



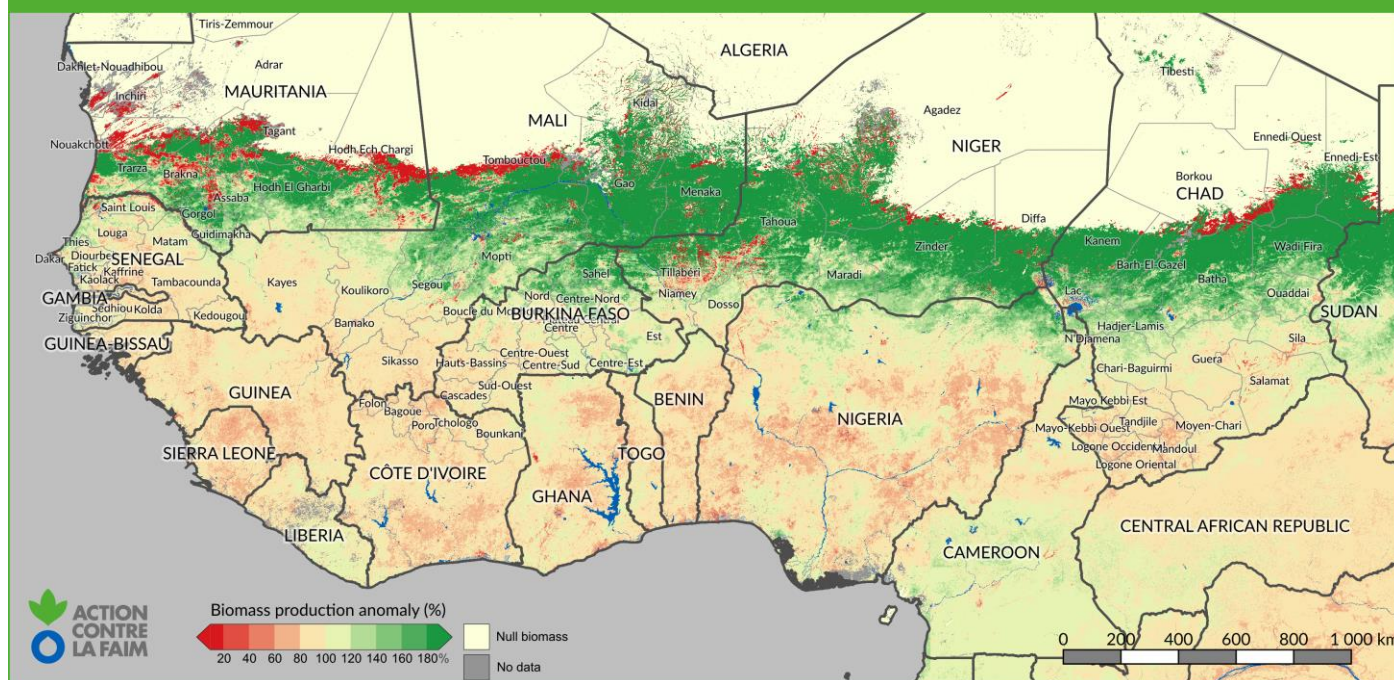
BIOMASS PRODUCTION IN 2024 ANALYSIS AND OUTLOOK FOR 2025

SAHEL REGIONAL REPORT

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MAP 1: ANOMALY OF BIOMASS PRODUCTION FOR YEAR 2024 IN PERCENT



HIGHLIGHTS

- Significant rainfall received, particularly in the Sahel countries
- Good biomass production in the Sahelian zone of West Africa overall
- Biomass production significantly above normal in Central Sahel
- Average to low biomass production on the western coast and coastal countries
- Low exposure of the region to vulnerability related to biomass
- Runoff above normal levels, causing significant flooding
- Security context severely hindering the mobility of herds and access to pastures and water resources in Central Sahel, in addition to mobility restrictions towards coastal countries, particularly Benin and Togo
- Significant movements of displaced populations with livestock in several areas of the region

INTRODUCTION

This document presents a quantitative assessment of plant production during the 2024 growing season in West Africa and the Sahel. The analysis mainly focuses on the Sahelian zones of West Africa but also provides an overview of the coastal countries.

