



Ministry of Foreign Affairs

Climate Change Profile

West African Sahel

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Introduction

This climate change profile is designed to help integrate climate actions into development activities. It complements the publication 'Climate-smart = Future-Proof! – Guidelines for Integrating climate-smart actions into development policies and activities' and provides answers to some of the questions that are raised in the step-by-step approach in these guidelines.

The current and expected effects of climate change differ locally, nationally and regionally. The impacts of climate change effects on livelihoods, food and water security, ecosystems, infrastructure etc. differ per country and region as well as community and individual, with gender a particularly important vulnerability factor.

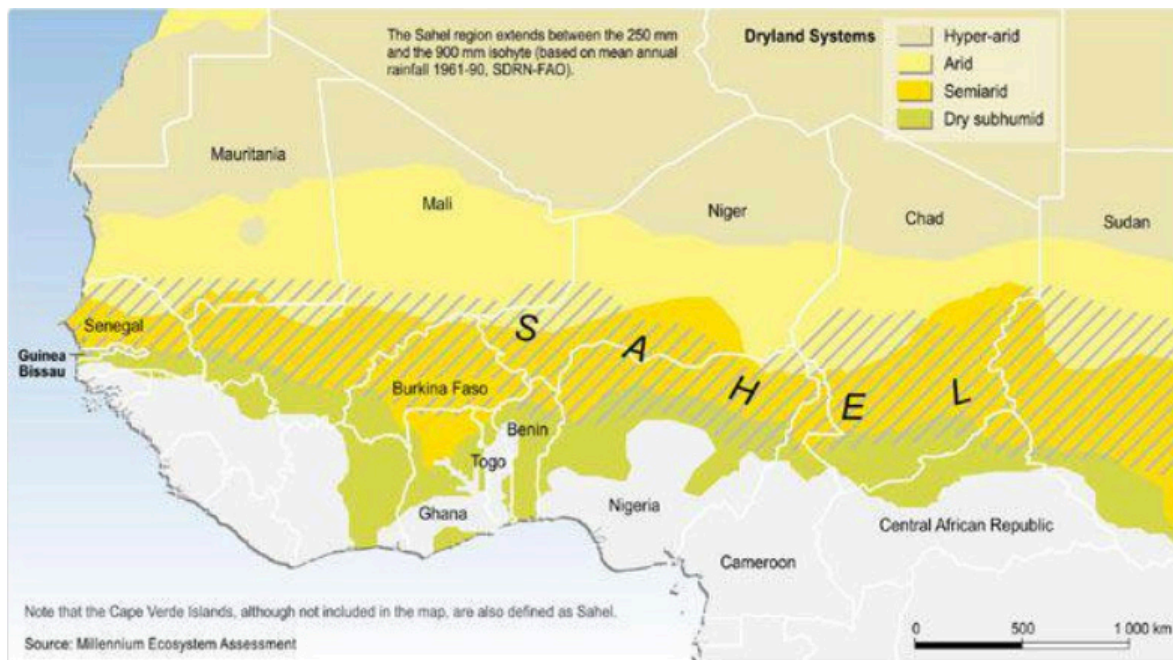
This climate change profile provides a brief analysis of climate change vulnerability and adaptive capacity in the countries in the West African Sahel: Burkina Faso, Chad,

Mali, Mauritania, Niger, and Nigeria¹. This region is one of the poorest and most environmentally degraded regions in the world. Drought and high inter-annual climate variability are already being felt in the region in the form of decreased agricultural yields, loss of pastureland, and the shrinking of important water bodies². It is one of the most vulnerable regions to climate change, not only because of rising temperatures and decreasing and erratic rainfall, but also because of its poverty, food insecurity, rapid population growth, gender inequality, political instability and conflict³. Climate change in the Sahel will amplify existing vulnerabilities, especially food insecurity and political instability⁴.

Overall ranking

The countries in the West African Sahel make only a minor contribution of an estimated 0.92% (if Nigeria is excluded⁵, 0.25%) to global GHG emissions with the per capita emissions of four of the countries (Burkina Faso, Chad, Mali and Niger) among the world's lowest 10% and two of the countries (Mauritania and Nigeria) among the lowest 25% (see [Table 1](#)). Additional information for Mali can be found in its Climate Change Country Profile.

West African Sahel region



Map source: originally in the Millennium Ecosystem Assessment (MEA) (2005), available at <http://kemperstichting.nl/accueil.html>

- ¹ Although Nigeria is often not included in the West African Sahel country cluster, northern Nigeria is included in this profile.
- ² A. Crawford (2015) Climate change and state fragility in the Sahel. FRIDE, Policy brief no.205, June 2015. Available at http://fride.org/download/PB205_Climate_change_and_state_fragility_in_the_Sahel.pdf
- ³ USAID (2017), Regional Fact Sheet, Climate Change Risk Profile, West Africa Sahel available at https://www.climatelinks.org/sites/default/files/asset/document/2017%20April_USAID%20ATLAS_Climate%20Change%20Risk%20Profile%20-%20Sahel.pdf
- ⁴ USAID (2017)
- ⁵ The large size of Nigeria's population is a primary reason for its larger contribution to global emissions.

Table 1. Ranking for climate change emissions and vulnerability

	Emission % (global) ⁸	Emissions Rank ⁹ (215 countries)	Rank Per Capita Emissions ¹⁰ (188 countries)	ND-Gain Index ¹¹ (181 countries)
Burkina Faso	0.05	142	175	164 14 th most vulnerable. 35 th least ready
Chad	0.06	172	187	180 3 rd most vulnerable. 4 th least ready
Mali	0.06	159	182	166 9 th most vulnerable. 43 rd least ready
Mauritania	0.02	143	141	154 23 rd most vulnerable. 42 nd least ready
Niger	0.06	152	179	175 #1 most vulnerable. 46 th least ready
Nigeria	0.67	41	148	145 58 th most vulnerable. 22 nd least ready

However, the countries in the West Sahel are very vulnerable to climate change. Like elsewhere in Africa, the burden of climate change will be borne by countries in the Sahel that produce very little of the greenhouse gases that are contributing to climate change⁶. According to the ND-GAIN Index⁷ which summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience, all but one of the Sahel countries (Nigeria) rank among the 20% most vulnerable to climate change, and three (Burkina Faso, Chad, Mali) are among the most vulnerable 10%. Vulnerability measures the exposure, sensitivity, and ability to cope with climate related hazards by accounting for the overall status of food, water, environment, health, and infrastructure within a country. Readiness measure a country's ability to leverage investments and convert them to adaptation actions by considering economic, governance and social readiness.

Biophysical Vulnerability

The Sahel (meaning "shore" in Arabic) is commonly defined as the area in Africa between 12°N and 20°N (see [Map 1](#))¹². Bordered on the west by the Atlantic Ocean it extends eastward to Chad, separating the Sahara to the north and the Sudanian Savanna to the south. A transitional ecoregion it includes semi-arid grasslands, savannas, steppes, and thorn

shrublands. It has a hot, semi-arid climate characterized by very high temperatures year-round, a long dry season from October-May, and a brief, irregular rainy season linked to the West African monsoon¹³. Of the six Sahelian countries, two of the countries (Mauritania, Nigeria) have Atlantic coastal areas and four are landlocked (Burkina Faso, Mali, Niger, Chad). Topographically the Sahel is mainly flat with most of it lying between 200 and 400 m in elevation with highlands in northern Chad, Niger, and Mali.

Mean annual temperature range between 21.9-36.4°C with cooler temperatures in the highlands and coastal zone of Mauritania. Mean annual rainfall is highly variable with a general pattern of lower rainfall in the north (100-200 mm)¹⁴ than in the south (500-600 mm) with the rainy season in the north ranging from one to two months and four to five months in the south. In the winter (November-March) the Harmattan, dry sand laden winds, blow from the Sahara Desert of the northeast across West Africa to the Gulf of Guinea¹⁵ to the southwest, resulting in desert-like weather conditions, haze, and producing dust/sandstorms. Multi-decadal droughts reoccur and inter-annual rainfall variations are high. Drought is the major environmental concern of this region¹⁶ (see below).

Climate trend

The West Sahel has become measurably drier and hotter¹⁷. The trends during the last 50 years include^{18 19}:

- Temperature has risen with an average temperature increase between 0.6-0.8°C, slightly higher than the global average increase;
- Increase in the number of warm days/nights and decrease in number of cold days/nights;

⁶ Interagency Regional Analysis Network (IRAN) (2017) East Africa and the Horn in 2022. <http://www.iris-france.org/wp-content/uploads/2017/03/IRAN-East-Africa-to-2022-revised.pdf>

⁷ GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. <http://index.gain.org/>

⁸ WRI (2018) <http://www.wri.org/resources/data-sets/cait-historical-emissions-data-countries-us-states-unfccc> (2013 data)

⁹ <http://www.globalcarbonatlas.org/en/CO2-emissions> (2013 data)

¹⁰ <https://en.actualitix.com/country/wld/co2-emissions-per-capita.php> (2011 data)

¹¹ GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. For the overall ranking lower ranking denotes less vulnerability and higher readiness. (#1 being the least vulnerable). For the vulnerability and readiness rankings, the lower ranking denotes higher vulnerability and least readiness (#1 being the most vulnerable; least ready). <http://index.gain.org/>

¹² P. Heinrigs (2010) Security Implications of Climate Change in the Sahel Region: Policy considerations. OECD Sahel and West Africa Club Secretariat. Available at <https://www.oecd.org/swac/publications/47234320.pdf>

¹³ USAID (2017)

¹⁴ 200 mm is considered to be the minimum rainfall for rainfed agriculture – although the rainfall pattern is also a major factor.

¹⁵ Gulf of Guinea is the northeastern most part of the tropical Atlantic Ocean from Gabon, north and west to Liberia.

¹⁶ S. Norrgård (2017) Changes in Precipitation over West Africa during recent centuries. Climate Science. Available at <http://climatescience.oxfordre.com/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-536>

¹⁷ USAID (2017); IPCC (2014), CDKN (2014)

¹⁸ USAID (2017)

¹⁹ IPCC (2014); CDKN (2014).

- Reduction in cumulative rainfall with less rainfall in the western Sahel (Burkina Faso, Mali, Mauritania) than in the Eastern Sahel (Niger, Chad, and northern Nigeria); in the 1970s and 1980s the region experienced one of the most severe multiyear droughts of the last hundred years with a 30% decrease in rainfall. Since the 1980s rainfall has not returned to pre-1960s levels.
- Lengthening of the dry season with rainfall less frequent, of shorter duration and with greater intensity.
- Increase in frequency and severity of extreme rainfall events and flooding.

