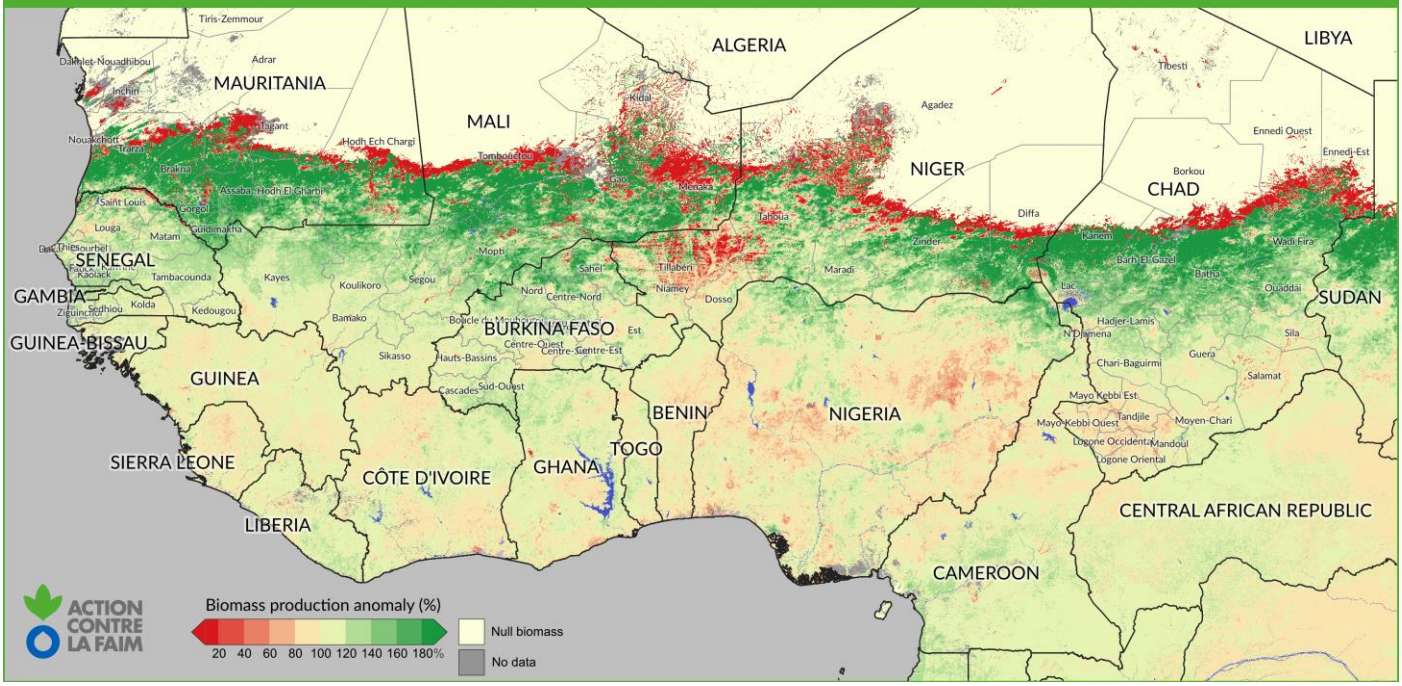
BIOMASS PRODUCTION IN 2022 ANALYSIS AND OUTLOOK FOR 2023

SAHEL REGIONAL REPORT

CHÉRIF ASSANE DIALLO
ERWANN FILLOL

ACTION AGAINST HUNGER
ACTION CONTRE LA FAIM

MAP 1: ANOMALY OF BIOMASS PRODUCTION FOR YEAR 2022 IN PERCENT



HIGHLIGHTS

- Very good rainy season in the Sahelian zone of West Africa
- Above normal biomass production in most of the Sahelian zone
- Very good biomass production in the western block composed of central and southern Senegal, southern Mauritania, central and southern Mali and Burkina Faso
- Good biomass production in Chad, except in the south of the country
- Low to very low production in the Central Sahel, particularly in south-west Niger
- Below average biomass production in coastal countries, particularly in Nigeria
- Security context strongly hindering herds mobility and access to pasture and water resources in the Central Sahel, in addition to restrictions on mobility to coastal countries, particularly Benin and Togo

INTRODUCTION

This report presents a qualitative assessment of the quality of the vegetal growing season in West and Central Africa. The analysis is focused on the Sahelian zone of West Africa, and reports on biomass production at the end of the 2022 growing season.

The year 2022 follows a 2021 wintering season that was below but close to normal for almost the entire Sahelian zone, with several pastoral zones recording negative biomass production anomalies.

Despite some dry spells at the beginning of the rainy season, the 2022 rainy season was marked by a good spatial and temporal distribution of rainfall, with an early start to the rains in some places and a late end of the season. This good rainfall caused a significant rise in river levels and flooding in some places.