The year 2024 follows a generally average rainy season in 2023. However, areas of low to very low production were recorded in 2023, particularly along the northern edge of the Sahelian zone and the Lake Chad basin.

The 2024 rainy season experienced a late onset followed by more or less prolonged dry spells.

Nevertheless, rainfall was abundant in the Sahelian countries, leading to above-normal runoff and causing significant flooding in urban centres as well as river overflows.

Furthermore, the region faces increasing insecurity, ecological disruptions, and the impacts of climate change, resulting in territorial fragmentation.

Additionally, the issue of displaced persons and their livelihoods remains a major concern, affecting the utilization of pastoral resources.

SYSTEM DESCRIPTION

WHAT IS BIOMASS AND HOW IS IT MEASURED?

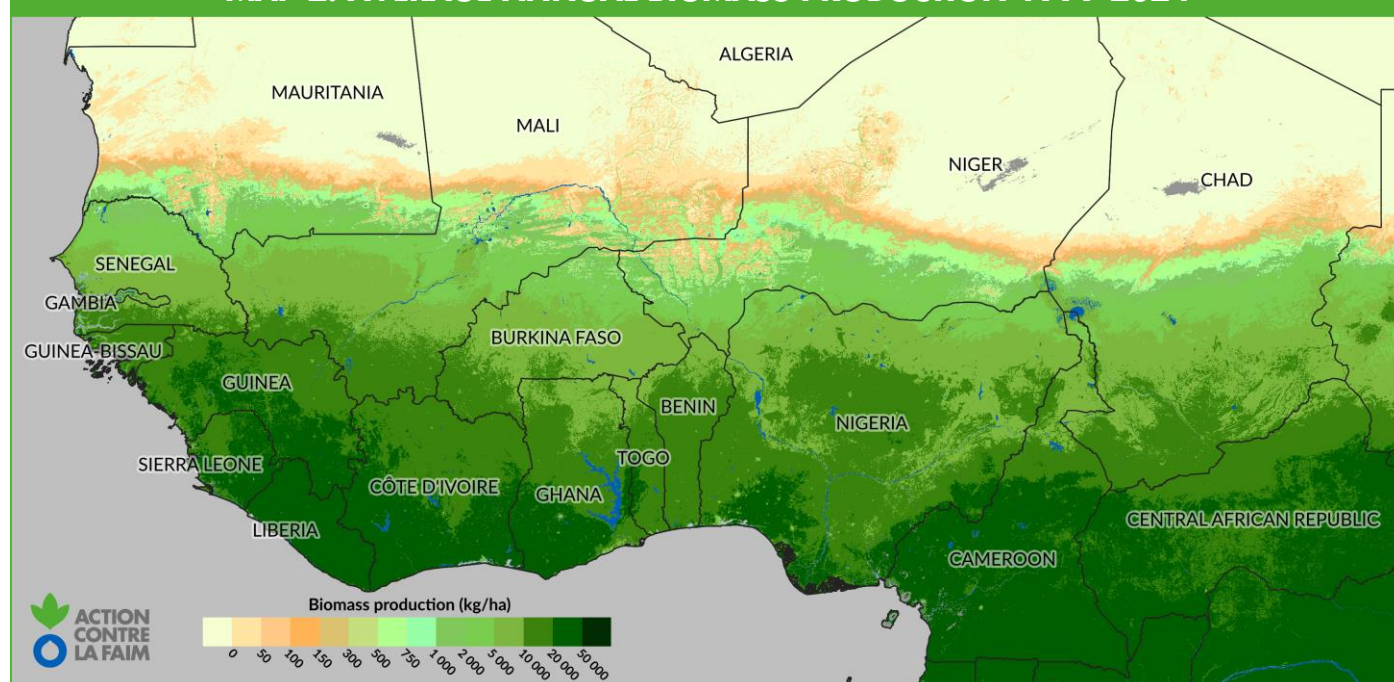
Biomass is the total production of vegetal material measured in kilograms of dry matter MS per hectare kg/ha. The term dry matter is used to describe any form of vegetation above the ground regardless of its water content. For an analysis of the pastoral situation, biomass is an effective way of measuring 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 1999-2024



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**

Methods and operating details of the BioGenerator can be accessed here: sigsahel.info/index.php/knowledgebase
The data produced can be downloaded here: data.humdata.org/organization/acf-west-africa

BIOMASS PRODUCTION IN 2024

MAPPING OF THE BIOMASS PRODUCTION ANOMALY

Map 1 illustrates the biomass production anomaly for 2024 in West Africa, expressed as a percentage of the average. Map 3 shows this same production anomaly, but in terms of the number of standard deviations (σ) from the average, referred to as the normalized anomaly.