An analysis of historical observations²⁰ for the average precipitation for the month of August over the period 1990–2000 in the Sahel, suggests the presence of at least three climate hotspots (see [Map 2](#)) in the Sahel of which two are in the West Sahel: one lies along the most western part of the region (Senegal and Mauritania) with the second stretching between Mali and Niger²¹. These climate hotspots experienced rainfall declines by up to 100% during the 10 most severe droughts of the 20th century²². These findings are reflected in the reports of West Sahel countries to the UNFCCC (e.g. National Communications²³) which include observations of erratic rainfall, the shift of isohyets to the south (see [Map 3](#))²⁴, increased occurrences of dry spells, and severe multi-year droughts, such as the droughts in 1972–1990 and the more recent droughts over the last 10 years²⁵.

Future climate

Climate projections suggest that the West Sahel will be hotter and drier with more frequent extreme events.

Temperature. Projections for temperature suggest that an increase, especially for summer, is likely to largely exceed the global mean increase. The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment (2014) climate model projections (CMIPs) suggest that unprecedented change in climate will occur earliest in Sahel and West Africa by the late 2030s to early 2040s^{26, 27}. Temperatures will rise and extremely hot seasons will become more frequent in the future²⁸. By 2100, temperatures will rise +3°C in the coastal areas (Mauritania) and up to +4°C in the inland countries of

Mali, Chad, Burkina Faso, and Niger²⁹. The summer months (June–September) will experience maximum warming. There will be a decrease in the frequency of days and nights that are considered ‘cold’; in much of the region ‘cold’ nights will not occur at all by the 2090s³⁰.

Precipitation and Rainfall Pattern. There is not a similar consensus on rainfall as there is for a rise in temperature, however, for the western-most Sahel most models agree on a significant decline in annual precipitation.³¹ Rainfall projections are hampered by the lack of data³² and in-depth understanding of the interplay of the three processes of the West Sahelian rainfall: a flow of moist air from the south associated with the west African monsoon, the seasonal movement of the Intertropical Convergence Zone (ITCZ) and a dry advection from the Sahara (Harmattan)³³. While there are differences, the projections are suggesting a decrease in rainfall, particularly in the northern region of the Sahel, with some areas in the southern Sahel receiving moderately higher although erratic rainfall.³⁴

Declining access to water. By 2030–2050, it is anticipated that changes in temperature and precipitation due to climate change will have variable impacts on surface water levels in different areas of the region. In general, river basins and their water supplies in the Sahel, and particularly in the Western Sahel, will be very vulnerable to climate change because of the projected higher temperatures and lower precipitation by the 2050³⁵. Climate variability and change - in addition to stressors such as population and economic growth, poor water management and infrastructure, inefficient water provision, inadequate joint management of basin resources, declines in groundwater, and land use/land cover changes - are expected to further reduce river basin water supply in the future. Climate change is estimated to contribute to the projected decline in river flows of 15–20% for 2020 and of 20–40% by 2050³⁶.

Extreme events. Droughts are likely to increase in severity with a decrease in rainfall and increase in temperature, particularly during the summer.³⁷

²⁰ Heinrigs (2010) OECD Sahel and West Africa Club Secretariat.

²¹ Heinrigs (2010).

²² Heinrigs (2010).

²³ http://unfccc.int/national_reports/items/1408.php

²⁴ See the Second National Communication of Burkina Faso to the UNFCCC which includes a map of the shift in isohyets to the south. Available at <http://unfccc.int/resource/docs/natc/bfanc2e.pdf>

²⁵ Chad's NDC notes that 'Over the last ten years, Chad's Saharan and Sahelian zones have spread 150 km south'. Available at http://www4.unfccc.int/ndcregistry/PublishedDocuments/Chad%20First/INDC%20Chad_Official%20version_English.pdf

²⁶ IPCC (2014)

²⁷ USAID (2017); Heinrigs (2010);

²⁸ C. Buontempo (2010) West Africa and Sahel Club Secretariat, OECD. Sahelian Climate: past, current, projections. Available at <https://www.oecd.org/swac/publications/47092928.pdf>

²⁹ USAID (2017). The IPCC (2014) suggests that the temperature could rise in West Africa between 3°C and 6°C by the end of the 21st century under a range of scenario.

³⁰ Heinrigs (2010);

³¹ Buontempo (2010)

³² Norrgård (2017)

³³ Buontempo (2010)

³⁴ USAID (2017); Buontempo (2010)

³⁵ USAID (2013). Climate change and water resources in West Africa: Transboundary River Basins. Available at https://www.climatelinks.org/sites/default/files/asset/document/Transboundary%20River_CLEARED.pdf

³⁶ USAID (2013) citing CIFOR (2005) Natural Resources, Communities and Climate Change in West Africa: Impacts, Vulnerabilities and Responses. Center for International Forestry Research, Ouagadougou.

³⁷ Buontempo (2010)

Rising sea levels. Overall, for Africa due to increased ocean warming and increased loss of glaciers and ice sheets, the rate of sea level rise will very likely exceed that observed during the past three decades³⁸. The IPCC (2014) projects a sea level rise between 18 and 59 cm by 2100 which in the West Africa Sahel will threaten the coastal zone of Mauritania with possible sea level rise of up to 14.4 cm by 2050 increasing coastal erosion, affecting settlements, and increasing saline intrusion, which in turn affect groundwater, infrastructure and ecosystems along the coast.³⁹ Similar sea level rise is anticipated along the Nigerian coastal areas raising deep concerns over climate risks to its large coastal cities, populations, and industries⁴⁰.

Socio-economic and political vulnerability

Climate vulnerability is the result of the complex interplay between the short and longer-term trends of climate change (e.g. heat, drought, erratic rainfall, sea level rise) and the socio-economic and political factors that enable effective adaptation. The West African Sahel is a region of rapidly growing populations, poverty, food insecurity, gender inequality, illiteracy, conflict, and political instability. Of the West Africa Sahel countries (see Table 3), three (Burkina Faso, Chad, and Niger) rank in the bottom five countries of

Table 2. Climate Change in the West Sahel Countries

	Temperature (increase)	Precipitation ⁴¹	Rainfall pattern	Extreme Events
Burkina Faso ⁴²	3-4°C (2080-2099) ⁴³ Temperatures will increase in the north at a relatively higher rate than in the south.	Models inconsistent; likely less rainfall;	Increase in climate variability; longer dry periods and drought	Increase in temperature and drought conditions
Chad ⁴⁴	1.0-3.4°C by 2060s 1.6-5.4°C by 2090s ⁴⁵	-15 mm to +9 mm per month by the 2090s ⁴⁶	The amount of rain that falls in 'heavy' rainfall events is projected to increase in southern Chad but decrease in northern Chad; increase in drought	Heat wave durations to increase over all of Chad by 2065 and 2100 with central-northern Chad to experience the largest increases in the length of heat waves
Mali ⁴⁷	1.2 to 3.6°C (2060) 1.8 to 5.9°C (2090) ⁴⁸	Models inconsistent; likely less rainfall	Erratic rainfall	More frequent and longer droughts
Mauritania ⁴⁹	0.5 to 2°C (2040)	Models inconsistent; likely less rainfall in eastern areas	Erratic rainfall	Increase in sea level rise and flooding; coastal erosion; increased saline intrusion, largest cities at risk
Niger ⁵⁰	1°-1.6°C between 2020-2049 ⁵¹ 2.3°-2.6°C between 2020-2049	Models inconsistent	Rainfall is projected to begin later in the rainy season	Increase in drought frequency; Heat wave duration increase by middle and late 21 st century
Nigeria (North/Northeastern) ⁵²	1.1°-2.5° C by the 2060s 1.4°-4.6° C by the 2090s ⁵³ warming will be greater in the northern part of Nigeria.	Models inconsistent; north and south variability with drier north; ⁵⁴	Lower and erratic rainfall in the north	Heat wave duration projected to increase by middle (2046-2065) and late 21 st century (2081-2100); largest increase in length of heat waves in northern Nigeria

³⁸ The Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) (2017). Available at <https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report>

³⁹ USAID (2017); World Bank Climate Change Knowledge Portal (2018) available at http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=MRT&ThisTab=ImpactsVulnerabilities While this profile focuses on Northern/Northeastern Nigeria, the coastal zone of Nigeria is also vulnerable to sea level rise with a projected to increase by 0.4 to 0.7 m by 2100. World Bank Climate Change Knowledge Portal (2018) available at http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=NGA&ThisTab=ClimateFuture

⁴⁰ Nigeria's Second National Communication to the UNFCCC. Available at <https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-convention/national-communications-o>

⁴¹ As noted earlier, there are model uncertainties, but there is a degree of consensus that there will be an increase in climate variability, likely drier, and extreme events.

⁴² http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=BFA&ThisTab=ClimateFuture

⁴³ Temperature reference 1980-1999;

⁴⁴ http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=TCD&ThisTab=ClimateFuture

⁴⁵ Temperature reference 1986-2005;

⁴⁶ Uncertainty in rainfall projections. Suggestion that north will become drier, south possibly wetter. http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=TCD&ThisTab=ClimateFuture

⁴⁷ http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=MLI&ThisTab=ClimateFuture

⁴⁸ Temperature reference 1986-2005;

⁴⁹ http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=MRT&ThisTab=ClimateFuture

⁵⁰ http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=NER&ThisTab=ClimateFuture

⁵¹ Temperature reference 1986-2005

⁵² http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=NGA&ThisTab=ClimateFuture

⁵³ Temperature reference 1986-2005

⁵⁴ Average precipitation per year has decreased significantly in Nigeria by 3.5 mm per month per decade between 1960-2006

the global Human Development Index (HDI), one (Mali) in the bottom 10% and two (Mauritania and Nigeria) in the bottom 20%⁵⁵. Also, the West Sahelian countries⁵⁶ all rank in the bottom 25% of the Gender Inequality Index of the HDI. Within Africa four of the West Sahelian countries (Chad, Mali, Mauritania, and Niger) are in bottom 10 (of 52) African countries in the Africa Gender Equality Index (AGEI) with only Burkina Faso and Nigeria ranking in the top 50%. The OECD Social Institutions and Gender Index (SIGI) for West Africa had similar results (see [Map 6](#)) citing *very high* level of discrimination for women in Chad, Mali, Mauritania, Niger and Nigeria and a *high* level of discrimination in Burkina Faso in customary practices, social norms, in addition to discriminatory legal frameworks and poor implementation measures⁵⁷.