The area covered by this bulletin remains marked by a social, economic, and political context underpinned by the global geopolitical context still influenced by the Russian-Ukrainian crisis and the COVID-19 pandemic. At the regional level, the extension of conflicts and violence in the Sahel, coupled with the increasing insecurity in the countries of the Gulf of Guinea, make the accessibility and usability of pastoral resources subject to instability.

SYSTEM DESCRIPTION

WHAT IS BIOMASS AND HOW IS IT MEASURED?

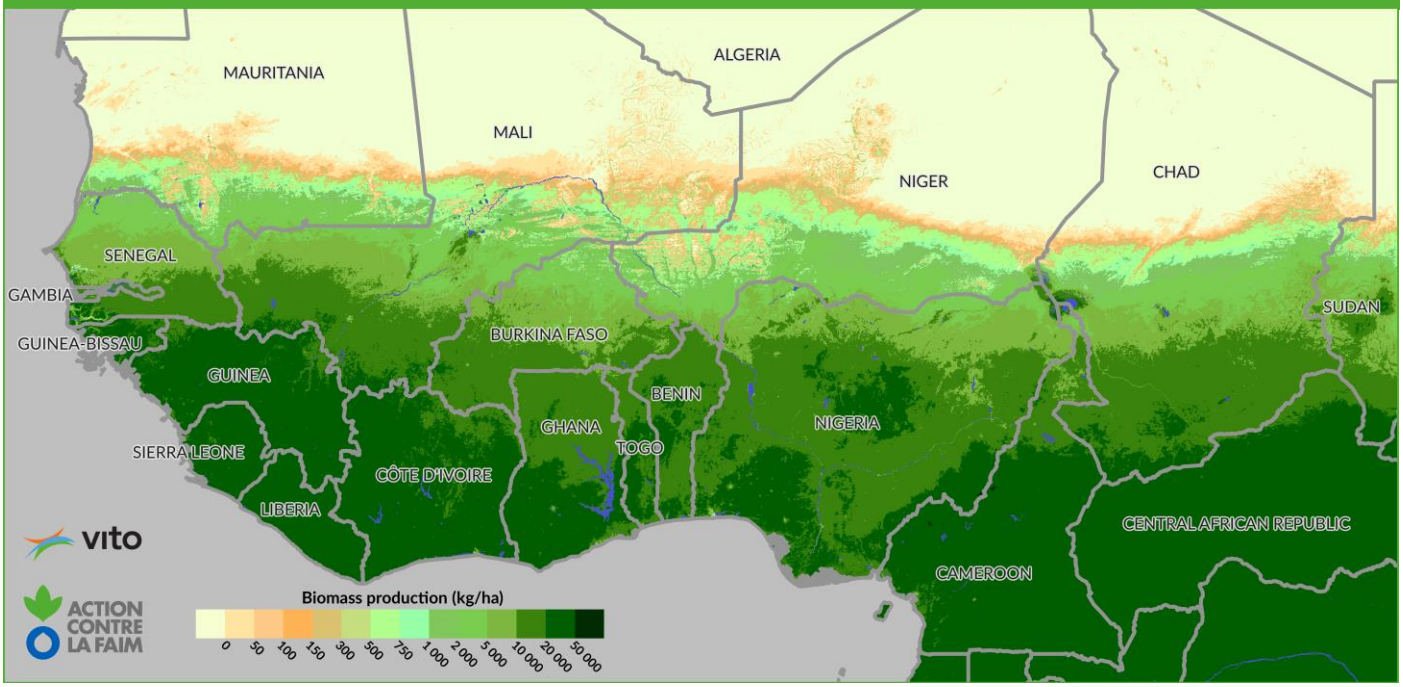
Biomass is the total production of vegetal material measured in kilograms of dry matter MS per hectare kg/ha. The term dry matter is used to describe any form of vegetation above the ground regardless of its water content. For an analysis of the pastoral situation, biomass is an effective way of measuring 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 supplied as decadal 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 that of the satellite archive from 1999 to present.

MAP 2: AVERAGE ANNUAL BIOMASS PRODUCTION 1999-2022



WHAT INDICATORS ARE GENERATED?

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

- Annual production kg/ha

The annual biomass production is compared to the average calculated overall years since 1999 in order to compute the anomaly which is represented in two ways:

- Anomaly expressed as a percentage of the mean value
- Standard deviation expressed as number of standard deviations σ from the mean

A vulnerability index linked to biomass availability, called VI (Vulnerability Index), is calculated recursively by weighting the most recent years to take into account sequences of dry or rainy wintering:

- Vulnerability Index VI

The methods used and the details of BioGenerator's operation are available at: www.sigsahel.info/index.php/section/tele/

BIOMASS PRODUCTION IN 2022

MAPPING OF THE BIOMASS PRODUCTION ANOMALY

Map 1 shows the biomass production anomaly for 2022 over West Africa and particularly the Sahel expressed as a % of the mean, and map 3 shows the same production anomaly but expressed as a number of standard deviations σ from the mean, called the normalised anomaly.