These maps indicate good biomass production in the Sahelian zone, but average to low production in the Sudanian-Sahelian and Sudanian zones, as well as in the coastal countries.

The central and eastern parts of the Sahel show good biomass production during the 2024 rainy season. Niger stands out with exceptional production, showing an anomaly of 141%. All regions of the country are in positive anomaly, notably Agadez and Tahoua with 268% and 163%, respectively. Strongly positive anomalies are also observed in Burkina Faso and Chad.

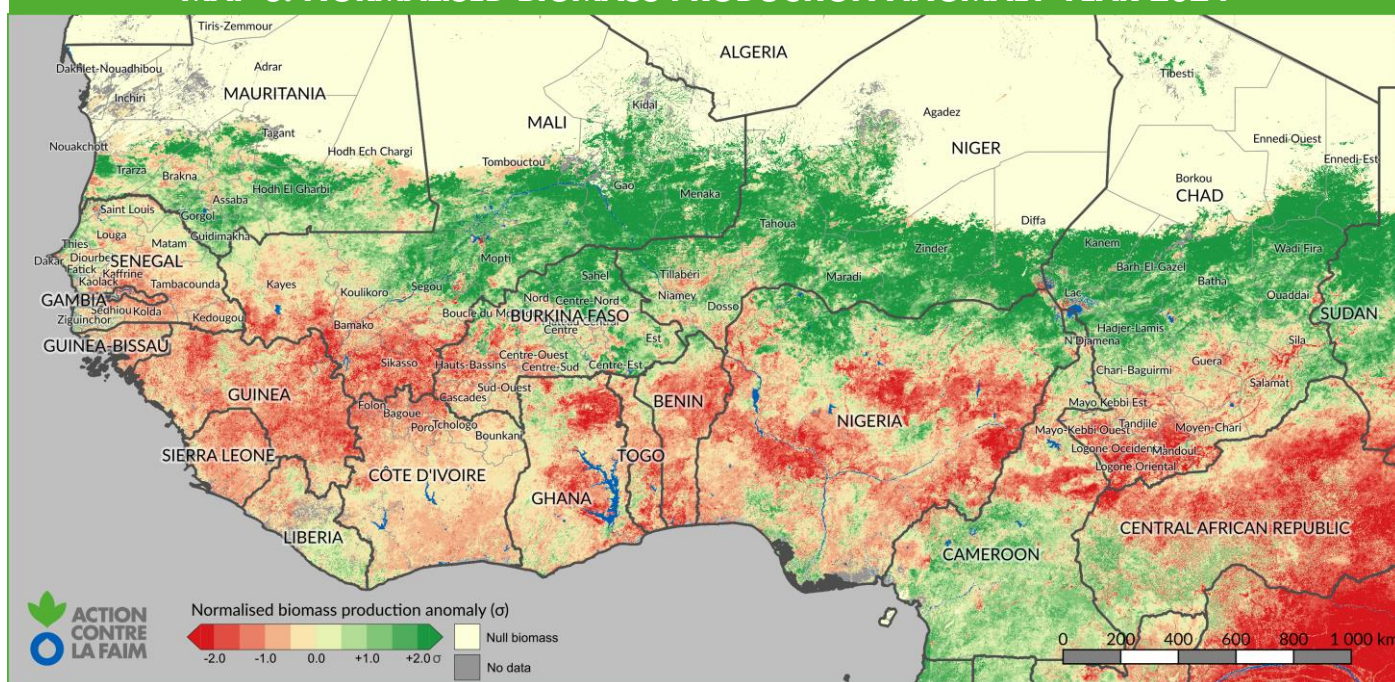
The southern part of this zone shows average to low production, mainly in Senegal, southern Mali, southern Burkina Faso, and southern Chad. In Mauritania, production varies by zone.

