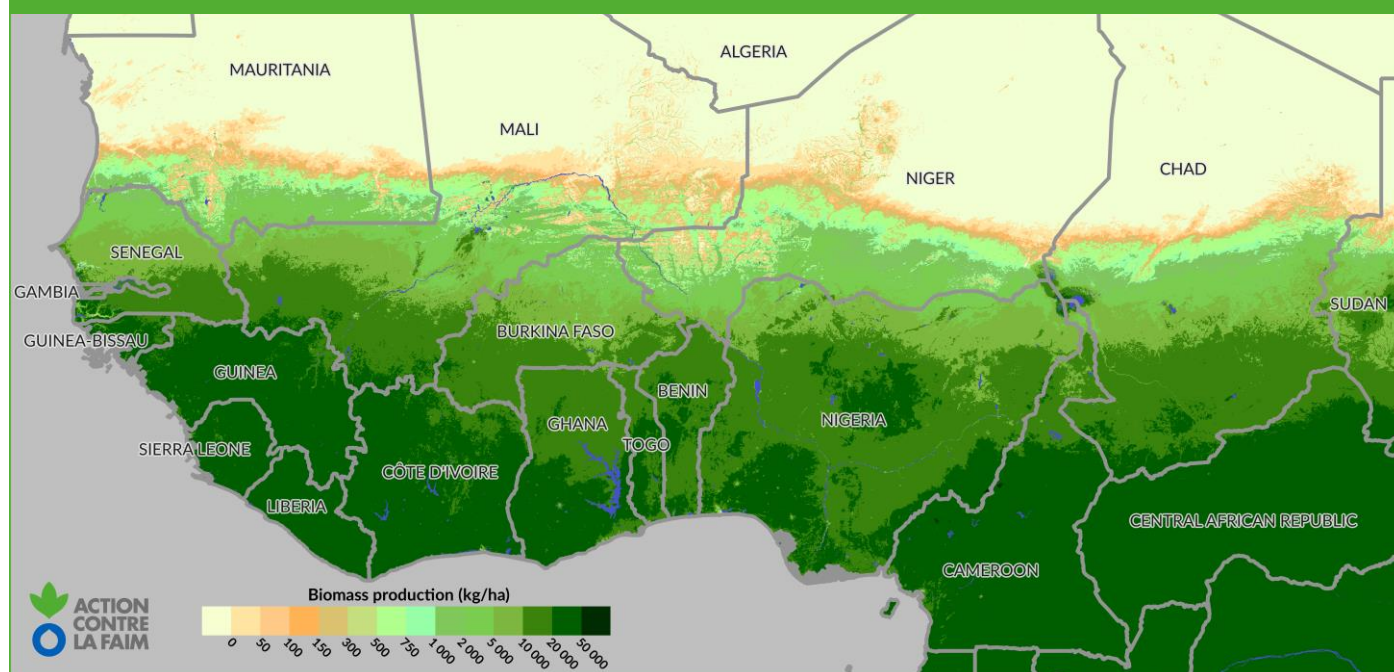
Biomass is the total production of vegetal matter measured in kilograms of dry matter MS per hectare kg/ha. The term dry matter is used to describe any form of vegetation above the ground regardless of its water/moisture content. For an analysis of the pastoral situation, biomass is an effective way to measure the availability of fodder resources.

Biomass production is calculated from satellite images collected by the European Space Agency's **SPOT-VEGETATION**, **PROBA-V** and **SENTINEL-3** satellites and provided, in form of 10-day products, by the European **COPERNICUS** programme through the Flemish Institute of Technology **VITO**.

The method for calculating daily biomass productivity (kg/ha/day) is based on an algorithm integrating biophysical parameters obtained from satellite images as well as climatic parameters of temperature and solar irradiance.

The **BioGenerator** tool developed by ACF integrates all these data to produce an annual biomass production map calculated over the growing season coinciding with the rainy season in the Sahel. The spatial resolution is 1 km, which corresponds to that of the satellite products used. The period covered is the one of the available satellite archives from 1999 to the present.

MAP 2: AVERAGE ANNUAL BIOMASS PRODUCTION 1999-2020



WHAT ARE THE INDICATORS GENERATED?

The first indicator is the annual biomass production calculated over the growing season:

- **Annual production in kg/ha**

The annual biomass production is compared to the average calculated over all the years since 1998 in order to highlight the anomaly which is represented in two ways:

- **Anomaly expressed as a percentage of the mean value %**
- **Normalised anomaly expressed as the number of standard deviations σ from the mean**

A vulnerability index linked to biomass availability, named « VI » (Vulnerability Index), is calculated recursively by weighting the most recent years in order to take into account the sequence of dry or rainy events:

- **Vulnerability Index VI**

The methods used and details of how BioGenerator works are available at: www.sigsahel.info/index.php/section/tele/

BIOMASS PRODUCTION AT MID-SEASON 2021

MAPPING THE BIOMASS PRODUCTION ANOMALY

Map 1 shows the biomass production anomaly, calculated at mid-growing season in the Sahel and expressed as a % of the average (sensitive to variation in the absolute quantity of biomass produced). Map 3 shows the same anomaly but expressed as a number of standard deviations σ from the average, and called a normalised anomaly (sensitive to the relative variation in the amount of biomass produced).

These maps show a production deficit in the western Sahelian zone, particularly in Senegal and Mauritania. The western and central parts of Mali also seem to be affected by a lower vegetation production this year, while the east of the country is in a surplus situation.