These maps show a higher-than-normal production over the whole area monitored, despite some local variations.

Central and southern Senegal, southern Mauritania except for the south-southwest, central and southern Mali and Burkina Faso except for the east constitutes the western block of good production, which is well above average. The other block of good production is in the east and includes south-eastern Niger and Chad except for its southern part.

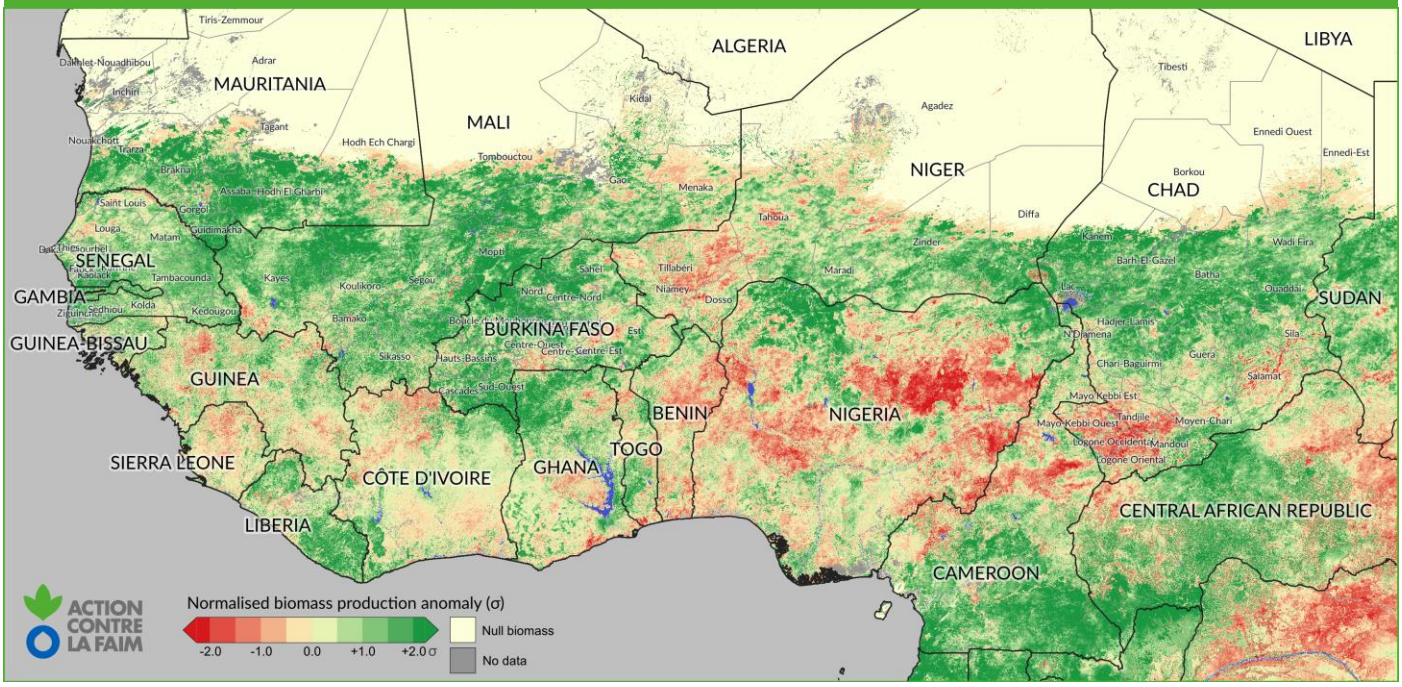
The tri-border region, which is often confronted with ecological disturbances, sees for this winter season only the south-west of Niger with a low to very low production. In addition, the area composed of northern Senegal and southwestern Mauritania shows low production due to unfavourable rainfall distribution in these territories.

For a more in-depth analysis, this production is expressed as a normalized anomaly (Map 3), which makes it possible to qualify the findings for the predominantly pastoral livelihood zones of the north of the region. This year, they recorded positive anomalies overall, despite a few localised pockets with negative values. However, with an overall positive situation, these pastures are considered to be of high quality by herders but subject to several conservation, accessibility and utilisation factors in these areas.

In the southern zones of the West Africa region, which are predominantly agricultural, the anomalies are generally positive, except for the low-production zones mentioned above. The negative anomalies that are localised result from irregular rainfall either at the beginning of the rainy season or during the growth phase.