In the rest of the region, the productions appear to be deficient. Regarding the coastal countries, as in previous years, biomass production analysed by anomalies is deficient. Only northern Nigeria shows positive anomalies. However, these negative anomalies do not necessarily indicate a lack of potential in forage resources for local and transhumant livestock.

The biomass production balance is strongly linked to the rainfall situation, and this year, the areas with positive anomalies are mainly livestock areas in the Sahelian band. However, this good regeneration of pastures will be beneficial if the conditions for development and accessibility are met, as these resources are ephemeral and fragile.

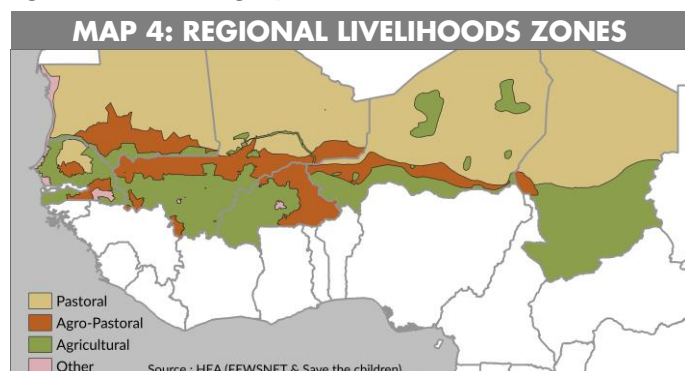
Interactions between the Sahel and the Sudanian-Sahelian and Sudanian zones are hindered by political, security, and exploitation method obstacles. Moreover, the relationships between these regions and the coastal countries are becoming more complex due to the evolving security and political context. This situation intensifies the pressure on the pastoral resources of the Sahel, leading to their rapid depletion and causing tensions.