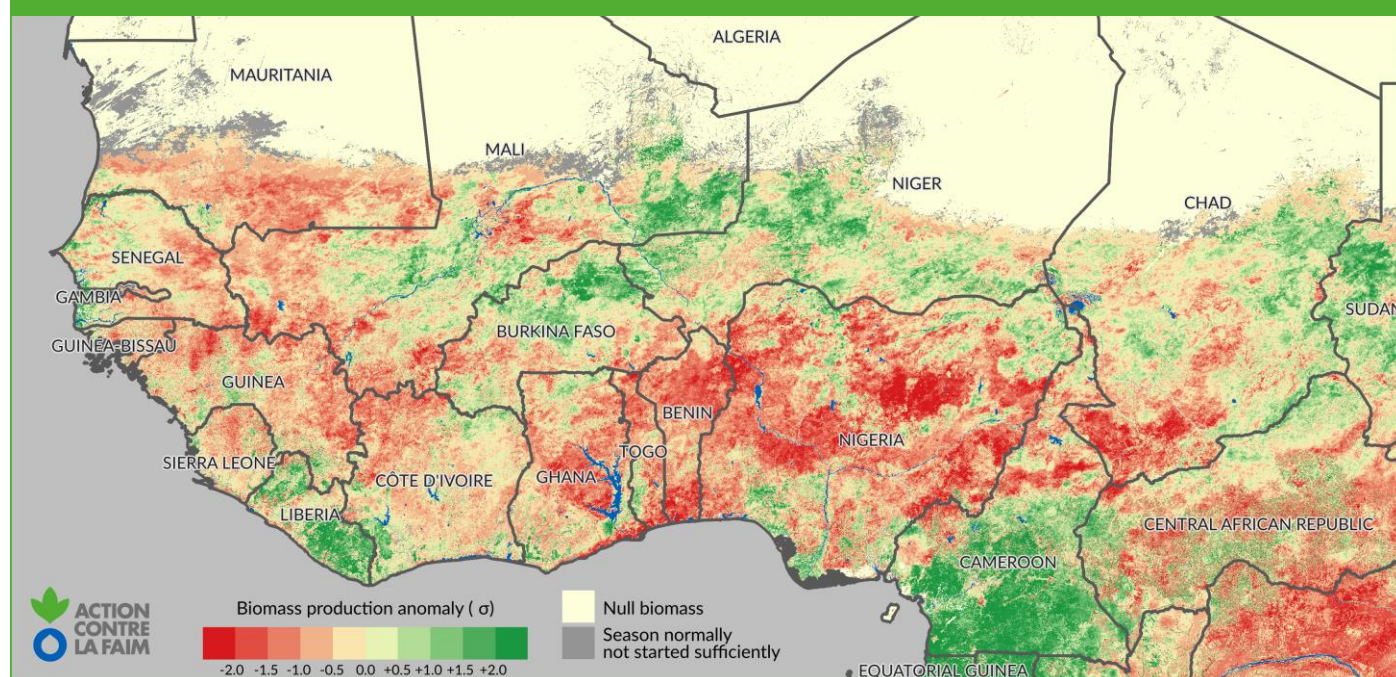
Burkina Faso seems to be split in two and shows a surplus of biomass production in the northern part, and a deficit in the south.

Niger is in a normal to positive biomass production situation.

Chad is in a normal to surplus production situation except for the south of the country, which is in deficit.

The coastal countries, although outside the scope of this monitoring bulletin, deserve attention. There is a very large deficit in biomass production throughout Nigeria, Benin, Togo and Ghana.

MAP 3: NORMALISED BIOMASS PRODUCTION ANOMALY AT END OF AUGUST 2021



THE 2021 GROWING SEASON

The figure on the following page shows the instantaneous biomass production profiles for a few regions (level 1 administrative division) selected as representative.

In Burkina Faso, the Eastern region shows a late start of the season, followed by a normal but delayed progression, while the Sahel region shows an early start and a clearly above-average progression.

In Mali, Gao region, production starts at the normal time and very strongly, while in the Timbuktu region production slows down sharply from early August.

In the Wilaya of Hodh El Gharbi in Mauritania, the start of the season is characterised by a late start but still within the normal range. It is the sudden halt in production after mid-August that strongly impacts the anomaly.

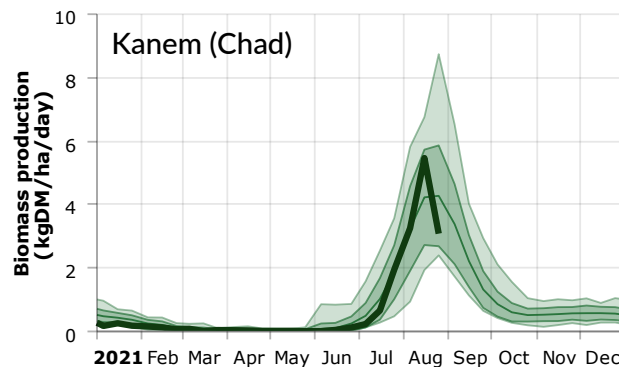
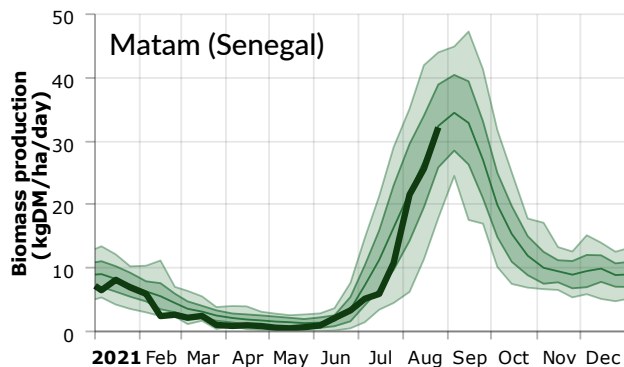
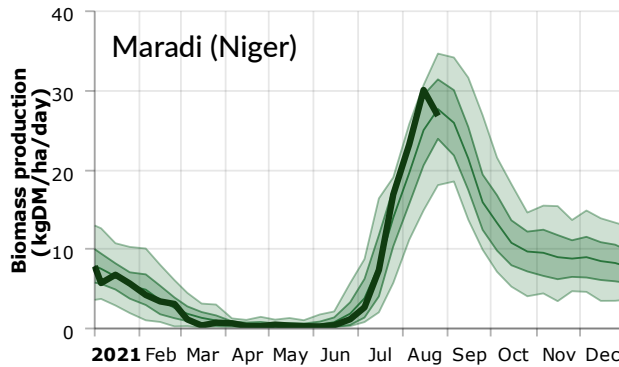
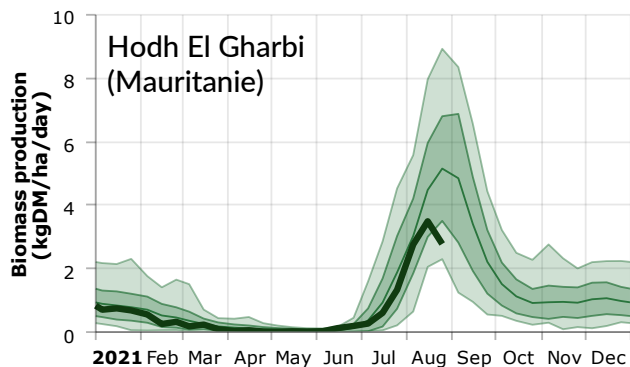
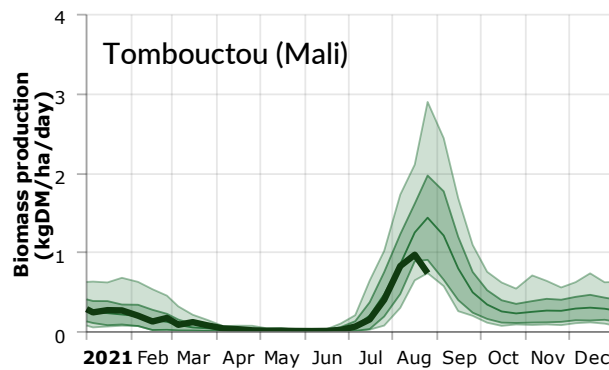
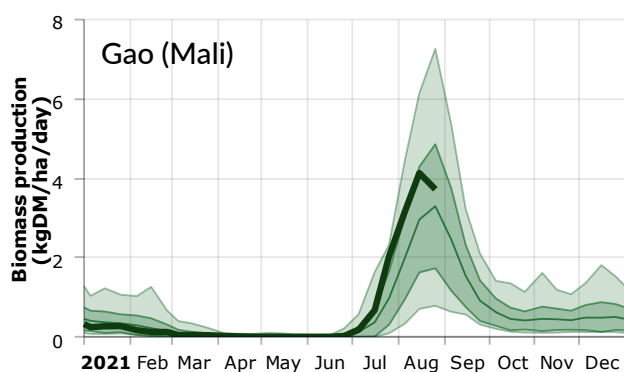
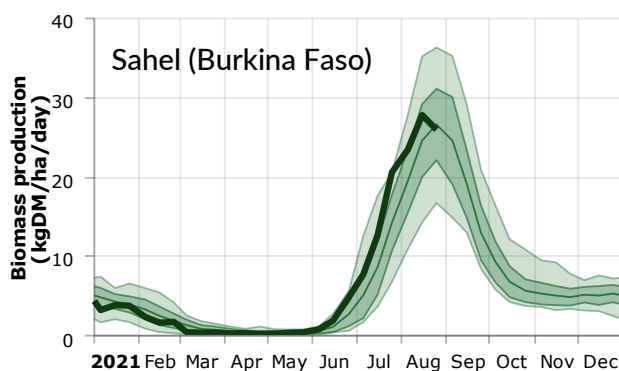
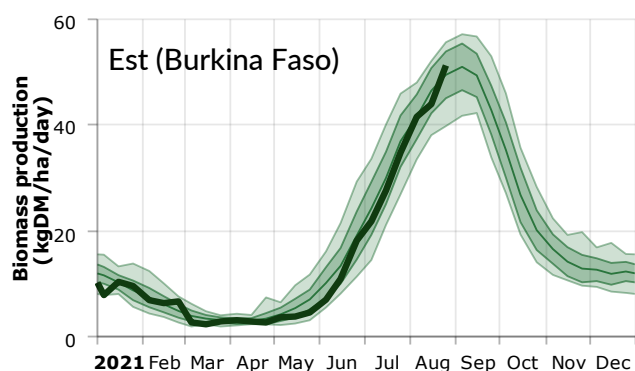
In the Maradi region, as in the rest of Niger, the season started on time and progressed rapidly, so that production was above average.