The instability of the West Sahel is reflected in the fragile state index ranking of its countries. Globally, Chad is ranked

as one of the ten most fragile states with Niger and Nigeria ranked as being among the twenty most fragile states. None of the three remaining countries (Burkina Faso, Mauritania and Mali) have a ranking below 44, placing all three within the 25% most fragile countries in the world. Due to its population growth rates, the West Sahel population (excluding Nigeria) of 81,063,984 is projected to more than double to 198,282,000 by 2050, placing an increasing number of people, already struggling with food insecurity, at risk to the consequences of climate change.

As in other regions in Africa (e.g. Greater Horn of Africa) the demographic, political instability and conflict, poverty, and climate change trends of the countries of the West Sahel are structural challenges that are interacting and driving one another to the detriment of its people⁷⁰. Climate change acts as a threat multiplier amplifying pre-existing vulnerabilities such as food insecurity and political instability.

Table 3. Socio-Economic Situation in the Sahel

	Burkina Faso	Chad	Mali	Mauritania	Niger	Nigeria ⁵⁸
GDP (PPP)⁵⁹	1771	1990	2125.7	3852.5	986	5861.1
Population (2018 est)⁶⁰	19,751,651	15,353,184	19,107,706	4,540,068	22,311,375	195,875,237
Pop. growth rate⁶¹	2.9	3.1	3.0	2.8	3.8	2.6
Pop. 2050⁶²	43,207,000	33,636,000	44,020,000	8,965,000	68,454,000	410,638,000
Pop. Density⁶³	68	11	15	4	16	204
Human Development Index (HDI) (2016)⁶⁴ (188 countries)	185	186	175	157	187	152
Corruption Perception Index (CPI) (2017)⁶⁵ (180 countries)	72	159	116	143	101	148
Gender Inequality Index (GII) (2016)⁶⁶ (188 countries)	146	157	156	147	157	n.a.
Africa Gender Equality Index (2015)⁶⁷ (52 countries)	22	44	50	46	45	23
Fragile State Index (2017)⁶⁸ (178 countries)	44	8	31	28	20	13
Adult Literacy (%)⁶⁹	34.6 (2014)	22.3 (2016)	33.07 (2015)	45.5 (2007)	15.4 (2012)	51.08 (2008)

⁵⁵ <http://hdr.undp.org/en/content/human-development-index-hdi>

⁵⁶ Nigeria is not assigned a ranking in the GII.

⁵⁷ Bouchama, N., et al. (2018), "Gender Inequality in West African Social Institutions", West African Papers, No. 13, OECD Publishing, Paris, <http://dx.doi.org/10.1787/fe5eaoca-en>.

⁵⁸ National data.

⁵⁹ <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

⁶⁰ World Population Review 2018 estimates <http://worldpopulationreview.com/countries/>

⁶¹ <https://data.worldbank.org/indicator/SP.POP.GROW>

⁶² UNDESA (2017): *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP/248. https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf

⁶³ <https://data.worldbank.org/indicator/EN.POP.DNST>

⁶⁴ <http://hdr.undp.org/en/content/human-development-index-hdi>

⁶⁵ https://www.transparency.org/news/feature/corruption_perceptions_index_2017

⁶⁶ <http://hdr.undp.org/en/composite/GII>

⁶⁷ Developed by the African Development Bank, it reflects the status of women along three dimensions of equality: economic opportunities, social development, and law and institutions. The index ranks 52 African countries according to their overall score and to these distinct dimensions of equality. Available at https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/African_Gender_Equality_Index_2015-EN.pdf

⁶⁸ <http://fundforpeace.org/fsi/>

⁶⁹ <https://www.indexmundi.com/facts/indicators/SE.ADT.LITR.ZS/rankings>

⁷⁰ Inter-agency Regional Analysis Network: East Africa and the Horn in 2022 (2017) <http://www.iris-france.org/wp-content/uploads/2017/03/IARAN-East-Africa-to-2022-revised.pdf>

In the West Sahel, economic reliance on farming and pastoralism link livelihoods and food security to weather trends and environmental conditions⁷¹. Agriculture is vitally important to national economics and livelihoods in the West Sahel contributing about 40% of the combined regional GDP and engaging more than 70% of the labor in Niger, Burkina Faso, Mali and Chad and over 50% in Mauritania. Agriculture plays a less important role in Nigeria, contributing less than 25% to the GDP and employing around 20% of labor. However, agriculture and livestock play a more important role in the north of the country (the most vulnerable region to climate change⁷²) than in its southern part⁷³. Farming in the West Africa Sahel is practiced down to the 350 mm rain belt while pastoralism provides the principal livelihood below the agriculture threshold (see [Map 4](#))⁷⁴. Agriculture in the West Sahel is almost entirely rain-fed and reliant on the limited three to four months of increasingly variable summer rainfall (June-September) making it highly vulnerable to climate variability and putting at risk the large percentage of the region's people that rely on agriculture as their primary source of livelihood. The generally nutrient limited soils in the regions, which are being degraded by overgrazing, continuous cropping, and deforestation, will be further threatened by desertification and sand intrusion brought about by reduced precipitation and higher temperatures.⁷⁵ The degraded environmental conditions have fostered the growing pattern of north-south and rural urban migration taking place in the regions, especially within Niger, Burkina Faso and Mali (see below).

Burkina Faso, Chad, Mali and Niger are the major cereal producers in the region and export to the neighboring countries. Staple dryland crops include millet, sorghum and cowpeas, with cotton and groundnut the major cash crops. Agricultural productivity in the region is already low by global standards and anticipated to fall even further due to the impact of climate change, not only because of the biophysical changes, but the limited economic and institutional capacity to cope with and adapt to climate variability and change⁷⁶. Examples of the impact in countries in the West Sahel include⁷⁷

- Decrease in millet and sorghum yield by 15-25% by 2080 in the region;
- Chad and Niger could potentially lose their entire rain-fed agriculture by 2100, while the cereal harvest in Mali might decline by 30%⁷⁸;

Livestock rearing plays a significant role in the West Sahel region contributing up to 10-15% of GDP in Burkina Faso, Chad, Mali and Niger, and a larger share in Mauritania where 50% of the population is pastoralist⁷⁹. Pastoralism has a long history in the West Sahel as livestock were moved from northern to southern pastoral areas during the dry season and back north during the wet season⁸⁰. The seasonal movement usually follow a similar pattern from year to year, over areas known to the herders (see [Map 7](#))⁸¹. Climate change threatens livestock production by affecting forage and fodder production, water availability, and livestock productivity (e.g. decreased milk production fertility, fitness, and longevity, and reduced calving rates)⁸². As drought and reduced rainfall diminish and alter traditional grazing areas and water resources, pastoral communities are increasingly under threat of losing their livelihoods and coming into conflict with settled agrarian communities as land degradation and competition over water and land resources increase⁸³ (see below).

In the West Sahel climate change does not affect all people equally. Women are among the most vulnerable. Existing social and economic disparities, which are the result of their limited access to land, credit, technology and low level of participation in decision-making, significantly reduce their ability to be resilient to external shocks.⁸⁴ Their role as primary caregivers and providers of food and fuel make them more vulnerable when droughts and floods occur. Resource shortages force women and girls to spend more time and go further to collect water and fuel wood. Increasingly long dry seasons and drought place greater demands on rural women to support their families as men migrate to urban areas for work (see below)⁸⁵. Since women are more likely to experience poverty it is more difficult to recover from climate-related disasters.

⁷¹ A. Crawford (2015) Climate change and state fragility in the Sahel. FRIDE, Policy brief no.205, June 2015. Available at http://fride.org/download/PB205_Climate_change_and_state_fragility_in_the_Sahel.pdf

⁷² Nigeria's Second Communication to the UNFCCC (2014) available at <http://unfccc.int/resource/docs/natc/nganc2.pdf>

⁷³ World Bank (2017 data) available at <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS> ; <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=NG>

⁷⁴ 200 mm annual precipitation isohyet is defined as used as the cut-off for aridity, below which farming and herding are not possible.

⁷⁵ USAID (2017)

⁷⁶ B. Sultan and M. Gaetani, (2016) Agriculture in West Africa in the Twenty-First Century: Climate Change and Impacts Scenarios, and Potential for Adaptation, *Frontiers in Plant Science*, 7: 1262. doi: 10.3389/fpls.2016.01262

⁷⁷ USAID (2017)

⁷⁸ USAID (2017) citing UNEP (2011), Livelihoods Security: Climate Change, Migration and Conflict in the Sahel. Available at <https://publications.iom.int/books/livelihood-security-climate-change-migration-and-conflict-sahel>

⁷⁹ USAID (2017)

⁸⁰ UNEP (2011)

⁸¹ OECD (2018). Transhumance and nomadism. Maps and Facts. No. 65. February 2018. Sahel and West Africa Club (SWAC). Available at <http://www.oecd.org/swac/maps/65-transhumance-nomadism.pdf>

⁸² USAID (2017)

⁸³ USAID (2017); UNEP (2011);

⁸⁴ M. D. Doka, D. Madougou, and A. Diouf (2014) Food crisis, gender, and resilience in the Sahel: Lessons from the 2012 crisis in Burkina Faso, Mali, and Niger. Oxfam Research Reports. https://reliefweb.int/sites/reliefweb.int/files/resources/rr-food-crisis-gender-resilience-sahel-160614-en_o.pdf

⁸⁵ T. Gaulkin (2018) Women and climate resilience. *Bullet of the Atomic Scientist*. Available at <https://thebulletin.org/women-and-climate-resilience11593>

Climate change, conflict and migration

The relationship between climate change, conflict and migration is complex. Steady urbanization and long-established international, intra-regional and circular migration between rural and urban areas are important and on-going demographic trends. In the past and present, West Sahel livelihood strategies have included migration. Pastoralists, as noted above, seasonally move their herds⁸⁶. Predating colonialism, in response to the extremely seasonal and unimodal distribution of rainfall, 'circular migration' is a common practice in which people travel long distances, especially to towns and to work by the roadsides, to seek work or alternative sources of income during the agricultural off-season when they are unable to grow food. For agricultural households particularly vulnerable to rainfall variability, this seasonal migration also establishes social and economic networks and provides a hedge against the frequent droughts that occur in the region⁸⁷. Climate change is expected to intensify the conditions which result in migration, in particular in the poorest and most climate-vulnerable areas. Climate variability, particularly multi-seasonal drought in dryland areas, is anticipated to increase the pace of internal migration and the refugee flows in the region⁸⁸.