MAP 3: NORMALISED BIOMASS PRODUCTION ANOMALY YEAR 2024



INTERANNUAL VARIATIONS IN BIOMASS PRODUCTION

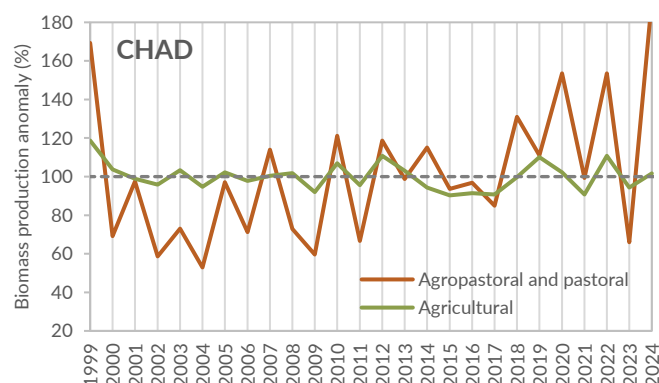
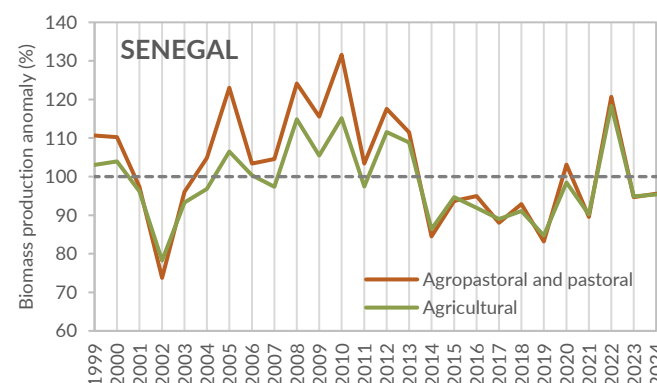
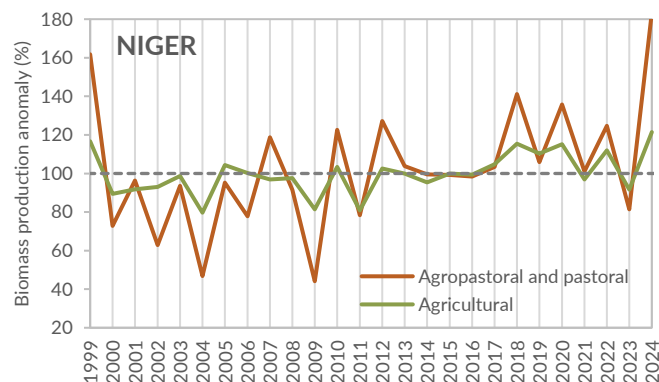
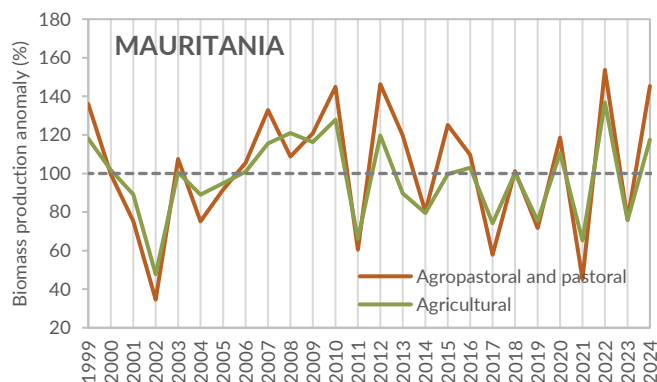
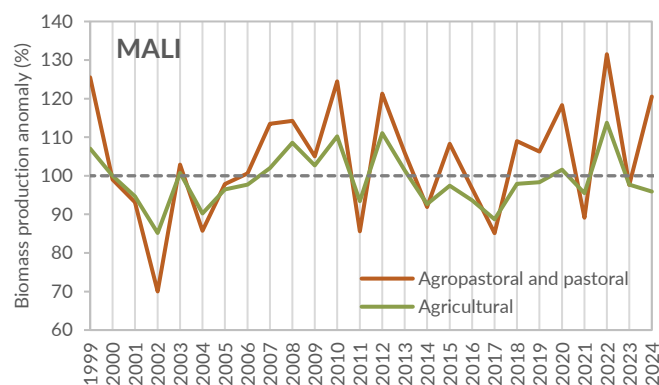
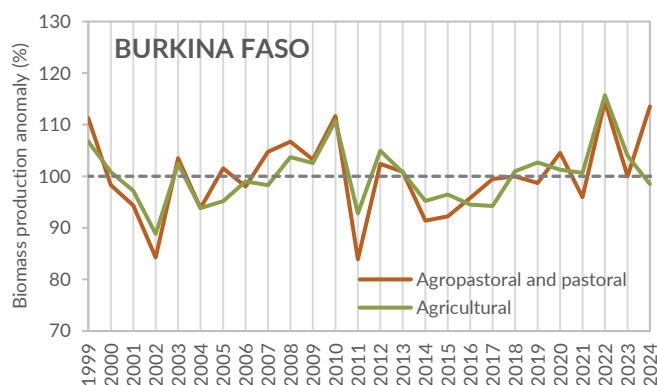
Based on the breakdown by livelihood zones, it is possible to observe the inter-annual variation in biomass production according to land use: agricultural and agropastoral.



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

The following charts show that 2024 had positive anomalies in agropastoral and pastoral production across the board, except in Senegal, and always higher than the anomalies in the more southern agricultural zones.

With the significant rainfall in the Sahelian band, production levels are above average and higher than last year. These good production levels are particularly notable in Niger and Chad, with +180% for agropastoral and pastoral production. However, below-average production is observed in Senegal in both agricultural and pastoral zones, and in Mali and Burkina Faso for agricultural production.



COMPARISON OF 2024 WITH RECENT YEARS

The vulnerability index (VI) related to biomass, represented by map 5, is sensitive to production variations recorded over recent years and highlights areas with repeated biomass deficits.

Following the 2024 rainy season, the region is exposed to low vulnerability. Indeed, almost the entire Sahel shows a “high” or even “very high” exceed. The southern part of the Sahel, including the coastal countries, is in a normal to slightly negative

situation. However, a few very localized areas have “high” to “very high” deficits. These areas in the Sahelian band are located in Mauritania, Mali, Niger, and Chad.