In the Matam region of Senegal, the season started on time and normally, but the rainfall break in July had a negative impact on production.

In the Kanem region of Chad, production, after a slight delay in the start of the season, seems to be

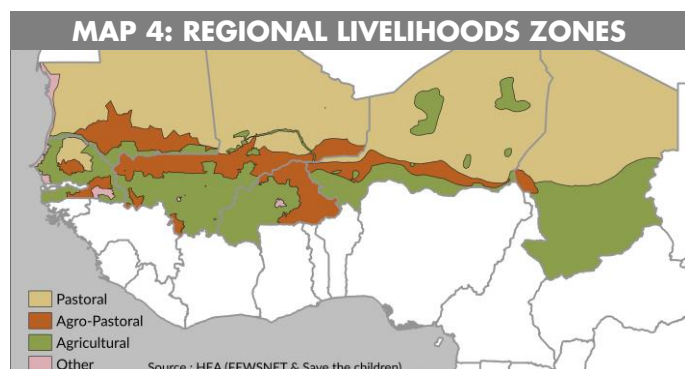
following a normal rhythm. A drop in production was observed during the last decade of August, and if it is confirmed, could have a negative impact on total annual production.

In all regions, the behaviour at the end of the rainy season will be decisive in determining total biomass production.



INTER-ANNUAL VARIATION IN BIOMASS PRODUCTION

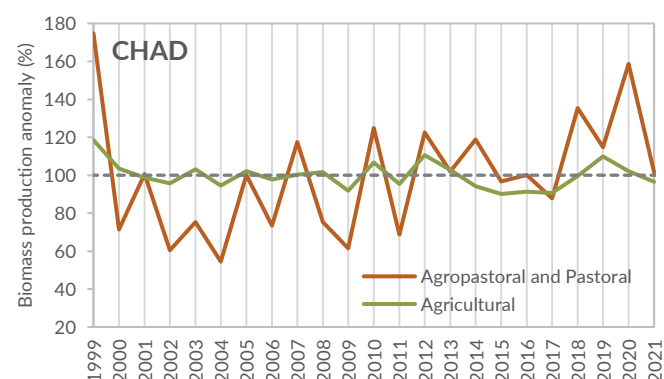
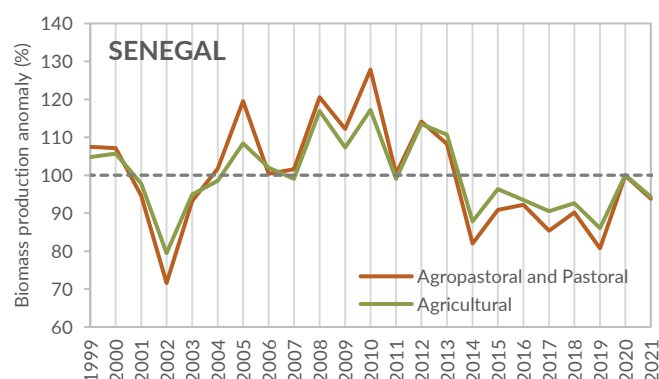
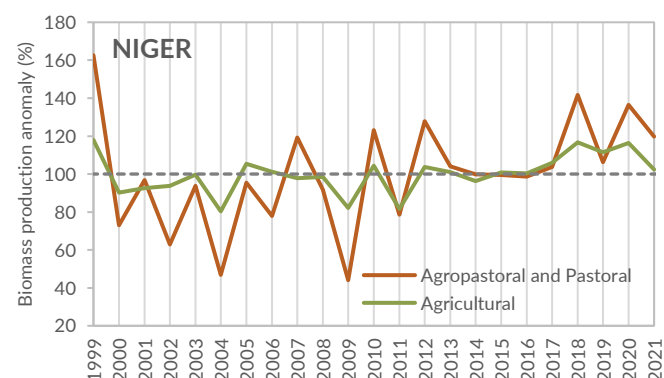
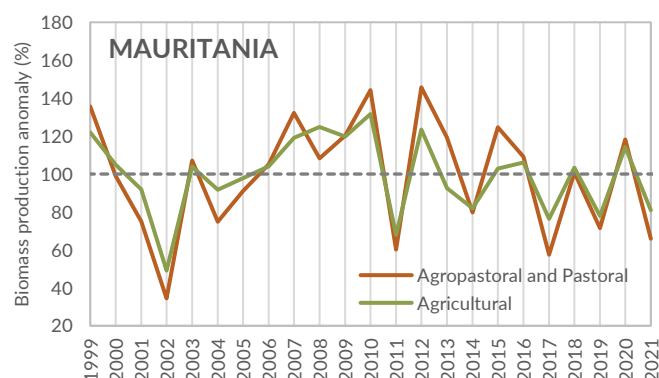
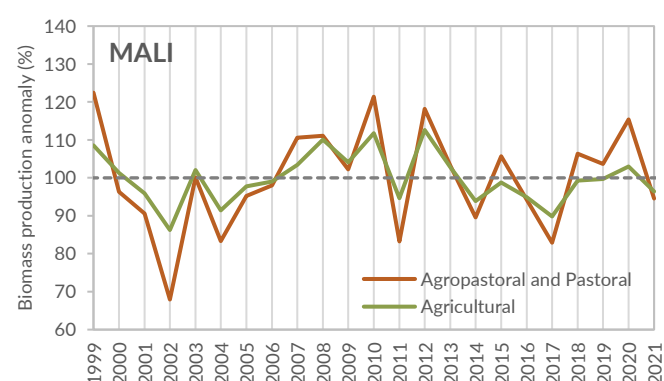
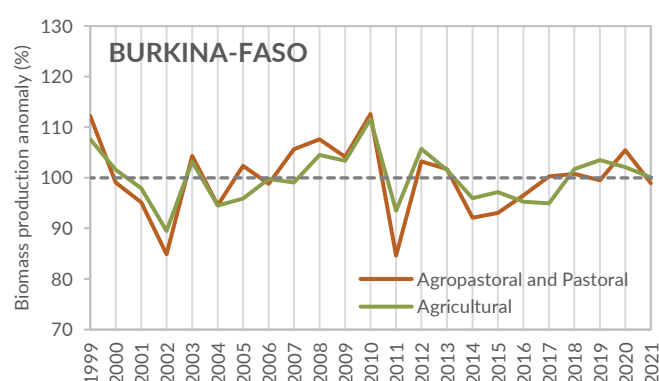
Based on the livelihood zone breakdown (Map 4), it is possible to observe inter-annual variations in biomass production according to land use: Agricultural, Pastoral and Agropastoral (source: Household Economy Analysis HEA / FEWSNET & Save the children).



For the elaboration of these comparisons the initial Agropastoral and Pastoral classes are combined in order to obtain statistic on the complete pastoral use area.

The graphs below show a year 2021 that is significantly lower than 2020, but remains close to normal values over the 1999-2021 period, with the exception of Niger and Mauritania.

Indeed, Niger shows higher than normal values in pastoral and agro-pastoral areas, although below the previous year. And, Mauritania shows well below average values comparable to the 2017 and 2019 drought years.

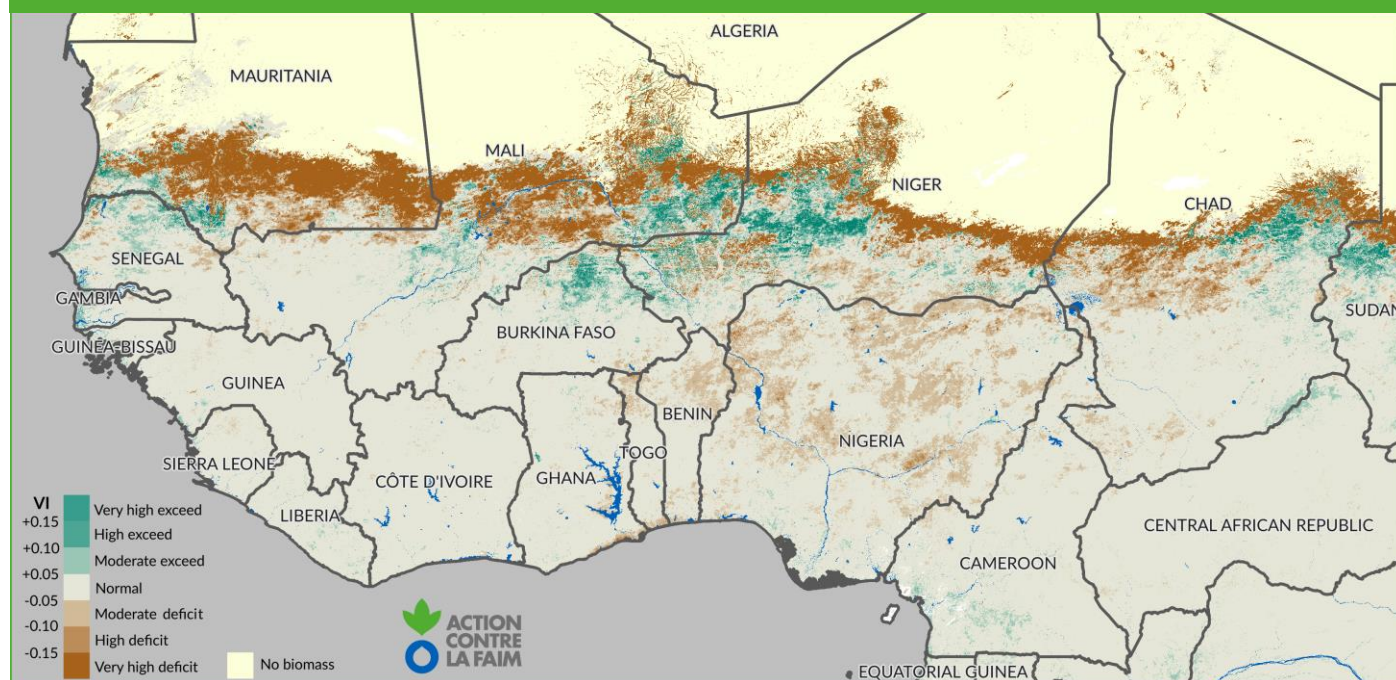


COMPARISON OF 2021 WITH RECENT YEARS

The vulnerability index VI linked to biomass, represented by Map 5, is sensitive to the variations in production recorded over the last few years and highlights the areas with successive biomass deficits.