In response to crises and opportunities, there is robust long-term rural-urban migration as well as migration within the region and a much smaller migration to the OECD countries⁸⁹. Over the past 60 years, urbanization has fundamentally changed West Africa with the number of people living in cities increasing from 5 million in 1950 to 133 million in 2010. During the same period the number of towns and cities with more than 10,000 inhabitants grew from 159 to close to 2,000, the large majority of which are secondary cities and small towns^{90 91}. Urbanization in the

four internal Sahelian countries ($\pm 20\%$ Burkina Faso, Mali, Niger, and Chad) are lower than those countries with coastal areas ($+30\%$ Mauritania and Nigeria)^{92 93}.

In West Africa the majority of people who leave their country stay within the region. The south-south migration is seven times greater than flows from West Africa to other parts of the world, including Europe⁹⁴. Of the West Sahel countries, Burkina Faso and Mali have the highest percentage of migrant populations (9.6% and 5.1%) with Cote d'Ivoire the top regional destination for both. Italy, France and Germany were the destination OECD countries for Burkina Faso and France and Spain for Mali⁹⁵.

Analysis by the International Organization for Migration (IOM) and a recent study by the World Bank suggest, as noted above, that 'environmental' migration is primarily internal (within the country) with a smaller proportion moving cross border, principally to neighboring countries⁹⁶. As reflected in past and current trends, migration can be temporary or permanent depending on the environmental trigger⁹⁷. In the West Sahel it is anticipated that there will be an increase in rural-urban migration in response to an increase in climate-related risks. This will increase the pressure on urban areas as anticipated crop failures and high livestock mortality will encourage rural to urban migration, placing increasing pressure on urban employment, housing, energy, health and sanitation⁹⁸. However, also cities may become areas of out-migration as a result of climate-related risks such as water scarcity, flooding and high temperatures⁹⁹.

Conflict. Competition over resources such as land and water is driven by a number of factors. In the Sahel there has been an increase in tensions between pastoralist and farmers

⁸⁶ OECD (2018). Transhumance and nomadism. Maps and Facts. No. 65. February 2018. Sahel and West Africa Club (SWAC). Available at <http://www.oecd.org/swac/maps/65-transhumance-nomadism.pdf>

⁸⁷ D. Rain (1999). Eaters of the Dry Season: Circular Labor Migration in the West African Sahel. Available at <http://agris.fao.org/agris-search/search.do?recordID=US201300037266>

⁸⁸ World Bank (2018). Groundswell: Preparing for Internal climate migration. Policy Note #1, Internal Climate Migration in Sub-Saharan Africa. Available at <https://openknowledge.worldbank.org/bitstream/handle/10986/29461/GroundswellIPN1.pdf?sequence=6&isAllowed=y>

⁸⁹ Migration Western Sahel (2015). Klima Navigator. available at <http://www.klimanavigator.de/dossier/artikel/057935/index.php>

⁹⁰ L. Hitimana, P. Heinrigs, and M. Tremolieres (2010) West African Urbanisation Trends, West African Future: Settlement, Market and Food Security. Sahel and West Africa Club (SWAC), OECD. Available at <https://www.oecd.org/swac/publications/48231121.pdf>

⁹¹ R. Curiel, P. Heinrigs, and I. Heo (2017) Cities and Spatial Interactions in West Africa: A clustering analysis of the local interactions of urban agglomerations. West African Papers. No. 5. March 2017. Available at <https://www.oecd-ilibrary.org/docserver/57b30601-en.pdf?expires=1523778529&id=id&accname=guest&checksum=F62907CoC1F-F3989A8952D6EBA6172C>

⁹² OECD/SWAC (2014) An Atlas of the Sahara-Sahel: Geography, Economics and Security. West African Studies. OECD Publishing. Available at https://read.oecd-ilibrary.org/agriculture-and-food/an-atlas-of-the-sahara-sahel_9789264222359-en#page36

⁹³ Hitimana et al. (2010);

⁹⁴ International Centre for Migration Policy Development (ICMPD) (2015). West Africa: migration flows mostly take place within the region, not outside. Available at <https://www.icmpd.org/news-centre/press-releases/west-africa-migration-flows-mostly-takes-place-within-the-region-not-outside/> Citing A survey on Migration policies in West Africa (2015) Available at https://www.icmpd.org/fileadmin/ICMPD-Website/ICMPD_General/Publications/2015/A_Survey_on_Migration_Policies_in_West_Africa_EN_SOFT.pdf

⁹⁵ World Bank (2016) Migration and Remittances Factbook. Available at <https://openknowledge.worldbank.org/bitstream/handle/10986/23743/9781464803192.pdf?sequence=3&isAllowed=y>

⁹⁶ World Bank (2018)

⁹⁷ IOM (2018) http://publications.iom.int/system/files/pdf/meccinfos-heet_climatechangeactivities.pdf

⁹⁸ USAID (2016)

⁹⁹ Nigeria's Second Communication to the UNFCCC, for example, expresses far more concern over the coastal areas, especially urban centers such as Lagos, than to the effects of climate change on the agricultural sector. Available at <http://unfccc.int/resource/docs/natc/nganc2.pdf>

with increasing competition for land and water. Northern pastoralists are extending further southwards (see [Map 7](#)) into areas traditionally dominated by crop agriculture. In southern Mali, for example, farmers are expanding crop production into migratory corridors traditionally used by herders. Expansion into pastoralist areas is fragmenting the migratory routes of pastoralists, triggering grievances and tension, while of movement of livestock into crop fields threatens farmer income¹⁰⁰.

It is well-accepted that climate change can fuel existing tensions such as that between pastoralists and farmers and there is on-going analysis and discussion as to the complex and intertwined relationship between climate change and armed conflict¹⁰¹. There is agreement that areas in which there is conflict, such as in Chad and Northeastern Nigeria, are more vulnerable to the effects of changing climate conditions compared to more politically stable areas. It is also recognized that climate change is the 'ultimate threat multiplier' with extreme weather events and sea level rise resulting in livelihood insecurity and migration, fueling local resource and transboundary water competition, and driving up food prices¹⁰². A prevailing view suggests that while the root causes of conflict are more historical and political, climate-related factors such as drought, flood, and migration often heighten conflict^{103 104}. Under certain conditions (e.g. history of violence, low levels of development, poor governance and inequality) climate change can increase the risk of conflict and affect the dynamics of conflict, including the conflict's duration, severity and likelihood of ending quickly¹⁰⁵. When institutions cannot address the shocks brought about by climate change, even stable states can be 'pushed to fragility'¹⁰⁶.

Lake Chad. The shrinking of Lake Chad and its far-reaching consequences is an often-cited example of how a combination of weak institutions, poor resource management, population growth and pressure, climate change and violent extremism can result in a disastrous social, economic and political situation (see [Maps 8 and 9](#)). Lake Chad Basin is currently one of the most unstable areas in the world. There are

2.3 million displaced people and around 4.5 million people across the conflict-hit region are food insecure, still needing food assistance as armed attacks and insecurity continue¹⁰⁷.

Lake Chad sits in the Chad Basin near Niger, Nigeria and the Cameroon¹⁰⁸. The Lake Chad Basin is the largest inland drainage area in Africa and covers an area of 2,434,000 km², equal to 8% of the total area of the African continent. The basin extends through seven countries: Algeria, Cameroon, Niger, Nigeria, Central Africa Republic, Chad, and Sudan¹⁰⁹. The water level is largely the result of the inflow from the Chari River from the south and, seasonally the Komodugu-Yobe river from the northwest. Rainfall also reaches the lake from smaller tributaries and groundwater discharge¹¹⁰. Inflow fluctuates with the shifting patterns of rainfall associated with the West African Monsoon, making it very sensitive to drought with years of little rain having a direct relationship with the water supply¹¹¹.

The Lake Chad Basin Commission (LCBC) was established by Cameroon, Niger, Nigeria, and Chad¹¹² in 1964 with the objective to i) sustainably and equitably managing the lake's natural resources; ii) preserving the lake's ecosystems; and iii) promoting economic integration and peace between the founding countries¹¹³. However, the Lake Chad Basin Commission manages only about 20% (427,500 km²) of the total area of the basin. Underfunded with little authority, the LCBC has only minimal influence on the area under its management.

Since 1963 when Lake Chad spanned an estimated 25,000 km², it has contracted by over 90 percent, down to 1,350 km². In addition to a decline in rainfall for much of the period, resource misuse and overuse as well as the increased demand for water associated with population growth contributed to this massive contraction. Between 1983 and 1994, the volumes of water used for irrigation were four times larger than during the previous 25 years. The population in the region increased from 13 million in 1960 to more than 35 million in 2007 and is expected to continue to grow by another 75 percent by 2025¹¹⁴. The reduction in the size of the lake has severely threatened the resources and livelihoods of the population

¹⁰⁰ Crawford (2015)

¹⁰¹ UNEP (2011).

¹⁰² Planetary Security Initiative (2017) A new climate for peace: Taking action on climate fragility and risks. Available at <https://www.planetarysecurityinitiative.org/news/action-climate-and-security-risks>

¹⁰³ USAID (2017)

¹⁰⁴ The United Nations Security Council on March 31, 2018 voted unanimously the [Resolution 2408](#), reaffirming climate change as one of the factors that destabilize the region and induce conflict in Somalia. Available at <https://www.planetarysecurityinitiative.org/news/unsc-reaffirms-climate-change-driver-fragility-and-conflict>

¹⁰⁵ Wilson School (2018). Climate change and conflict: new research for defense, diplomacy, and development. <https://www.wilsoncenter.org/event/climate-change-and-conflict-new-research-for-defense-diplomacy-and-development>

¹⁰⁶ Planetary Security Initiative (2017)

¹⁰⁷ OCHA (2018) Lake Chad Basin: Crisis Overview (March 26, 2018) Available at https://public.tableau.com/profile/oumou.sy7865#!/vizhome/lcb_snapshot/Tableaudebord1

¹⁰⁸ K. Hansen (2017). The Rise and Fall of Africa's Great Lake. Earth Observatory. Available at <https://earthobservatory.nasa.gov/Features/LakeChad/>

¹⁰⁹ USAID (2013)

¹¹⁰ Hansen (2017)

¹¹¹ Hansen (2017)

¹¹² In 1996, the Central African Republic became a member of the Lake Chad Basin Commission, followed by Libya in 2008.