From a global perspective, only the agropastoral and pastoral zones of Mauritania, particularly those in the southeast of the country, are exposed to vulnerability due to recurrent locally deficient production already under the pressure from displaced populations.

MAP 5: BIOMASS VULNERABILITY INDEX 2024



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 highlights a good to very good situation despite some variations. Over this five-year period, except for 2022 which was excellent everywhere, 2024 is one of the best years in terms of biomass production.

Countries	Livelihood zones	Anomaly 2020	Anomaly 2021	Anomaly 2022	Anomaly 2023	Anomaly 2024	VI 2024
Burkina Faso	Agricultural	+0.2σ (101%)	+0.1σ (101%)	+2.7σ (116%)	+0.7σ (104%)	-0.3σ (098%)	-0.01
	Agropastoral and Pastoral	+0.6σ (104%)	-0.5σ (096%)	+1.8σ (114%)	-0.0σ (100%)	+1.7σ (113%)	+0.04
Mali	Agricultural	+0.4σ (103%)	-0.5σ (096%)	+2.1σ (115%)	-0.2σ (099%)	-0.4σ (097%)	-0.01
	Agropastoral and Pastoral	+1.0σ (114%)	-1.0σ (086%)	+1.9σ (127%)	-0.4σ (094%)	+1.1σ (116%)	+0.03
Mauritania	Agricultural	+0.6σ (114%)	-1.5σ (067%)	+1.8σ (140%)	-1.0σ (078%)	+0.9σ (121%)	+0.03
	Agropastoral and Pastoral	+0.5σ (117%)	-1.7σ (045%)	+1.6σ (152%)	-0.8σ (075%)	+1.3σ (143%)	-0.03
Niger	Agricultural	+1.4σ (115%)	-0.3σ (097%)	+1.1σ (112%)	-0.7σ (092%)	+2.0σ (122%)	+0.01
	Agropastoral and Pastoral	+1.0σ (133%)	-0.0σ (099%)	+0.7σ (122%)	-0.7σ (079%)	+2.5σ (179%)	+0.06
Senegal	Agricultural	-0.0σ (100%)	-0.9σ (091%)	+2.0σ (120%)	-0.4σ (096%)	-0.3σ (097%)	-0.01
	Agropastoral and Pastoral	+0.0σ (100%)	-0.9σ (087%)	+1.3σ (117%)	-0.6σ (092%)	-0.5σ (093%)	-0.01
Chad	Agricultural	+0.3σ (102%)	-1.3σ (091%)	+1.5σ (111%)	-0.8σ (094%)	+0.2σ (102%)	+0.01
	Agropastoral and Pastoral	+1.5σ (152%)	-0.1σ (098%)	+1.5σ (152%)	-1.0σ (065%)	+2.5σ (189%)	+0.08