The VI index calculated at the end of August 2021 shows negative values for most of the Sahel, in particular Mauritania and the central part of Mali. The main reason for this is the sharp decline in the year 2021 compared to the previous year 2020, when biomass production was above normal everywhere.

MAP 5: BIOMASS VULNERABILITY INDEX END OF AUGUST 2021



The following table shows the anomalies in biomass production, expressed as the number of standard deviations σ from the average and as a % of the average, for the six countries monitored and according to the administrative level 1 division (regions or wilayas).

This table shows anomalies for 2021 that are globally close to the average and with normal to slightly negative vulnerability index VI.

However, some regions are exceptions, in particular:

- The Timbuktu region in Mali shows a negative VI due to the clear deterioration in 2021 compared to previous years.
- Almost all Wilayas in Mauritania show a negative VI due to the progressive deterioration of biomass production in recent years, with the exception of 2020.

Country	Region/Wilaya	Superficie (km ²)	Anomaly 2017	Anomaly 2018	Anomaly 2019	Anomaly 2020	Anomaly 2021	VI 2021
Burkina Faso	Boucle du Mouhoun	33614	-0.4 σ (097%)	+0.7 σ (105%)	+0.2 σ (102%)	+0.3 σ (102%)	+0.1 σ (101%)	+0.00
	Cascades	18054	-1.5 σ (093%)	-0.3 σ (099%)	+1.8 σ (108%)	+1.0 σ (104%)	+0.5 σ (102%)	+0.01
	Centre	2773	-0.2 σ (098%)	+0.5 σ (104%)	+0.1 σ (101%)	+0.3 σ (103%)	+1.9 σ (117%)	+0.04
	Centre-Est	14234	+0.4 σ (103%)	+0.5 σ (103%)	+1.6 σ (110%)	+0.4 σ (103%)	-0.4 σ (097%)	-0.01
	Centre-Nord	19180	-0.1 σ (099%)	+0.1 σ (101%)	-1.0 σ (089%)	+0.8 σ (108%)	+1.3 σ (114%)	+0.05
	Centre-Ouest	21433	-1.5 σ (091%)	+0.2 σ (101%)	+0.3 σ (102%)	-0.8 σ (095%)	-0.3 σ (098%)	+0.00
	Centre-Sud	11742	-0.5 σ (097%)	+0.9 σ (105%)	+0.8 σ (105%)	+0.4 σ (102%)	+0.4 σ (102%)	+0.00
	Est	46592	+0.2 σ (101%)	-0.5 σ (097%)	-0.5 σ (096%)	+0.1 σ (101%)	-0.9 σ (093%)	-0.01
	Hauts-Bassins	25729	-1.1 σ (094%)	+0.3 σ (102%)	+1.1 σ (106%)	+0.6 σ (103%)	-1.3 σ (093%)	-0.02
	Nord	16421	-0.3 σ (096%)	+0.8 σ (108%)	-0.0 σ (100%)	+0.5 σ (106%)	+0.5 σ (105%)	+0.01
	Plateau Central	8977	-0.1 σ (099%)	+0.1 σ (101%)	-0.3 σ (097%)	-0.0 σ (100%)	+1.2 σ (110%)	+0.02
	Sahel	36088	-0.1 σ (098%)	+0.5 σ (108%)	-0.2 σ (097%)	+1.5 σ (124%)	+1.1 σ (118%)	+0.04
	Sud-Ouest	16327	-1.0 σ (095%)	-0.1 σ (099%)	+1.5 σ (108%)	+0.7 σ (103%)	-0.3 σ (098%)	-0.00
	Entire country	272386	-0.6 σ (097%)	+0.3 σ (102%)	+0.4 σ (102%)	+0.6 σ (103%)	-0.0 σ (100%)	+0.01