These anomalies in biomass production in 2022 compared to previous years are illustrated in more detail by the analyses of seasonal and interannual variability in biomass.

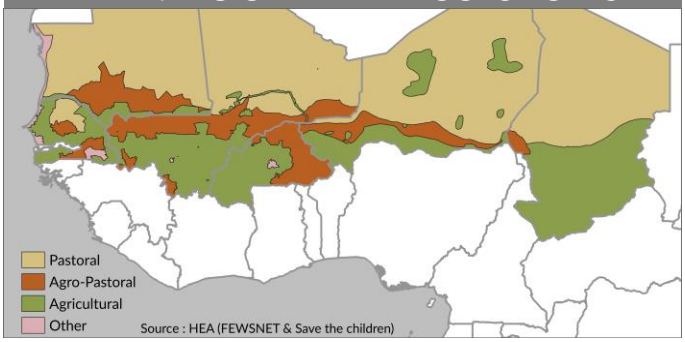
MAP 3: NORMALISED BIOMASS PRODUCTION ANOMALY YEAR 2022



INTERANNUAL VARIATIONS IN BIOMASS PRODUCTION

Based on the breakdown by livelihood zones, it is possible to observe the inter-annual variation in biomass production according to land use: agricultural and agropastoral.

MAP 4: REGIONAL LIVELIHOODS ZONES



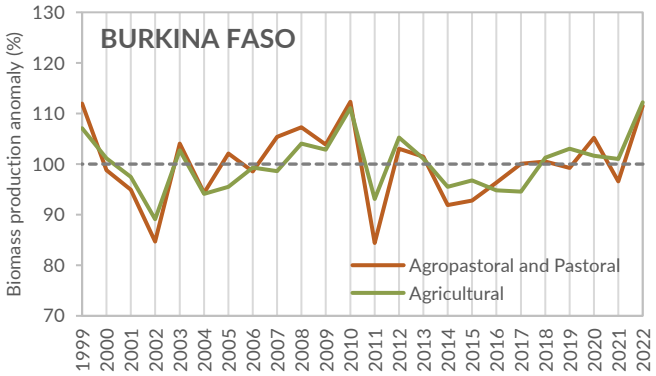
For the elaboration of these comparisons, the initial agropastoral and pastoral classes are combined in order to obtain statistics on the dominantly pastoral use area.

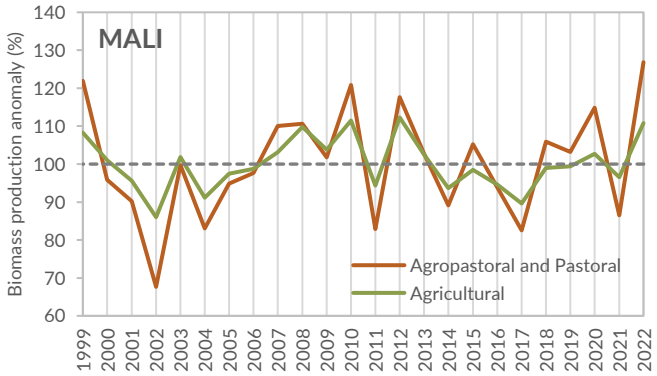
The graphs show a year 2022 that is better than 2021 everywhere and above the average for the whole covered area.

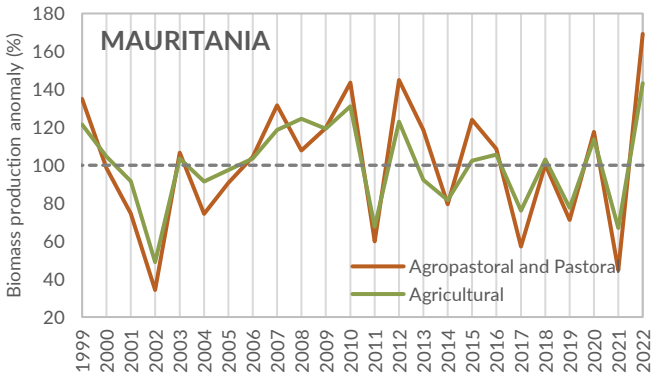
Production in 2022 is above the 1999-2022 average in agricultural, agropastoral, and pastoral areas in all the countries covered by this bulletin, despite some clear variations.

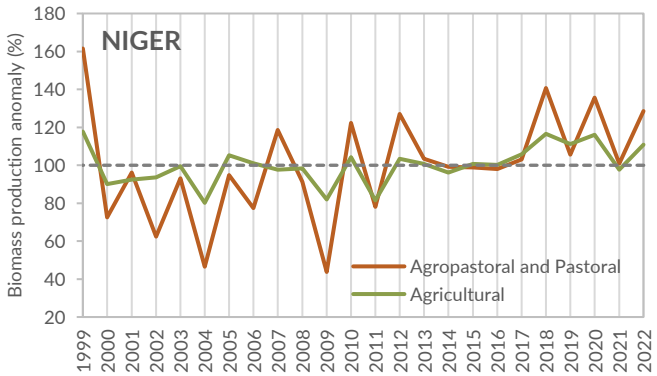
The best productions are recorded in Mauritania for all zones, with values never reached before. Although above average, the lowest yields are recorded in Chad for agricultural production and in Niger for agropastoral and pastoral production.