RAINFALL CONTEXT

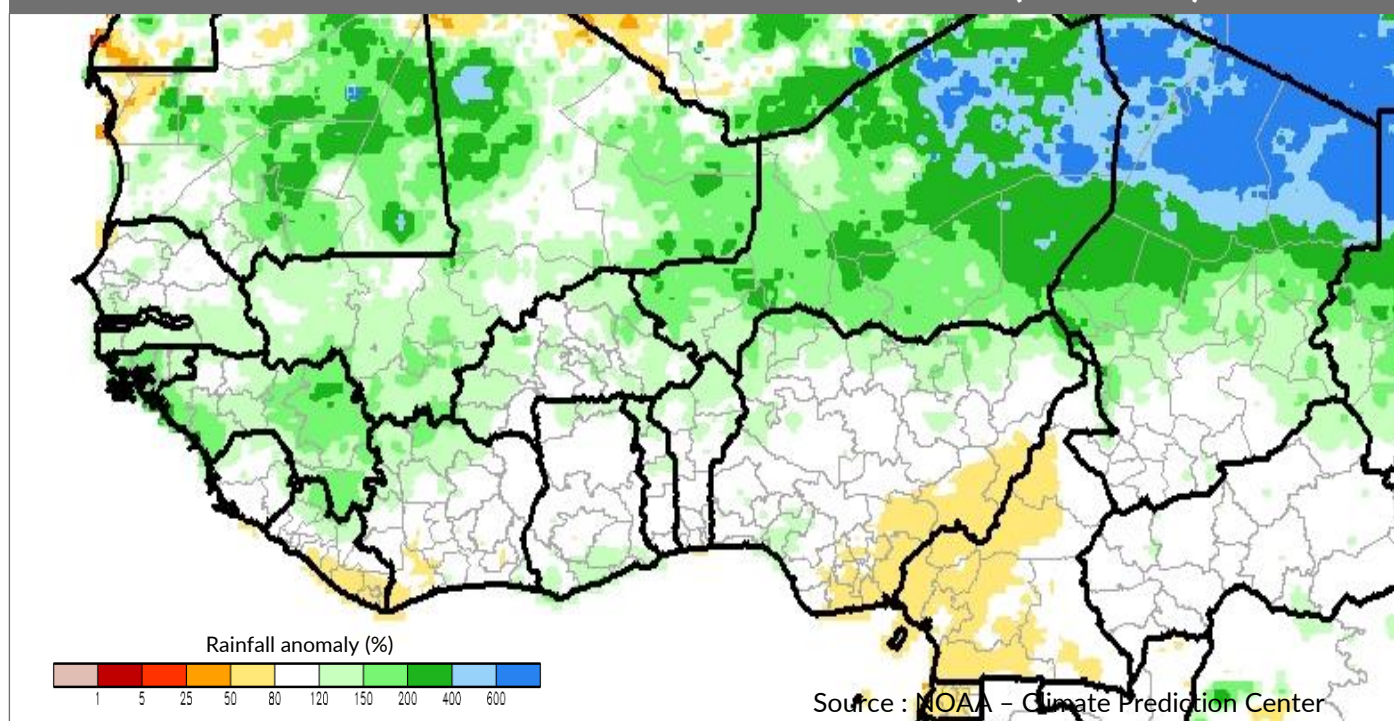
For the Sahel, as for other semi-arid zones, the availability of water and the spatiotemporal distribution of rainfall are two factors determining the annual biomass production balance.

Maps 6 and 7 display cumulative precipitation derived from satellite imagery for the 2024 rainy season. These maps are derived from two distinct sources: NOAA-Climate Prediction Center and the United States Geological Survey (USGS). While these two precipitation anomaly maps may occasionally diverge in their data, they provide an overview of the progression of the rainy season.

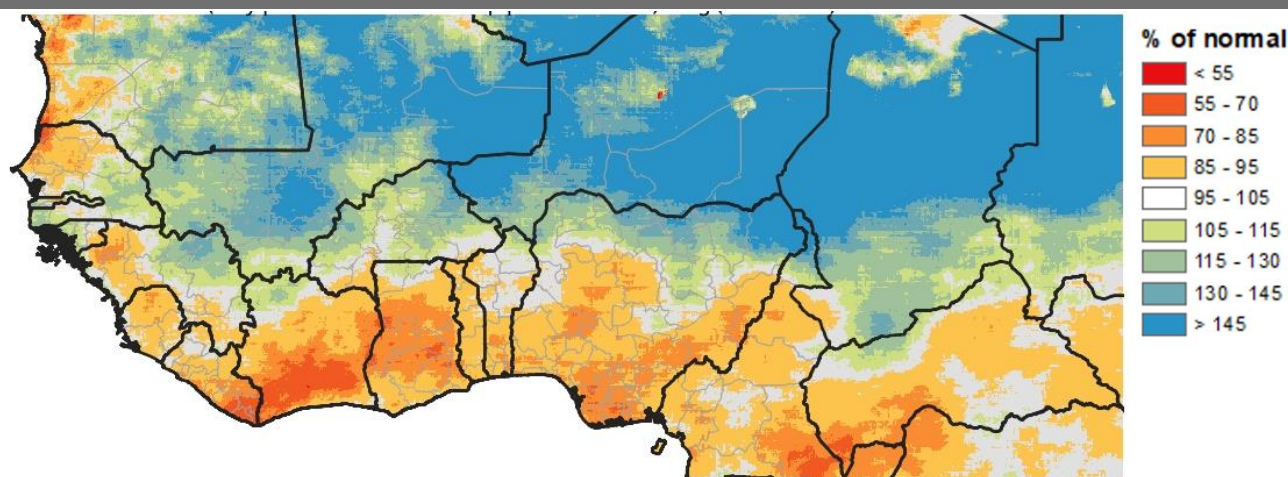
The 2024 rainy season had a late start followed by more or less prolonged dry spells in July. However, from August onwards, significant amounts of rainfall were recorded, particularly in the Sahelian countries. On the other hand, the western coast and coastal countries experienced average to low rainfall.