Country	Region/Wilaya	Superficie (km ²)	Anomaly 2017	Anomaly 2018	Anomaly 2019	Anomaly 2020	Anomaly 2021	VI 2021
Mali	Bamako	200	-2.1σ (068%)	-1.5σ (077%)	-1.5σ (077%)	-1.1σ (083%)	-1.2σ (082%)	+0.02
	Gao	176422	-0.0σ (099%)	+1.8σ (183%)	+1.3σ (159%)	+1.3σ (161%)	+0.7σ (134%)	-0.10
	Kayes	121931	-1.6σ (084%)	-0.4σ (096%)	-0.7σ (093%)	-0.0σ (100%)	-1.0σ (090%)	-0.01
	Kidal	149277	+0.1σ (115%)	+1.2σ (228%)	+1.5σ (263%)	+3.7σ (507%)	+0.2σ (121%)	-0.13
	Koulikoro	89917	-1.4σ (087%)	-0.0σ (100%)	-0.1σ (099%)	+0.6σ (105%)	-0.3σ (097%)	-0.00
	Mopti	79584	-0.8σ (086%)	+0.1σ (102%)	+0.5σ (108%)	+1.6σ (126%)	+0.3σ (105%)	-0.01
	Segou	61972	-0.8σ (091%)	+0.6σ (107%)	+0.2σ (103%)	+1.1σ (113%)	+0.4σ (105%)	+0.01
	Sikasso	71877	-1.6σ (093%)	-0.2σ (099%)	+0.3σ (101%)	-0.0σ (100%)	-1.2σ (094%)	-0.01
	Tombouctou	498882	-0.6σ (077%)	+1.3σ (148%)	+1.6σ (159%)	+1.6σ (159%)	-0.4σ (085%)	-0.17
Mauritania	Entire country	1257151	-1.4σ (088%)	+0.2σ (101%)	+0.1σ (101%)	+0.8σ (107%)	-0.5σ (096%)	-0.06
	Adrar	220687	-0.4σ (038%)	+0.3σ (146%)	-0.1σ (090%)	-0.5σ (020%)	-0.0σ (096%)	-0.02
	Assaba	35239	-1.1σ (071%)	-0.7σ (082%)	-1.3σ (066%)	+0.6σ (115%)	-1.4σ (066%)	-0.15
	Brakna	32734	-1.1σ (046%)	-1.0σ (050%)	-1.1σ (046%)	+0.2σ (111%)	-0.6σ (068%)	-0.17
	Dakhlet-Nouadhibou	37920	-0.3σ (004%)	-0.3σ (004%)	-0.3σ (015%)	-0.3σ (004%)	-0.0σ (099%)	-0.04
	Gorgol	13812	-1.0σ (067%)	-0.7σ (079%)	-1.4σ (056%)	+0.1σ (103%)	-0.1σ (095%)	+0.02
	Guidimakha	10914	-0.8σ (083%)	-0.2σ (097%)	-1.4σ (073%)	+0.5σ (109%)	-0.9σ (082%)	-0.00
	Hodh Ech Chargi	182159	-1.0σ (064%)	+1.5σ (151%)	+0.1σ (102%)	+0.8σ (128%)	-0.6σ (079%)	-0.23
	Hodh El Gharbi	50287	-1.2σ (069%)	-0.3σ (091%)	-1.3σ (066%)	+0.5σ (112%)	-1.6σ (058%)	-0.20
	Inchiri	31504	-0.4σ (000%)	-0.4σ (008%)	-0.1σ (074%)	-0.4σ (011%)	+0.0σ (100%)	-0.05
	Nouakchott	1137	-0.5σ (029%)	-0.4σ (037%)	-0.5σ (027%)	-0.5σ (030%)	-0.0σ (095%)	+0.00
	Tagant	99789	-0.8σ (038%)	-0.6σ (056%)	-0.8σ (035%)	+0.5σ (138%)	-0.7σ (045%)	-0.25
	Tiris-Zemmour	258552	-0.3σ (001%)	-0.2σ (018%)	-0.3σ (000%)	-0.3σ (000%)	-0.0σ (099%)	-0.21
	Trarza	66032	-1.6σ (045%)	-0.5σ (083%)	-0.8σ (070%)	+0.7σ (124%)	-0.1σ (097%)	-0.07
	Entire country	1040397	-1.4σ (066%)	+0.1σ (102%)	-1.0σ (075%)	+0.7σ (117%)	-1.1σ (073%)	-0.16
Niger	Agadez	622088	-0.2σ (090%)	+1.5σ (196%)	+1.7σ (204%)	+1.9σ (219%)	+0.8σ (151%)	-0.19
	Diffa	145423	+0.0σ (101%)	+1.7σ (137%)	+0.4σ (108%)	+1.7σ (138%)	+0.5σ (110%)	-0.15
	Dosso	30935	-0.7σ (094%)	+0.9σ (108%)	+1.5σ (114%)	+1.6σ (114%)	-0.2σ (098%)	-0.01
	Maradi	38874	+0.9σ (115%)	+1.7σ (129%)	+0.8σ (114%)	+0.7σ (112%)	+0.3σ (105%)	-0.02
	Niamey	506	+0.3σ (105%)	-0.5σ (092%)	-1.8σ (071%)	-0.4σ (094%)	-0.9σ (085%)	-0.02
	Tahoua	107482	-0.3σ (093%)	+0.7σ (119%)	+0.5σ (113%)	+1.4σ (138%)	+0.7σ (119%)	-0.00
	Tillabéri	91413	+0.8σ (110%)	+0.6σ (108%)	-0.4σ (095%)	+1.1σ (114%)	+0.5σ (106%)	-0.01
	Zinder	146807	+0.5σ (111%)	+2.0σ (145%)	+0.4σ (110%)	+1.1σ (126%)	+0.4σ (110%)	-0.09
	Entire country	1187491	+0.3σ (105%)	+1.6σ (125%)	+0.6σ (110%)	+1.4σ (123%)	+0.5σ (108%)	-0.07
Senegal	Dakar	606	-1.2σ (080%)	-2.1σ (065%)	-1.4σ (076%)	-0.2σ (096%)	-0.4σ (093%)	+0.03
	Diourbel	4586	+0.4σ (105%)	-0.2σ (098%)	-0.9σ (086%)	+0.4σ (106%)	-0.1σ (098%)	+0.00