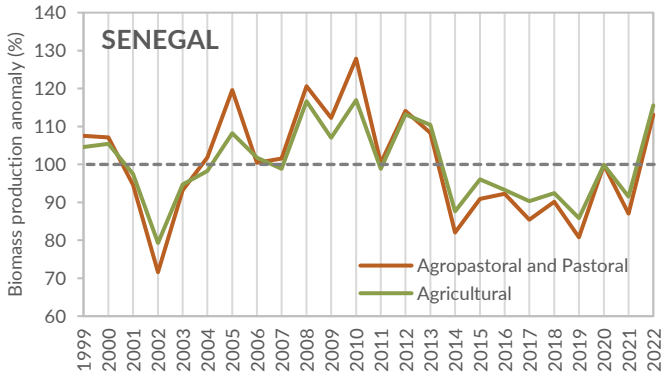
From an overall point of view, biomass production in agropastoral and pastoral areas is better than that measured in agricultural areas.

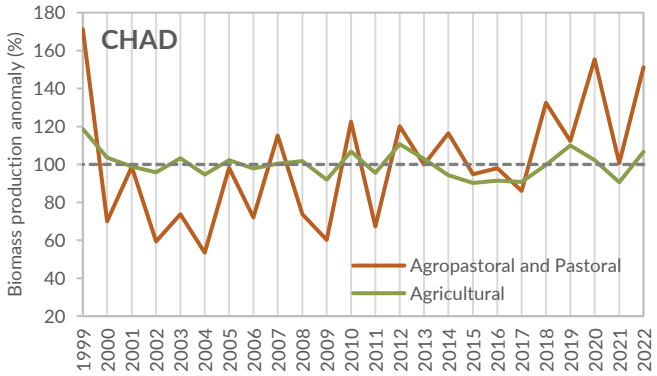








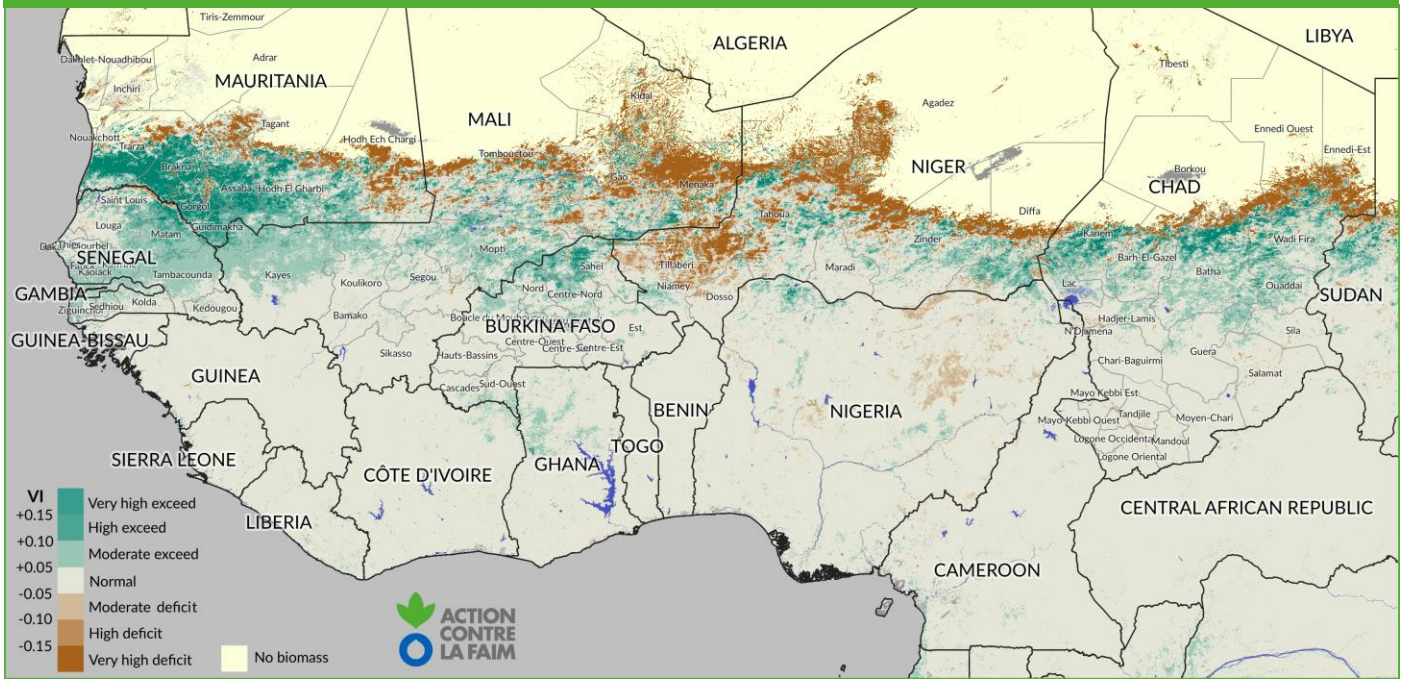




COMPARISON OF 2022 WITH RECENT YEARS

The vulnerability index VI linked to biomass, represented by Map 5, is sensitive to the variations in production recorded over the most recent years and highlights the areas with repeated biomass deficits. The area covered displays contrasting vulnerability indices, ranging from "very significant" deficits to "significant excesses" depending on the geographical entity chosen. At the country level, they vary from "significant deficit" to "moderate excess". Despite good production, the negative deficits are explained by the repetition of years of low production: 2019 and 2021.

MAP 5: BIOMASS VULNERABILITY INDEX 2022



The following table shows the biomass production anomalies, expressed as the number of standard deviations from the mean and as a % of the mean by agricultural and agropastoral areas for the six countries monitored.

This table shows a generally positive situation for the year 2022 everywhere with a good improvement compared to 2021.