The significant rainfall received led to above-normal runoff across the region. Flooding in urban centres and river overflows caused damage, impacting the populations and their livelihoods.

MAP 6: RAINFALL ANOMALIES MAY-OCTOBER 2024 (NOAA-CPC)



MAP 7: RAINFALL ANOMALIES MAY-SEPTEMBER 2024 (USGS)



Map produced by USGS/EROS



CONCLUSION

WINTERING SEASON 2024

The 2024 rainy season benefited from good rainfall in the Sahelian region, especially in the east, while the rest of the region experienced average to low precipitation.

Biomass production, which is highly dependent on rainfall patterns, shows extensive areas of good production in the Sahel, particularly in Mali, Niger, Burkina Faso, and Chad. In Niger, biomass production is exceptionally good.

The rest of the region is characterized by average to low production, mainly on the western coast, particularly in Senegal, and in the coastal countries, where biomass production is increasingly limited. However, the double rainy season and resource

potential mitigate the impacts of these low productions. In Mauritania, production varies by zone. Pastoral resources, already limited, are under increased pressure due to the arrival of displaced persons with their livestock.

The rapid alternation between very rainy years (2020, 2022) and very dry years (2021, 2023) was again confirmed in 2024. Indeed, significant rainfall and runoff well above normal were observed during this rainy season. The Sahel was wetter, providing good forage resources and abundant agricultural production. However, the security situation and regional context may hinder optimal exploitation of these resources.

OUTLOOK FOR 2025

Following the 2024 rainy season, the overall assessment of forage resource production is generally good despite some disparities. On one hand, the Sahel was humid, while the rest of the region experienced a deficit. Thus, the outlook for the 2025 dry season depends on three key factors: resource availability, the evolution of the security context, and the geopolitical situation of the region.

- **Resources:** They are generally sufficient to very sufficient. Indeed, areas with low production already have the potential to sustain livestock during the dry season. Moreover, the challenge for the dry season is the management of resources in both high and low production areas to ensure their optimal use. This challenge is more related to bushfires and overexploitation.
- **Accessibility:** Despite the availability of resources, accessibility remains an issue. Increasing insecurity and its spread to pastoral

areas limit the prospects for optimal use of dry season resources. This leads to abnormal movements, high concentrations, and early depletion. Consequently, pastoral lean periods may be early and severe.

- **Political Situation:** It impacts the management and exploitation of resources. On one hand, access is regulated, and on the other, stakeholders are organizing. At the regional level, restrictions on livestock mobility create overloads that can prematurely deplete available forage. Conversely, favourable access conditions can also lead to early depletion.

However, regional interventions are expected to mitigate the impact of abnormal resource reductions. Therefore, humanitarian and other actors must identify priority sectors and areas for action.

RECOMMENDATIONS

- Follow the general recommendations in favour of pastoral and agropastoral sectors:
 - Advocate for the recognition of the importance of transhumant livestock for the functioning of the Sahelian agrarian system
 - Facilitate pastoral mobility, especially cross-border transhumance
 - Develop services for livestock and herders (animal health, vaccination...)
 - Improve pastoral infrastructure, considering it a priority for the stability and socio-economic development of countries
 - Strengthen support for the sector and preventive actions
- Establish monitoring of pasture stock throughout the dry season and monitor the impact of bushfires
- Facilitate transhumance, particularly cross-border transhumance, to reduce the vulnerability of pastoral communities facing biomass production deficits and persistent insecurity
- Adapt support for displaced persons to their livelihoods
- Integrate support for the pastoral sector into the core of intervention strategies in the sub-region
- Operationalize the regional livestock feed reserve

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.

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