	Fatick	7080	-0.9σ (091%)	-0.8σ (092%)	-1.8σ (081%)	+0.5σ (105%)	+0.1σ (101%)	+0.02
	Kaffrine	10878	-0.8σ (089%)	-0.9σ (087%)	-1.6σ (077%)	-0.1σ (098%)	-0.1σ (099%)	+0.03
	Kaolack	5541	-0.4σ (096%)	-0.4σ (096%)	-1.8σ (081%)	+0.4σ (104%)	-0.3σ (097%)	+0.01
	Kedougou	16821	-1.4σ (089%)	-1.0σ (092%)	-0.7σ (095%)	-0.3σ (098%)	-1.0σ (092%)	-0.00
	Kolda	13778	-1.4σ (088%)	-0.7σ (094%)	-1.4σ (088%)	-0.4σ (096%)	-1.1σ (090%)	-0.00
	Louga	25653	-0.6σ (089%)	-0.6σ (089%)	-0.6σ (089%)	+0.9σ (116%)	-0.1σ (099%)	+0.01
	Matam	28560	-1.0σ (079%)	-0.8σ (084%)	-1.6σ (067%)	-0.3σ (094%)	-0.6σ (088%)	+0.02
	Saint Louis	19615	-1.2σ (070%)	-0.2σ (096%)	-0.9σ (077%)	+1.0σ (124%)	+0.4σ (111%)	+0.04
	Sedhiou	7398	-1.1σ (093%)	-0.5σ (096%)	-1.6σ (089%)	-0.5σ (097%)	-0.6σ (096%)	+0.00
	Tambacounda	43144	-0.8σ (090%)	-0.7σ (091%)	-1.3σ (084%)	-0.2σ (097%)	-0.8σ (090%)	-0.00
	Thies	6924	+0.5σ (106%)	-0.9σ (089%)	-0.7σ (092%)	+1.2σ (115%)	+0.5σ (106%)	+0.01
	Ziguinchor	7592	-1.2σ (092%)	-0.7σ (096%)	-1.6σ (090%)	-0.1σ (100%)	+1.4σ (109%)	+0.04
	Entire country	198320	-1.0σ (089%)	-0.8σ (092%)	-1.4σ (085%)	+0.0σ (100%)	-0.5σ (095%)	+0.01
Chad	Barh-El-Gazel	49876	-0.1σ (097%)	+1.5σ (145%)	+0.3σ (109%)	+1.4σ (143%)	-0.4σ (089%)	-0.13
	Batha	90543	-0.4σ (090%)	+0.8σ (119%)	+0.8σ (119%)	+1.6σ (137%)	-0.1σ (097%)	-0.05
	Borkou	149318	+0.0σ (104%)	+0.2σ (122%)	+0.2σ (124%)	+2.1σ (305%)	+0.0σ (104%)	-0.25
	Chari-Baguirmi	46298	-0.6σ (094%)	+0.2σ (102%)	+1.7σ (117%)	+0.7σ (107%)	-0.0σ (100%)	-0.01
	Ennedi Ouest	123959	-0.5σ (052%)	+0.5σ (144%)	+0.7σ (160%)	+1.1σ (205%)	+0.4σ (134%)	-0.20
	Ennedi-Est	83306	-0.7σ (036%)	+1.4σ (226%)	+1.3σ (219%)	+2.1σ (295%)	+0.4σ (137%)	-0.27
	Guera	60921	-1.3σ (089%)	+0.1σ (101%)	+1.0σ (109%)	+0.1σ (101%)	-0.5σ (096%)	-0.01
	Hadjer-Lamis	29085	-0.4σ (094%)	+1.6σ (124%)	+0.9σ (113%)	+1.7σ (125%)	+0.2σ (103%)	-0.02
	Kanem	72851	-0.2σ (095%)	+1.8σ (156%)	+0.1σ (102%)	+1.9σ (158%)	-0.1σ (098%)	-0.16
	Lac	21746	-0.1σ (099%)	+1.6σ (118%)	+1.0σ (111%)	+2.0σ (122%)	+0.0σ (100%)	-0.04
	Logone Occidental	8640	-0.6σ (096%)	-1.0σ (094%)	+0.8σ (105%)	-1.5σ (090%)	-2.3σ (085%)	-0.03
	Logone Oriental	23840	-0.5σ (098%)	-1.3σ (094%)	+1.4σ (106%)	-0.6σ (097%)	-2.0σ (091%)	-0.02
	Mandoul	17388	-0.5σ (098%)	-1.2σ (094%)	+0.7σ (104%)	-0.6σ (097%)	-2.0σ (090%)	-0.02
	Mayo Kebbi Est	18395	-1.1σ (091%)	-0.9σ (093%)	+1.4σ (111%)	-1.1σ (091%)	-1.2σ (091%)	-0.02
	Mayo-Kebbi Ouest	12551	-0.9σ (094%)	-0.5σ (097%)	+1.5σ (110%)	-1.8σ (088%)	-1.9σ (087%)	-0.03
	Moyen-Chari	40810	-1.3σ (093%)	-0.8σ (096%)	+1.2σ (106%)	-0.6σ (097%)	-0.9σ (095%)	-0.01
	N'Djamena	471	-0.9σ (087%)	+0.2σ (103%)	+0.8σ (112%)	+0.6σ (109%)	-0.8σ (088%)	-0.03
	Ouaddai	29689	-1.0σ (083%)	+0.6σ (110%)	+1.1σ (118%)	+1.3σ (122%)	+0.4σ (106%)	+0.01
	Salamat	68151	-1.8σ (084%)	-0.7σ (094%)	+0.7σ (106%)	-0.3σ (097%)	-0.0σ (100%)	+0.01
	Sila	36285	-1.7σ (082%)	+0.1σ (101%)	+1.7σ (119%)	+0.6σ (106%)	+0.6σ (106%)	+0.02
	Tandjile	17850	-1.1σ (093%)	-0.9σ (094%)	+1.0σ (106%)	-1.2σ (092%)	-1.5σ (090%)	-0.02
	Tibesti	210958	-0.2σ (070%)	+0.2σ (130%)	+4.4σ (649%)	-0.2σ (077%)	-0.1σ (094%)	-0.18
	Wadi Fira	52068	-1.0σ (064%)	+0.7σ (127%)	+0.6σ (121%)	+1.6σ (160%)	+0.6σ (122%)	+0.04
	Entire country	1272128	-1.3σ (090%)	+0.1σ (101%)	+1.3σ (110%)	+0.6σ (104%)	-0.4σ (097%)	-0.05