Despite good production, pastoral and agropastoral areas remain vulnerable. Indeed, only Burkina Faso and Senegal have "moderate excess" vulnerability indices with +0.03 and +0.06 respectively. Negative vulnerability indices with "significant deficits" are recorded in the agropastoral and pastoral areas of Mali (-0.08), Niger (-0.13) and Chad (-0.10).

Countries	Livelihood zones	Anomaly 2018	Anomaly 2019	Anomaly 2020	Anomaly 2021	Anomaly 2022	VI 2022
Burkina Faso	Agropastoral et Pastoral	+0.1σ (101%)	-0.1σ (099%)	+0.7σ (105%)	-0.5σ (097%)	+1.6σ (111%)	+0.03
	Agricultural	+0.2σ (101%)	+0.5σ (103%)	+0.3σ (102%)	+0.2σ (101%)	+2.2σ (112%)	+0.03
Mali	Agropastorale et Pastorale	+0.4σ (106%)	+0.2σ (103%)	+1.0σ (115%)	-0.9σ (087%)	+1.8σ (127%)	-0.08
	Agricole	-0.1σ (099%)	-0.1σ (099%)	+0.4σ (103%)	-0.5σ (097%)	+1.5σ (111%)	+0.03
Mauritanie	Agropastorale et Pastorale	+0.0σ (100%)	-0.9σ (071%)	+0.5σ (117%)	-1.6σ (045%)	+2.1σ (169%)	-0.01
	Agricole	+0.1σ (103%)	-1.0σ (077%)	+0.6σ (114%)	-1.5σ (067%)	+1.9σ (143%)	+0.08
Niger	Agropastorale et Pastorale	+1.4σ (141%)	+0.2σ (106%)	+1.3σ (135%)	+0.0σ (101%)	+1.0σ (128%)	-0.13
	Agricole	+1.6σ (116%)	+1.1σ (111%)	+1.6σ (116%)	-0.2σ (098%)	+1.0σ (111%)	-0.07
Sénégal	Agropastorale et Pastorale	-0.7σ (090%)	-1.4σ (081%)	-0.0σ (100%)	-0.9σ (087%)	+0.9σ (113%)	+0.06
	Agricole	-0.8σ (092%)	-1.4σ (086%)	-0.0σ (100%)	-0.8σ (092%)	+1.5σ (116%)	+0.06
Tchad	Agropastorale et Pastorale	+1.0σ (133%)	+0.4σ (112%)	+1.7σ (155%)	+0.0σ (101%)	+1.6σ (151%)	-0.10
	Agricole	-0.1σ (100%)	+1.4σ (110%)	+0.3σ (102%)	-1.3σ (091%)	+0.9σ (107%)	+0.02