¹¹³ USAID (2013)

¹¹⁴ UNEP (2011)

in the Lake Chad region¹¹⁵. The drying-up of the Northern half¹¹⁶ of the Lake caused migration to the remaining Southern shores, intensifying pressure on resources for agriculture, fishing, and livestock breeding in the rest of the lake area and related conflicts with spill over migration to Europe¹¹⁷. As the receding waters exposed new islands, land ownership issues created tensions between Cameroon, Chad, Niger and Nigeria¹¹⁸. The lack of capacity of existing political institutions to resolve these competing claims increased the likelihood of violent conflicts over resources. Disputes focusing on land and on fish catches and on access to and use of water, are occurring regularly. Numerous conflicts have broken out among pastoralists and farmers, and between different ethnic groups in Niger, because of the loss of the lake and its resources¹¹⁹.

Conflicts over the diminished and degraded resources are occurring within the larger political context of the Boko Haram, the greater majority of whom are of the Kanuri ethnic group which historically resided in the Lake Chad Basin area. Recent analysis¹²⁰ suggests that non-state armed groups, such as Boko Haram, thrive in a fragile environment such as Lake Chad in which resource scarcity erodes the livelihoods of many people, aggravates poverty and unemployment, leads to population displacement, and increases local competition for land and water that often fuels social tensions and even violent conflict. In this context Boko Haram can operate more easily and engage not only in acts of violence but also in transnational organized crime. At the same time, as climate change degrades yields from agriculture, cattle rearing and fisheries, many people are left unemployed, with few economic opportunities and low levels of education making them extremely vulnerable not only to negative climate impacts but also to recruitment from terrorist groups such as Boko Haram¹²¹.

National Strategies and Policies

All the countries in the West Sahel have ratified the UN Convention on Biological Diversity (CBD), the Convention to Combat Desertification (CCD), the Framework Convention on Climate Change (UNFCCC) and the Kyoto Agreement. The countries have also signed and ratified the Paris agreement on climate change. Four of the countries (Burkina Faso, Chad, Mali, and Nigeria) have prepared two National Communications to the UNFCCC; Mauritania and Niger have prepared a Third National Communications. Burkina Faso is the only country in the region that has submitted a National Adaptation Plan (NAP)¹²² and Mali the only one that submitted Nationally Appropriate Mitigation Actions (NAMA¹²³) to the UNFCCC¹²⁴.

In addition to the reports and commitments submitted to the UNFCCC, West Sahel countries have prepared national climate change-related strategies, policies and actions:

- *Burkina Faso*: has prepared a number of strategies and proposed actions: Strategic Framework for Investment in Sustainable Land Management (SFI-SLM); Strategy for Accelerated Growth and Sustainable Development (SAGSD); National Adaptation Plan (NAP); NAMA Framework (2008); National Action Programme for Adaptation for Climate Change (NAPA) (2007); The National Strategy for implementing the Climate Change Convention (2001).
- *Chad*¹²⁵: Country Resilience Priorities (PRP) AGIR CHAD (2020); National Investment Plan for the Rural Sector (PNISR) (2014 - 2020); National Adaptation Programme of Action for Climate Change (NAPA);
- *Mali* - National Policy on Climate Change (2008); National Climate Change Strategy (NCCS) (2011)¹²⁶;
- *Mauritania*: prepared one of the first National Action Programme for Adaptation (NAPA) (2004) submitted to the UNFCCC; National Environmental Action Plan (PANE);
- *Niger*: National Action Programmes for Adaptation (NAPAs); Strategic Framework for Sustainable Land Management (SF-SLM);

¹¹⁵ M. Sow (2017). Brookings : Africa in Focus, website article <https://www.brookings.edu/blog/africa-in-focus/2017/02/09/figure-of-the-week-the-shrinking-lake-chad/>

¹¹⁶ The area which has been the Northern lake is now a desert.

¹¹⁷ S.M. Abdullahi, (2017) Executive Director of Lake Chad Basin Commission (LCBC). Speech given at the High-Level Conference on Africa: Towards a renewed partnership with Africa. European Parliament. Available at <http://www.europarl.europa.eu/cmsdata/133421/ABDULLAHI%20Lake%20Chad%20Commission%20speech%2022%20November.pdf>

¹¹⁸ UNEP (2011)

¹¹⁹ UNEP (2011)

¹²⁰ K. Nett and L. Ruttinger (2016) Insurgency, Terrorism and Organised Crime in a Warming Climate Analysing the Links Between Climate Change and Non-State Armed Groups. Climate Diplomacy Initiative. Available at <https://www.climate-diplomacy.org/publications/insurgency-terrorism-and-organised-crime-warming-climate>

¹²¹ The results of a two-year G-7 Climate-Fragility Risk Assessment on Lake Chad (2017-2019) will be reported at the Planetary Security Initiative conferences. <https://www.adelphi.de/en/in-focus/g7-lake-chad-risk-assessment-project>

¹²² [http://www.unfccc.int/nap/Documents/Parties/PNA_Version_version%20finale\[Transmission\].pdf](http://www.unfccc.int/nap/Documents/Parties/PNA_Version_version%20finale[Transmission].pdf)

¹²³ Two projects for preparation: renewable energy and energy efficiency; forestry sector. Available at <http://www.unfccc.int/sites/nama/SitePages/Country.aspx?CountryId=107>

¹²⁴ The Burkina Faso NAP comprises (i) adaptation plans for each development sector and (ii) a global adaptation plan for the entire country. Available at [http://www.unfccc.int/nap/Documents/Parties/PNA_Version_version%20finale\[Transmission\].pdf](http://www.unfccc.int/nap/Documents/Parties/PNA_Version_version%20finale[Transmission].pdf)

¹²⁵ See the Adaptation Partnership (2011) review of the Adaptation strategies and proposed actions. Available at https://www.preventionweb.net/files/25674_chad.pdf

¹²⁶ Mali Ministry of Environment and Sanitation (2011): *Stratégie Nationale Changements Climatiques – Mali*. <http://mptf.undp.org/document/download/8101>

- *Nigeria*: The National Agricultural Resilience Framework (NARF 2014)¹²⁷; National Adaptation Strategy and Plan of Action for Climate Change Nigeria (NASPA-CCN)¹²⁸; Nigeria Climate Change Policy Response and Strategy;

are similar actions for large scale restoration of degraded lands, including afforestation/reforestation/agroforestry and improved pasture; climate-smart or conservation agriculture including improved seeds, crop diversification and for livestock, rotational grazing; water harvesting and efficiency; and early warning systems.

Nationally Determined Contributions (NDC)

Prior to COP21 in Paris at the end of 2015, all the West Sahel countries submitted an Intended Nationally Determined Contribution (INDC) to UNFCCC, which they later submitted as their First NDC. In their NDCs the countries stressed their vulnerability to climate change, especially for food security, and while committing to do their fair share for emissions, highlighted adaptation as the priority and included adaptation actions. While the proposed NDC adaptation actions reflect each country's priorities (see [Table 4](#)), there

Although low emissions countries, each makes a commitment to lower emissions taking into consideration their business-as-usual scenario. As with proposed adaptation actions, while the NDCs reflect each of the country's priorities, there are similar interests and actions in renewable energy, energy efficiency, transport, and reforestation/afforestation (to mitigate emissions). The majority of the proposed mitigation and adaptation actions are conditional, requiring significant international finance and technical assistance for implementation (see [Table 4](#)).

Table 4. NDC Targets and Priorities

	NDC ¹²⁹	NDC ¹³⁰ Targets and Priorities ^{131 132}	
		Mitigation	Adaptation ¹³³
Burkina Faso	11/11/2016	18.2% reduction: 6.6% unconditional; 11.6% conditional	Agriculture, water management, and land use: <ul style="list-style-type: none"> • Restore and maintain land fertility of 1.575 million ha of cropland; • Restore 1.125 million ha of degraded land for pasture and forest; • 10,000 tons of fodder collected and stored each year; • 30,000 ha of stream banks protected; • Compost from biogas digesters fertilize 750,000 ha.
Chad	12/01/2017	18.2% unconditional; 71% conditional	Agriculture, livestock and fisheries: <ul style="list-style-type: none"> • Develop intensive and diverse cultivation; • Use improved inputs, (organic fertilizers including composts, adapted plant varieties); • Agroforestry; • Land and water conservation; • Common grazing zones, creating and popularizing fodder banks, crossbreeding of animal species; • Development of enclosed fish farming areas.

¹²⁷ <https://cgspace.cgiar.org/handle/10568/68165>

¹²⁸ <http://csdevnet.org/wp-content/uploads/NATIONAL-ADAPTATION-STRATEGY-AND-PLAN-OF-ACTION.pdf>

¹²⁹ <http://www4.unfccc.int/ndcregistry/Pages/Home.aspx>

¹³⁰ Target year: 2030 except for Niger which includes targets for 2020 and for 2030

¹³¹ NDCs are posted on the NDC registry, UNFCCC. Available at <http://www4.unfccc.int/ndcregistry/Pages/Home.aspx>

¹³² World Bank NDC Platform includes analysis of each country's NDC. Available at <http://spappssecext.worldbank.org/sites/indc/Pages/INDCHome.aspx> <http://www.worldbank.org/en/topic/climatechange/brief/the-ndc-platform-a-comprehensive-resource-on-national-climate-targets-and-action>

¹³³ Targets and priorities in agriculture, water, sustainable land management.