RAINFALL CONTEXT

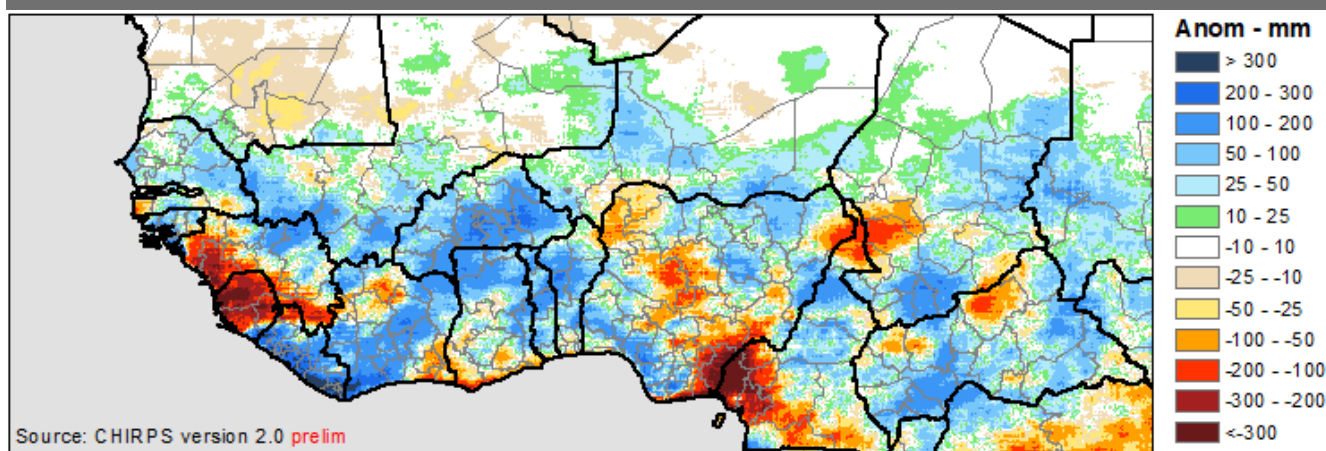
Although water availability is the limiting parameter for vegetation growth in the Sahel, it is the distribution of rainfall over time that is crucial and will determine the annual production of biomass. The annual accumulation cannot alone explain the anomaly in biomass production.