RAINFALL CONTEXT

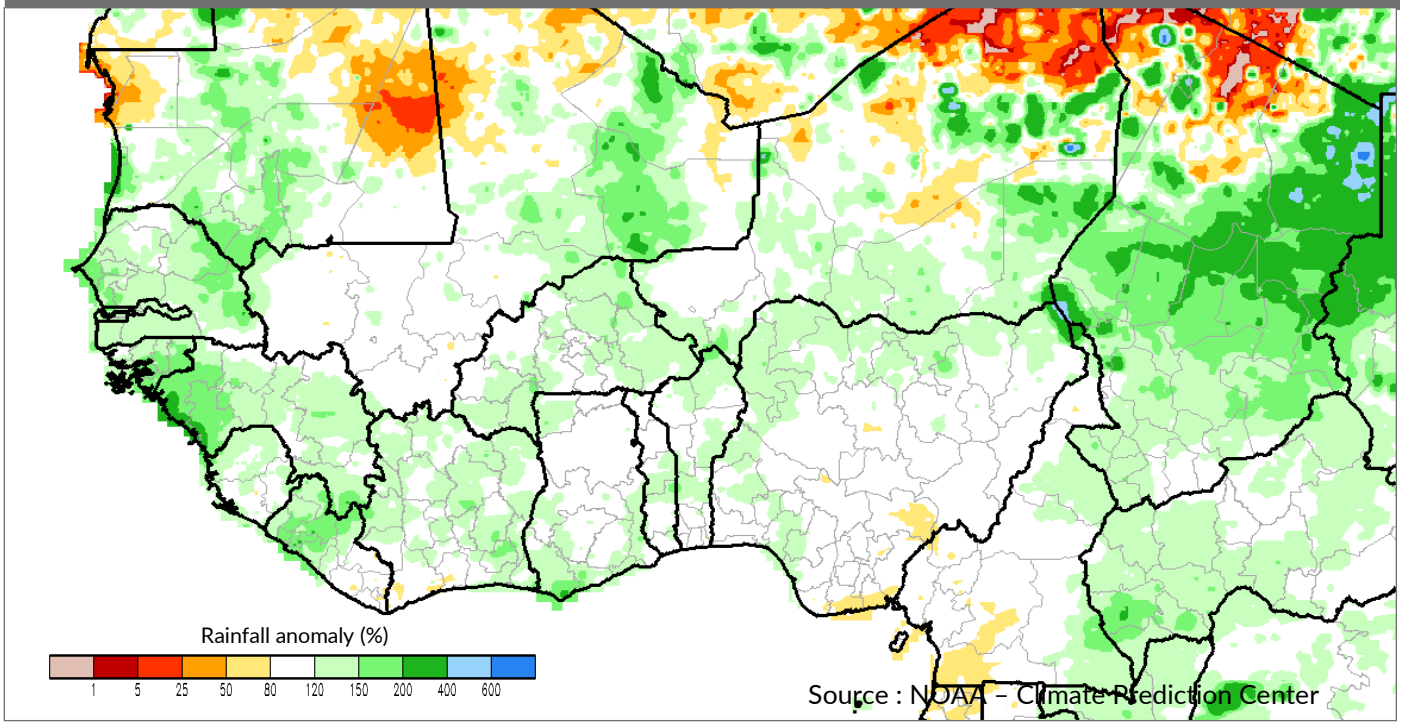
For the Sahel, as for other semi-arid zones, the availability of water and the spatiotemporal distribution of rainfall are two factors determining the annual biomass production balance.

Maps 6 and 7 show rainfall totals derived from satellite imagery over the 2022 rainy season. The maps are derived from two different sources: NOAA-Climate Prediction Center and United States Geological Survey USGS. These two precipitation anomaly maps present sometimes divergent data but give an overview of the course of the rainy season.

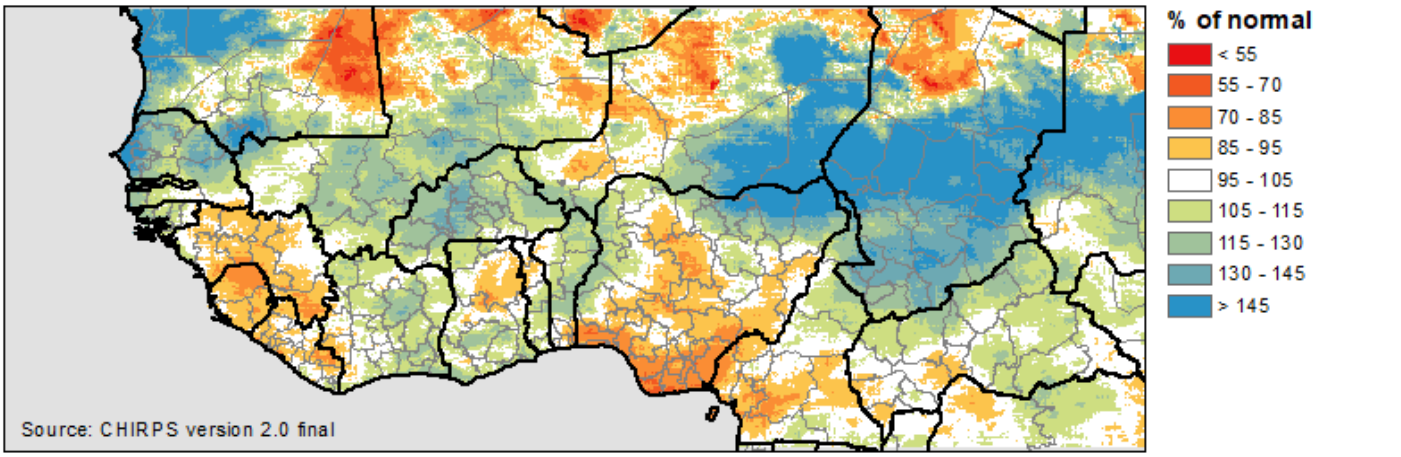
2022 is above to well above normal over the entire Sahel in terms of cumulative rainfall. The areas with the lowest rainfall coincide with those with low biomass production, particularly southwest Niger, and the coastal countries.