	NDC ¹²⁹	NDC ¹³⁰ Targets and Priorities ^{131 132}	
		Mitigation	Adaptation ¹³³
Mali ¹³⁴	23/09/2016	Reduction of emissions by 2030: a reduction of 29% in agriculture, 31% in the energy sector, 21% in forestry and land use	Agriculture: <ul style="list-style-type: none"> 92,000 ha under climate smart agriculture and sustainable land management; Improve livestock rotation over grazelands to reduce farmer-livestock conflict over 400,000 ha; Improved crop and livestock varieties; Small scale agricultural development, including fruit trees for reforestation, and vegetation cover and erosion prevention (post 2020); Land use and forestry: <ul style="list-style-type: none"> Anti-desertification and protection of 9 million ha; Reforestation of 325,000 ha. Water and water supply: <ul style="list-style-type: none"> Rainwater harvesting and storage to ensure universal potable water access; 75,000 rural households have drinking water from drinking water systems and water collection structures; Watershed management (post-2020) Wastewater treatment (post-2020)
Mauritania	27/02/2017	22.3% reduction of which 12% unconditional 88% conditional	Agriculture and land management: <ul style="list-style-type: none"> Aerial seeding of degraded land (10,000 ha per year) to promote regeneration of the natural environment; Restoration of natural pastures (deferred grazing and rangeland management); Exploration of aquifers (drilling) Fisheries and aquaculture: <ul style="list-style-type: none"> Promotion of fish-farming and responsible fishing on Lake Fouta Djall; Water and water management: <ul style="list-style-type: none"> Rehabilitation and integrated management of sustainable wetlands against the effects of climate change; Drinking water supply systems in rural areas equipped with solar energy; Climate risk management: <ul style="list-style-type: none"> Protecting cities of Nouakchott and Nouadhibou against risks marine emersion and silting;
Niger	21/09/2016	2020 reduction: 2.5% unconditional 25% conditional 2030 reductions: 3.5% unconditional 34.6% conditional	Agriculture and sustainable land management: <ul style="list-style-type: none"> Restoration of agricultural/forestry/pastoral lands: 1,030 000 ha.; Assisted natural regeneration: 1,100,000 ha.; Fixation of dunes: 550,000 ha.; Management of natural forests: 2,220,000 ha.; Hedgerows: 145,000 km.; Planting of multiuse species: 750,000 ha.; Planting of Moringa oleifera: 125 000 ha.; Seeding of roadways: 304,500 ha.; Private forestry: 75,000 ha.
Nigeria	05/05/2017	45% reduction 20% unconditional 25% conditional	Agriculture: <ul style="list-style-type: none"> Adopt improved agricultural systems for both crops and livestock (e.g. diversify livestock and improve range management); Increase access to drought resistant crops and livestock feeds; adopt better soil management practices; provide early warning/meteorological forecasts and related information); Implement strategies for improved resource management (e.g., water efficiency of irrigation systems; increase rainwater & sustainable ground water harvesting); Increase planting of native vegetation cover & promotion of re-greening efforts; Focus on agricultural impacts in the savanna zones, particularly the Sahel, the areas that are likely to be most affected by the impacts of climate change.

¹³⁴ http://climatecollege.unimelb.edu.au/files/site/factsheets/Mali_INDCFactsheet_UoM-PRIMAP_GWPAR4.pdf

Climate Finance and key projects

All the countries in the West Sahel are engaged in seeking international climate finance for programs and activities (e.g. all have a nationally designated authority (DNA) for the

Green Climate Fund and the Adaptation Fund). All the countries have received international finance for climate related projects.

Table 5: Internationally financed climate projects in the West Africa Sahel

Name of Project	Fund (implementing agency)	Funding Approved (USD millions)	Date of project approval (GEF) / Implementation dates (others)
Burkina Faso ^{135 136 137}			
GGW: Community Based Rural Development Project 3 rd Phase with Sustainable Land and Forestry Management	GEF-5 ¹³⁸ (World Bank)	7.4	2012
Integrating Climate Resilience into Agricultural and Pastoral Production for Food Security in Vulnerable Rural Areas Through the Farmers Field School Approach.	GEF-5 (FAO)	3.8	2014
Strengthening Climate Information and Early Warning Systems in Africa for Climate Resilient Development and Adaptation to Climate Change - Burkina Faso	GEF-5 (UNDP)	4	2013
Adapting Natural Resource Dependent Livelihoods to Climate Induced Risks in Selected Landscapes in Burkina Faso: the Boucle du Mouhoun Forest Corridor and the Mare d'Oursi Wetlands Basin.	GEF-5 (UNDP)	7	2014
Gazetted Forests Participatory Management Project for REDD+ (PGFC/REDD+)	Climate Investment Funds: Forest Investment Program (African Development Bank)	12	2013
Africa Hydromet Program-Strengthening Climate Resilience in Sub-Saharan Africa: Burkina Faso Country Project	Green Climate Fund (World Bank)	25	2018-2023
Chad ^{139 140}			
LCB-NREE Chad Child Project: Integrated Management of Natural Resources in the Chadian part of the Lake Chad Basin	GEF-5 (African Development Bank)	2.6	2016
Restoring Ecological Corridors in the Mayo-Kebbi Quest, Chad, to Support Multiple Land and Forests Benefits - RECONNECT	GEF-6 (IUCN)	5.37	2018
Chad National Adaptation Plan	GEF-6 (UNDP)	5.78	2018
Restoring Ecological Corridors in the Mayo-Kebbi Quest, Chad, to Support Multiple Land and Forests Benefits - RECONNECT	GEF-6 (IUCN)	5.37	2018
Enhancing the Resilience of the Agricultural Ecosystems	GEF-5 (IFAD)	7.3	2015

¹³⁵ <https://www.thegef.org/country/burkina-faso>

¹³⁶ <https://www.adaptation-fund.org/adaptation-fund-in-djibouti/>

¹³⁷ <https://www.greenclimate.fund/-/africa-hydromet-program-strengthening-climate-resilience-in-sub-saharan-africa-burkina-faso-country-project>

¹³⁸ Global Environment Facility

¹³⁹ <https://www.thegef.org/country/chad>

¹⁴⁰ <https://www.adaptation-fund.org/project/climate-change-adaptation-programme-in-water-and-agriculture-in-anseba-region-eritrea/>

Name of Project	Fund (implementing agency)	Funding Approved (USD millions)	Date of project approval (GEF) / Implementation dates (others)
Mali ^{141 142 143 144}			
MALI First Biennial Update Report	GEF-6 (UNDP)	.352	2015
Flood Hazard and Climate Risk Management to Secure Lives and Assets in Mali	GEF-5 (UNDP)	8.9	2016
Promoting Sustainable Electricity Generation in Malian Rural Areas through Hybrid Technologies	GEF-5 (UNDP)	1.16	2016
GGW Natural Resources Management in a Changing Climate in Mali	GEF-5 (World Bank)	8.43	2013
Strengthening the Resilience of Women Producer Groups and Vulnerable Communities in Mali	GEF-5 (UNDP)	5.46	2014
Strengthening Resilience to Climate Change through Integrated Agricultural and Pastoral Management in the Sahelian zone in the Framework of the Sustainable Land Management Approach	GEF-5 (FAO)	2.17	2014
Programme support for climate change adaptation in the vulnerable regions of Mopti and Timbuktu	Adaptation Fund	8.5	2015-2018
Rural Electrification Hybrid Systems	Climate Investment Funds: Scaling Up Renewable Energy Program (SREP)	15.4	2013
Africa Hydromet Program- Strengthening Climate Resilience in Sub-Saharan Africa: Mali Country Project	Green Climate Fund (World Bank)	22.8	2016-2020
Mauritania ^{145 146}			
Promoting Sustainable Mini-grids in Mauritanian Provinces Through Hybrid Technologies	GEF-5 (UNDP)	1.27	2015
Development of an Improved and Innovative Management System for Sustainable Climate-resilient Livelihoods in Mauritania	GEF-5 (UNEP)	5	2017
Improving Climate Resilience of Water Sector Investments with Appropriate Climate Adaptive Activities for Pastoral and Forestry Resources in Southern Mauritania	GEF-5 (African Development Bank)	6.35	2014
Enhancing Resilience of Communities to the Adverse Effects of Climate Change on Food Security in Mauritania	Adaptation Fund (World Food Program)	7.8	2014-2018

¹⁴¹ [https://www.thegef.org/projects?f\[\]=field_country:102&f\[\]=field_p_focalareas:2207](https://www.thegef.org/projects?f[]=field_country:102&f[]=field_p_focalareas:2207)

¹⁴² <https://www.adaptation-fund.org/project/programme-support-for-climate-change-adaptation-in-the-vulnerable-regions-of-mopti-and-timbuktu-2/>

¹⁴³ <https://www.climateinvestmentfunds.org/projects/rural-electrification-hybrid-systems>

¹⁴⁴ <https://www.greenclimate.fund/-/africa-hydromet-program-strengthening-climate-resilience-in-sub-saharan-africa-mali-country-project>

¹⁴⁵ [https://www.thegef.org/projects?f\[\]=field_country:105&f\[\]=field_p_focalareas:2207](https://www.thegef.org/projects?f[]=field_country:105&f[]=field_p_focalareas:2207)

¹⁴⁶ <https://www.adaptation-fund.org/project/enhancing-resilience-of-communities-to-the-adverse-effects-of-climate-change-on-food-security-in-mauritania/>

Name of Project	Fund (implementing agency)	Funding Approved (USD millions)	Date of project approval (GEF) / Implementation dates (others)
Niger ^{147 148 149}			
LCB-NREE Niger child project: Improving Sustainable Management of Natural Resources in Niger's Diffa Region	GEF-5 (African Development Bank)	3.3	2016
Niger: Food-IAP: Family Farming Development Programme (ProDAF)	GEF-6 (IFAD)	7.6	2016
Disaster Risk Management and Urban Development Project	GEF-5 (World Bank)	6.65	2013
Integrating Climate Resilience into Agricultural and Pastoral Production for Food Security in Vulnerable Rural Areas through the Farmers Field School Approach	GEF-5 (FAO)	3.8	2014
Scaling up Community-Based Adaptation (CBA) in Niger	GEF-5 (UNDP)	3.75	2014
Enhancing Resilience of Agriculture to Climate Change to Support Food Security in Niger, through Modern Irrigation Techniques	Adaptation Fund	9.9	2016-2021
Project for the Improvement of Climate Forecasting Systems and Operationalization of Early Warning Systems (PDIPC)	Climate Investment Fund: Pilot Programme for Climate Resilience (PPCR) (African Development Bank)	13	2012
Water Resources Mobilization and Development Project (PROMOVARE)	Climate Investment Fund: Pilot Programme for Climate Resilience (PPCR) (African Development Bank)	22	2012
Community Action Project for Climate Resilience (CAPCR)	Climate Investment Fund: Pilot Programme for Climate Resilience (PPCR) (IBRD)	63.4	2012-2017
Nigeria ¹⁵⁰			
LCB-NREE ¹⁵¹ : Nigeria Child Project: Comprehensive and Integrated Management of Natural Resources in Borno State	GEF-5 (African Development Bank)	4.14	2016
Food-IAP: Integrated Landscape Management to Enhance Food Security and Ecosystem Resilience in Nigeria	GEF-6 (UNDP)	7.14	2017
Sustainable Fuelwood Management in Nigeria	GEF-5 (UNDP)	4.4	2016
GGW: Nigeria Erosion and Watershed Management Project (NEWMAP)	GEF-5 (World Bank)	8.6	2012-2020