Map 6 shows the cumulative rainfall derived from satellite imagery over the 2021 rainy season (May to September) given by the United States Geological Survey USGS. This map shows a positive situation

over the whole Sahel except for the central part of Mali and Mauritania which are slightly below normal cumulative rainfall.

Map 7 shows the rainfall forecast for October 2021 by the National Oceanic and Atmospheric Administration's Climate Prediction Center CPC. This map shows a slightly negative anomaly at the end of the 2021 rainy season and is therefore expected to be slightly early over the whole Sahel area.

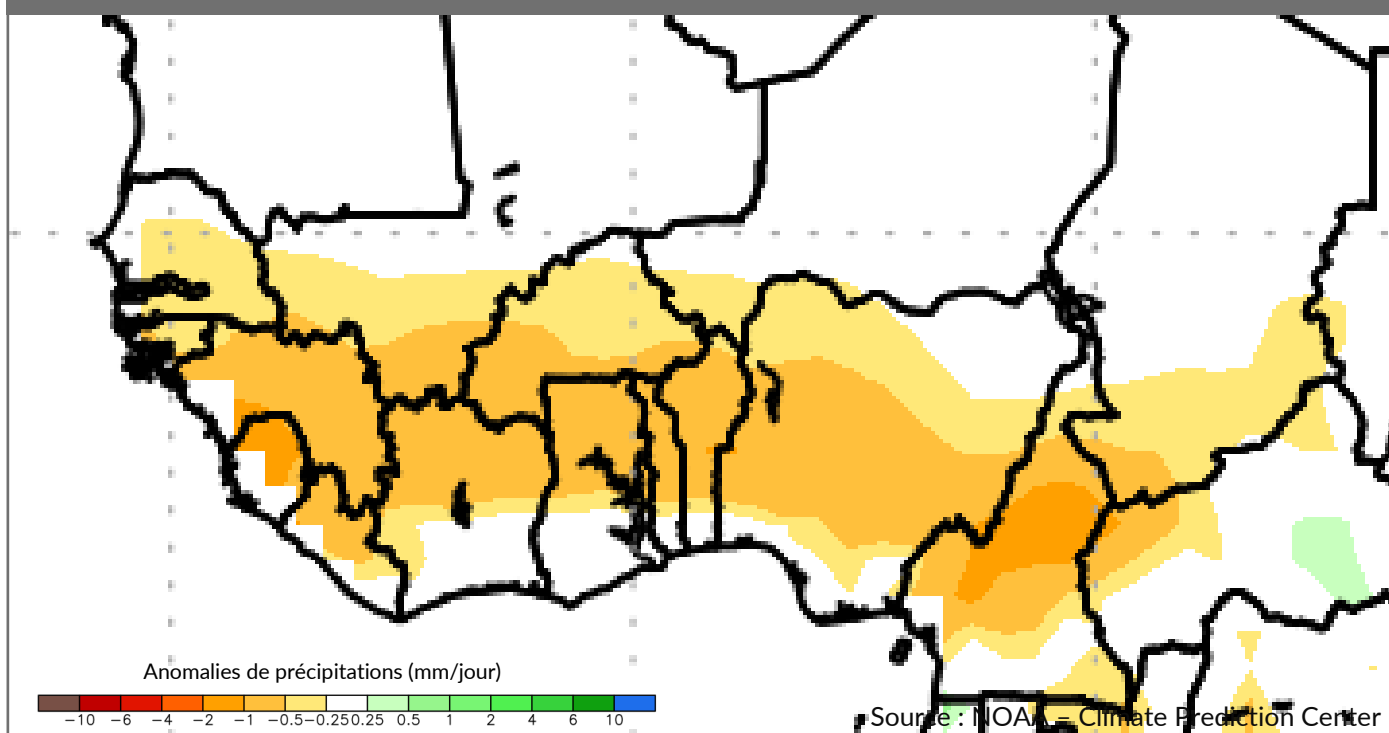
MAP 6: RAINFALL ANOMALIES MAY-SEPTEMBER 2021 (USGS)



Map produced by USGS/EROS



MAP 7: RAINFALL FORECAST FOR OCTOBER 2021 (NOAA-CPC)



CONCLUSION

WINTERING SEASON 2021

At mid-season, the 2021 season appears to be mixed in the Sahelian strip of West Africa, with a significant contrast between the eastern part of Mali up to Chad in a neutral to positive situation, and the western part from Mauritania to the central part of Mali in a negative situation.

Niger, the northern part of Burkina Faso and the eastern part of Mali are in a positive situation, with the growing season proceeding well and recording above-normal biomass production values. Nevertheless, production is down compared to past positive years, and in particular 2020 which was particularly above normal.

The central and western parts of Mali, the central part of Senegal, and especially Mauritania as a whole are experiencing unfavourable biomass production in the first half of the growing season. The course of

the end of the rainy season will be decisive in determining the exact state of pasture regeneration. Nevertheless, these areas deserve special attention due to the succession of dry years since 2017, to the exclusion of 2020 which was positive.

The coastal countries, in particular Nigeria as a whole, Benin, Togo and Ghana, are in a worrying situation with biomass production, including fodder and crop production, down sharply in the first half of the growing season.

The final situation of the end of the rainy season will be decisive for the precise measurement of biomass production, and forecasts predict a slightly early cessation of production throughout the Sahelian zone of West Africa.

RECOMMENDATIONS

- Consult and use the ACF Biomass Early Warning Guide available at www.sigsahel.info for adequate use and interpretation of information
- Carry out regular monitoring during the off-season in vulnerable target areas in Mauritania, central Senegal and central and western Mali
- Integrate support to the pastoral sector into the heart of intervention strategies in the sub-region
- Involve the various stakeholders in the development and sustainability of the pastoral sector:
 - Revalorisation of the pastoral sector
 - Strengthening public livestock services and pastoral organisations
 - Improvement of pastoral infrastructures
 - Veterinary support and livestock vaccination

The data used for the calculation of biomass production comes from the data generated by the COPERNICUS ground service, the European Commission's Earth observation programme. The research that led to the current version of the product was funded by various European Commission research and technical development programmes. The product is based on data from the SENTINEL-3, PROBA-V and SPOT-VEGETATION satellites of the European Space Agency ESA.

Action contre la Faim
Regional Office for West and Central Africa ROWCA
Ngor Almadies N°13 Bis, Rue NG 96, BP 29621, Dakar, Senegal

Surveillance and Risk Reduction Department: Erwann FILLOL
Email: erfillol@wa.acfspain.org
Portal: www.sigsahel.info