It should be noted that in addition to the quantities received, the distribution is also an important factor for growth. In fact, this winter is marked in places by dry sequences and delays in growth, as in northern Senegal and part of the Central Sahel.

MAP 6: RAINFALL ANOMALIES MAY-OCTOBER 2021 (NOAA-CPC)



MAP 7: RAINFALL ANOMALIES MAY-SEPTEMBER 2021 (USGS)



Map produced by USGS/EROS

USGS USAID FEWS NET

CONCLUSION

WINTERING SEASON 2022

The 2022 winter season was exceptionally productive, and even better than the 2018 and 2020 seasons, which were noted for their biomass production well above normal in most Sahelian countries.

Rainfall totals are above normal. However, an unfavourable distribution of rainfall in some places resulted in lower-than-average productivity.

The best biomass production was recorded in Mauritania, which had experienced a generally unfavourable winter in 2021, coupled with significant vulnerability.

In the Central Sahel, the situation remains mixed, with biomass production close to or below average in western Niger and high vulnerability of communities.

In recent years, deficit and surplus years alternated. However, it is still premature to deduce a model for the management of crises and disasters related to the biomass production deficit.

If this biomass is directly valorised from plant production in agricultural areas, it remains a potential that can be valorised by animal production in agropastoral and pastoral areas. However, the context in the Sahel is not evolving in favour of the pastoral sector, which faces several constraints, such as the extension of conflicts, violence and including in the countries of the Gulf of Guinea, the progressive monopolisation of pastoral resources (land and water points), and the exposure of pastoralists to various abuses (theft, racketeering, etc.). All these factors have a direct impact on the accessibility and usability of this biomass and the valuing of pastoral resources.

OUTLOOK FOR 2023

This end-of-season assessment gives a complete picture of the apparent availability of biomass, an essential resource for the management of livestock systems in the sub-region. However, regular monitoring of the biomass stock and the situation of the herds remains essential to anticipate possible difficulties related to early movements, bush fires and mobility restrictions.

For the 2023 outlook, three main geographical areas are emerging.

The western block covering Senegal, Mauritania, Mali, and Burkina Faso is marked by good to very good production with a slight vulnerability in its extreme north. With transhumance to the Sudano-Sahelian zones of this block, it has sufficient resource potential until the next growing season.

The block from the central Sahel to the coastal countries has recorded below-average production in some places and is worryingly vulnerable in the Sahelian part, while it is normal for the coastal countries. In addition to this constraint related to low production, this zone is marked by insecurity, which hinders any effort at mobility to adapt to environmental conditions.

The eastern block, comprising eastern Niger and Chad, has good overall production, but with pockets of lower-than-average production in the north up to the limits of the desert zone. In terms of resources, this block is not very vulnerable, but security remains a determining factor for the development of its resources during the year.

A close partnership with herders' and pastoral organisations can help develop and implement technical innovations related to pastoral resource management, such as locally adapted fodder production and holistic management.

RECOMMENDATIONS

- Consult the ACF Early Warning Guide on biomass available at www.sigsahel.info
- Follow the general recommendations in favour of the pastoral and agropastoral sectors:
  - Advocacy for the recognition of the importance of transhumant livestock for the functioning of the Sahelian agrarian system
  - Facilitation of pastoral mobility
  - Development of services for herders and flocks (animal health, vaccination, etc.)
  - Improvement of pastoral infrastructures that should be considered as priorities for the stability and socio-economic development of the countries concerned by the monitoring system
- Establish monitoring of grazing stock throughout the dry season and monitor the impact of bushfires
- Carry out regular monitoring during the off-season in vulnerable target areas in the Central Sahel, particularly in south-west Niger
- Integrate support to the pastoral sector at the heart of intervention strategies in the sub-region

The data used for the calculation of biomass production comes from the data generated by the COPERNICUS land 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 Against Hunger
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

ACTION AGAINST HUNGER ACTION CONTRE LA FAIM