¹⁴⁷ https://www.thegef.org/projects?field_country:119&field_focalareas:2207

¹⁴⁸ <https://www.adaptation-fund.org/project/enhancing-resilience-of-agriculture-to-climate-change-to-support-food-security-in-niger-through-modern-irrigation-techniques-2/>

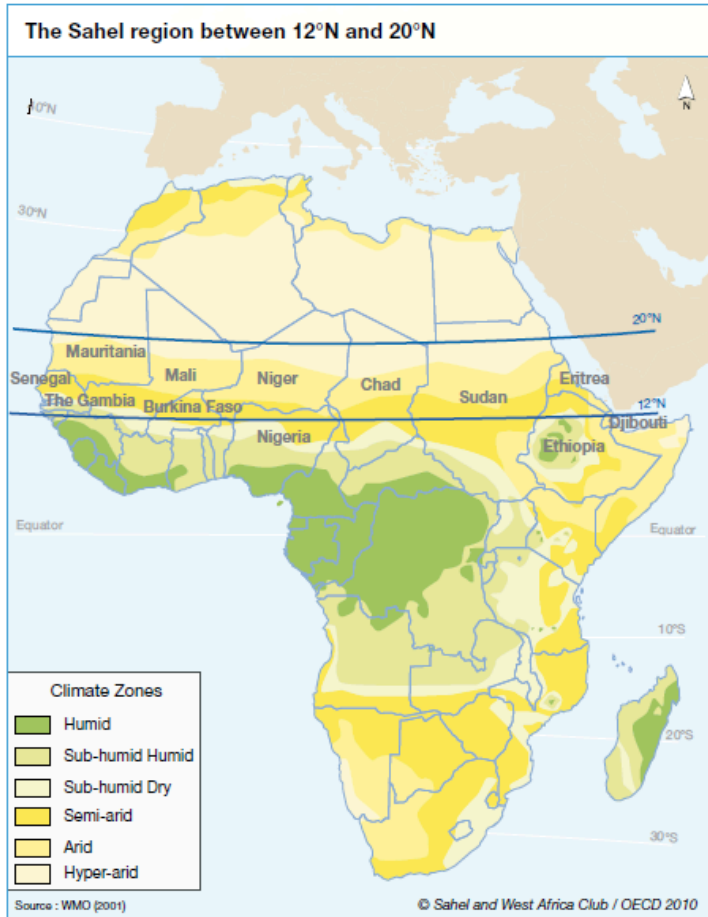
¹⁴⁹ https://www.climateinvestmentfunds.org/projects?field_related_country_target_id=39&field_mdb_tid=All&field_sector_tid=All&field_pp_sector_tid=All&field_related_fund_target_id=All&title=

¹⁵⁰ https://www.thegef.org/projects?field_country:120&field_focalareas:2207

¹⁵¹ LCB: Lake Chad Basin

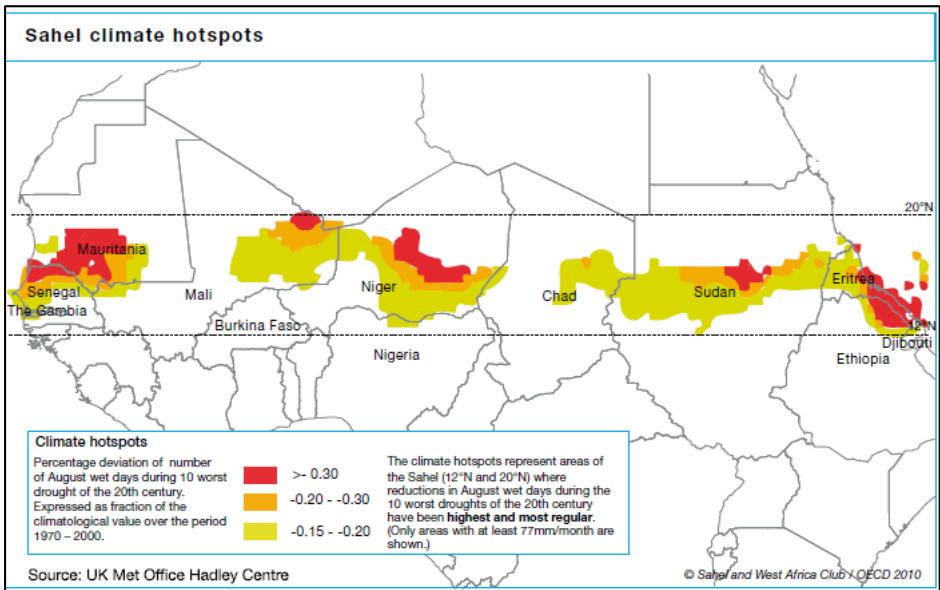
Maps

Map 1 The Sahel region



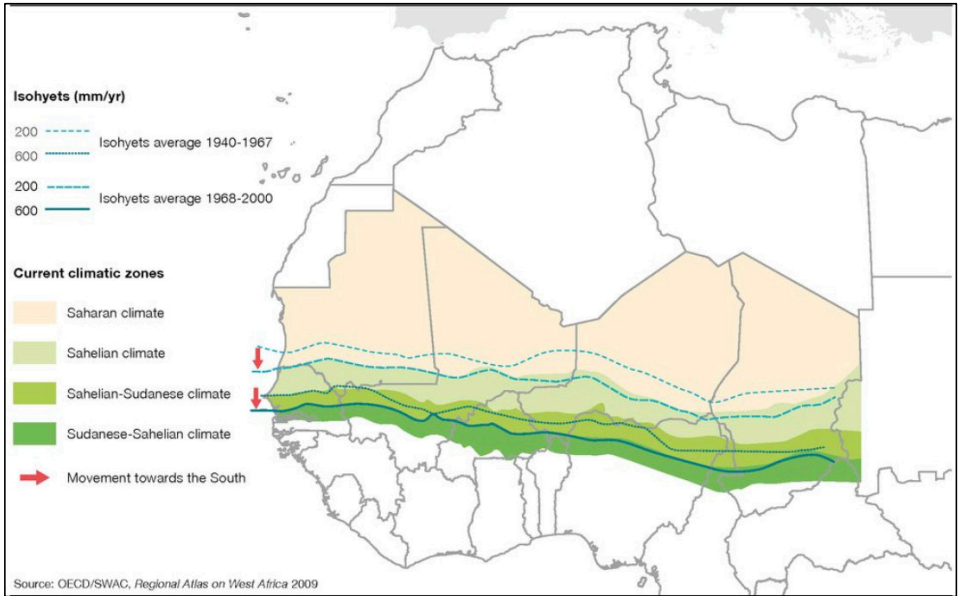
Source: P. Heinrigs (2010) Security Implications of Climate Change in the Sahel Region: Policy considerations. OECD Sahel and West Africa Club Secretariat. Available at <https://www.oecd.org/swac/publications/47234320.pdf>

Map 2 Climate hotspots in the Sahel



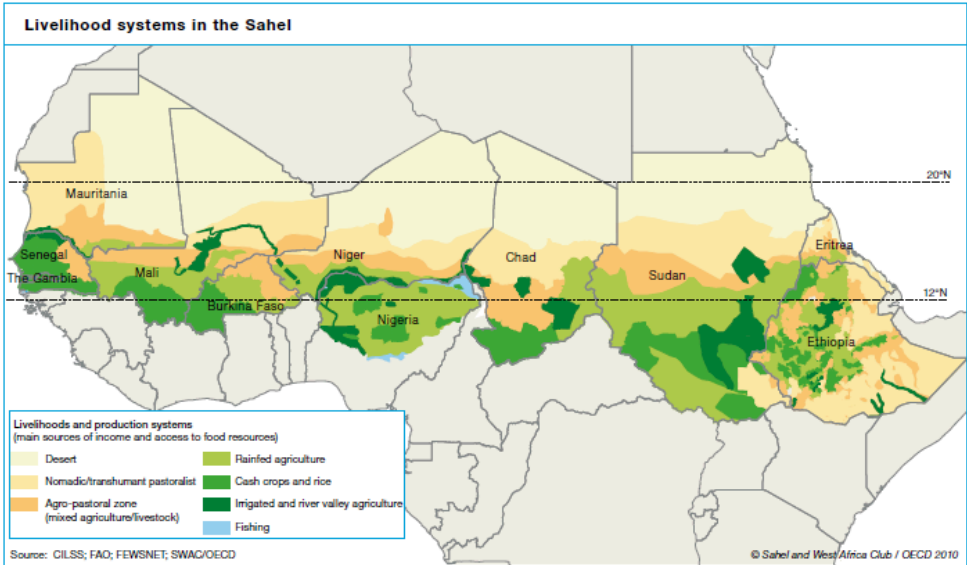
Source: P. Heinrigs (2010) Security Implications of Climate Change in the Sahel Region: Policy considerations. OECD Sahel and West Africa Club Secretariat. Available at <https://www.oecd.org/swac/publications/47234320.pdf>

Map 3 Shift of climate zones to the south



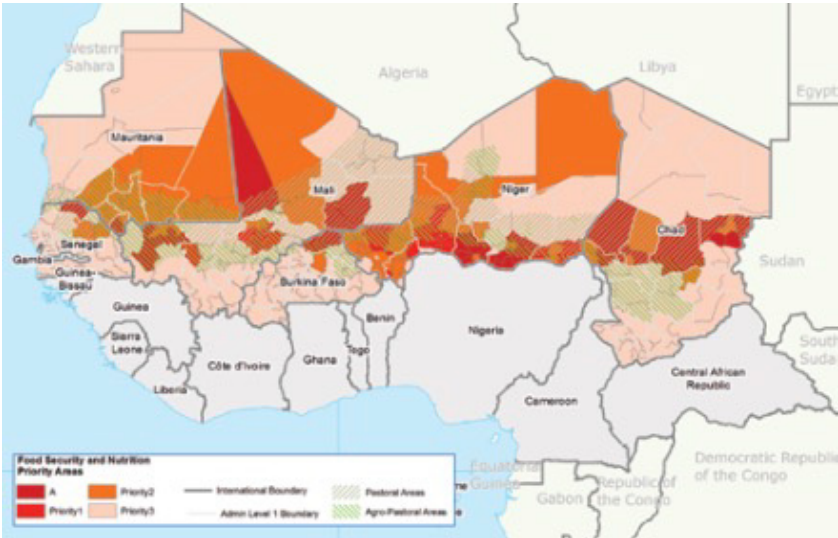
Source: OECD/SWAC (2014) *An Atlas of the Sahara-Sahel: Geography, Economics and Security*. West African Studies. OECD Publishing.
Available at https://read.oecd-ilibrary.org/agriculture-and-food/an-atlas-of-the-sahara-sahel_9789264222359-en#page36

Map 4 Livelihood systems in the Sahel



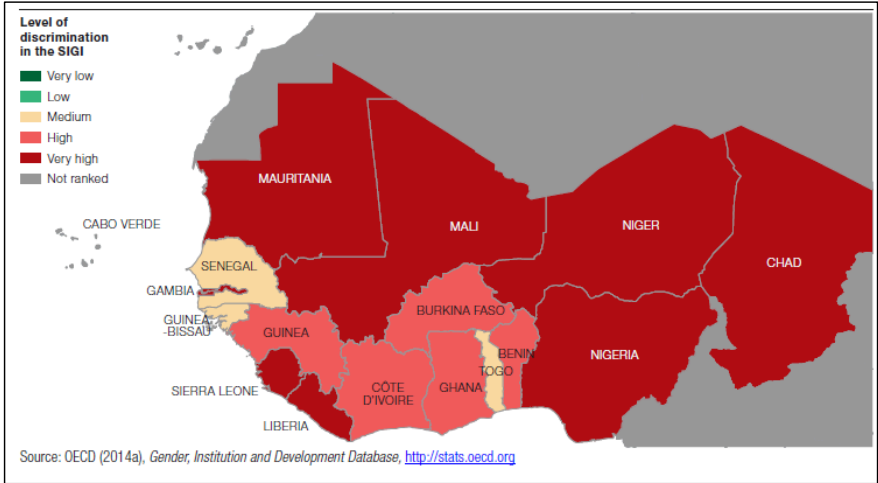
Source: OECD (2010) *Sahel and West Africa Club Secretariat. Security Implications of Climate Change in the Sahel Region: Policy considerations*.
Available at <https://www.oecd.org/swac/publications/47234320.pdf>

Map 5 Food insecurity in the West Sahel region



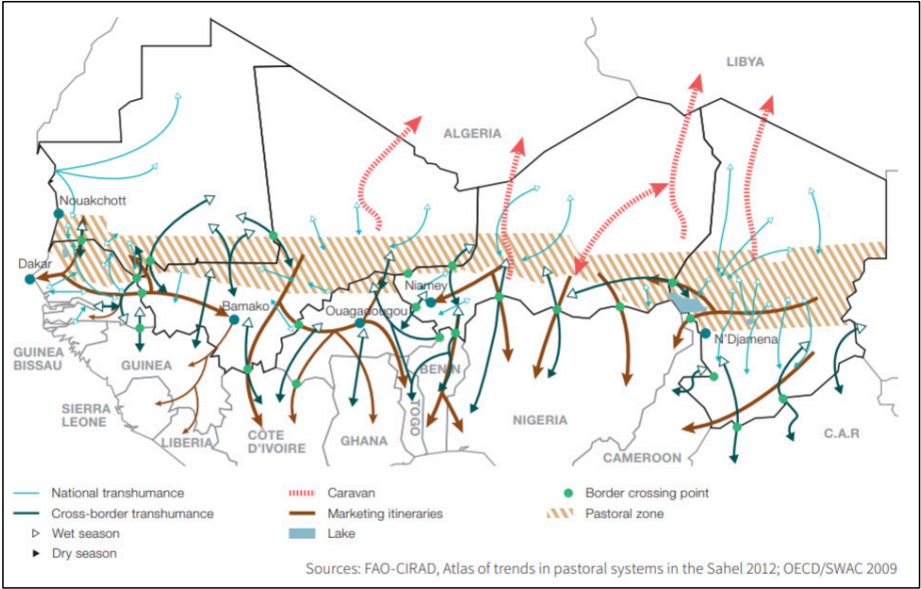
Source: FAO, UNICEF, and World Food Programme (WFP) (2018) *Sahel: Early action and scale-up of emergency response 2018* available at <http://www.fao.org/3/i8940en/i8940en.pdf>

Map 6 Gender discrimination in the West Africa Sahel



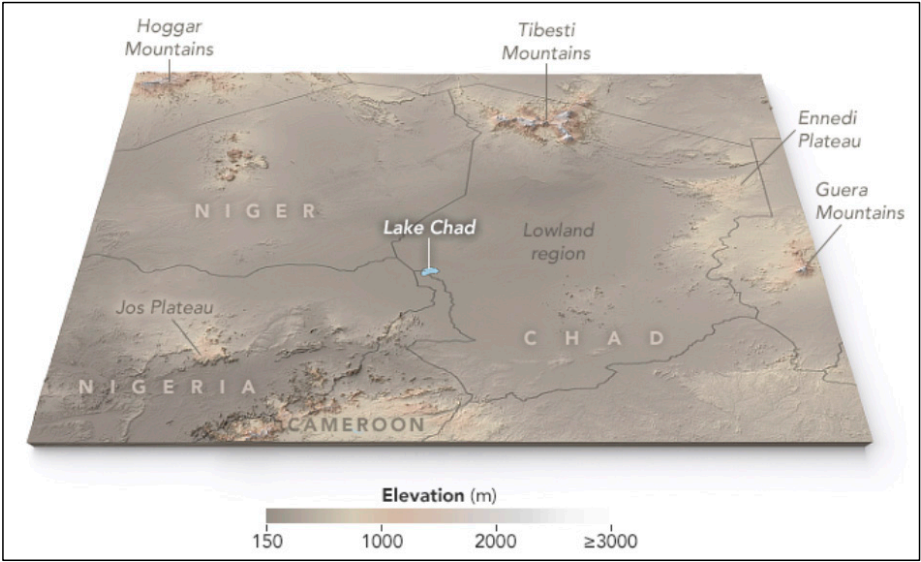
Source: Bouchama, N., et al. (2018), "Gender Inequality in West African Social Institutions", *West African Papers*, No. 13, OECD Publishing, Paris, <http://dx.doi.org/10.1787/fe5eaoca-en>

Map 7 Pastoral seasonal migration in the West Sahel

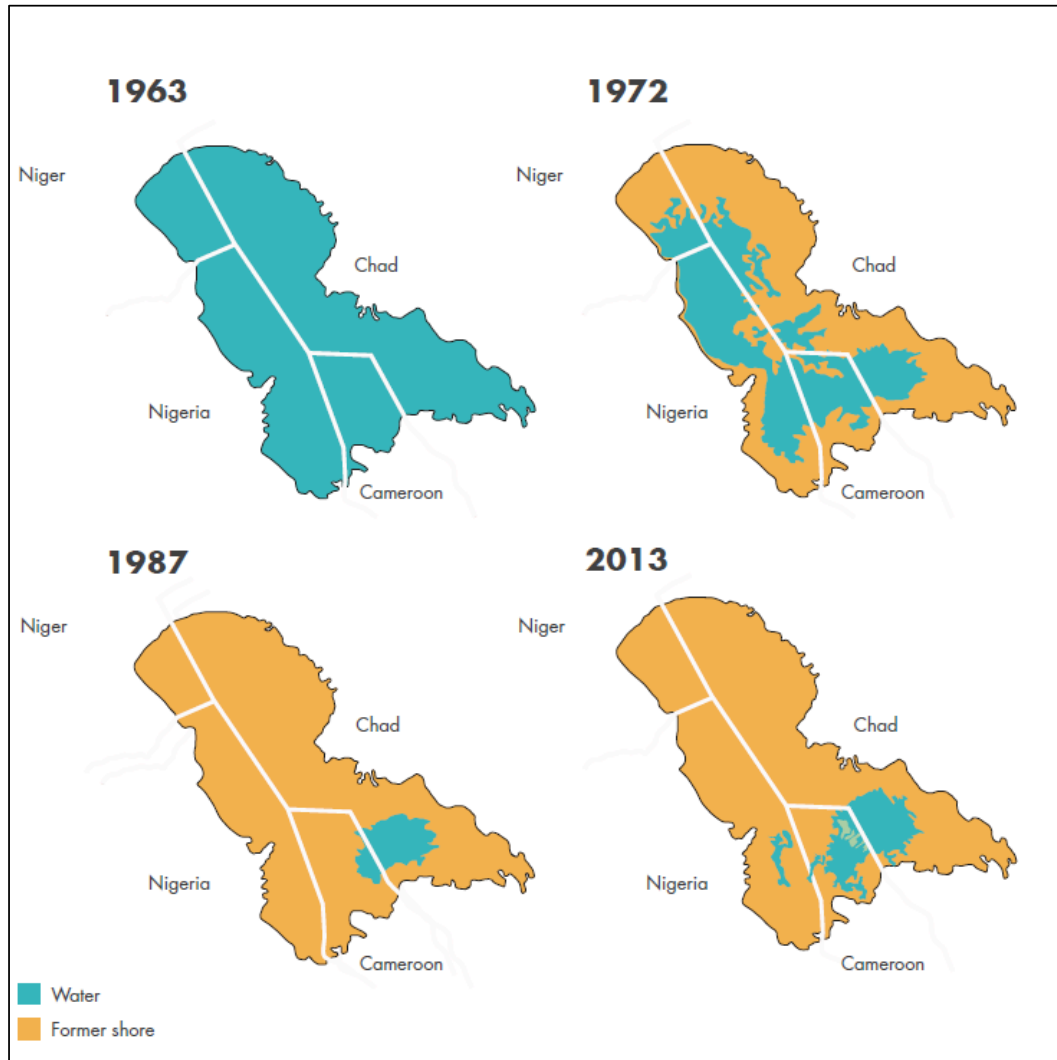


Source: OECD (2018). *Transhumance and nomadism. Maps and Facts. No. 65. February 2018. Sahel and West Africa Club (SWAC).*
Available at <http://www.oecd.org/swac/maps/65-transhumance-nomadism.pdf>

Map 8 Location of Lake Chad



Source: K. Hansen (2017). *The Rise and Fall of Africa's Great Lake.* Earth Observatory.
Available at <https://earthobservatory.nasa.gov/Features/LakeChad/>

Map 9 The shrinking of Lake Chad

Source: This map appeared in the chapter *Confronting Climate Change in Foresight Africa*, 2017, Brookings Institute available at https://www.brookings.edu/wp-content/uploads/2017/01/global_20170109_foresight_africa_chapter-5.pdf

The source cited for the original map is United Nations Environment Program and DIVA-GIS in Kingsley, P. "The small African region with more refugees than all of Europe." *The Guardian*. 26 November 2016. Available at: <https://www.theguardian.com/world/2016/nov/26/boko-haram-nigeria-famine-hunger-displacementrefugees-climate-change-lake-chad>

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