MAURITANIA

AFRICAN DEVELOPMENT BANK

NATIONAL CLIMATE CHANGE PROFILE

PRODUCED IN COLLABORATION WITH:
African Climate & Development Initiative, University of Cape Town;
Climate Systems Analysis Group, University of Cape Town;
Energy Research Centre, University of Cape Town; Cirrus Group.

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MAURITANIA

CONTENTS

LIST OF TABLES

MAURITANIA

LIST OF FIGURES

ACKNOWLEDGEMENT

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1. BACKGROUND

1.1 Geographic and socio-economic context

The Islamic Republic of Mauritania (henceforth 'Mauritania' and shown below in figure 1-1) is a large (1,040,000 km2, 10th largest in Africa) and sparsely populated country (4 people/km2, 3rd lowest in Africa) in the arid Maghreb region of West Africa. Mauritania is bordered by Senegal and the Senegal River at the country's southwest, by Mali at the southeast and east of the country, by Algeria at the northeast, and by the disputed territories of Western Sahara at the north and northwest. Mauritania's west coast is bordered by the Atlantic Ocean, where the country's two largest urban centres (Nouakchott and Nouadibhou) are situated. Mauritania is classified as a Least Developed Country, and the economy (annual GDP estimated to be ~USD 4.6 billion, equivalent to annual GDP per capita of ~USD 1,078) is relatively undiversified and heavily dependent on crop and livestock agriculture, fisheries and extraction of mineral commodities such as iron ore, gold and phosphate, and production of oil for export and domestic consumption. Fisheries contribute ~21-25% of Mauritania's export earnings, including direct export of fish products as well as licensing fees paid by international fishing boats using Mauritania's territorial waters.

Inland from the country's coastal region, Mauritania's rural population (comprising ~40% of the total population) continue to practice various forms of nomadic and transient pastoral production of livestock such as cattle, goats, sheep and camels – typically cattle are confined to the comparatively high rainfall areas of the south, whereas small ruminants and camel are increasingly favoured along the gradient of aridity that extends northwards towards the Sahara. However, as a result of multiple factors such as ecosystem degradation, increased variability of rainfall, and the severe impacts of successive droughts in the past (particularly in the 1970's and 1980's), a large number of Mauritanian households have shifted from nomadic lifestyles to increasingly sedentary forms of mixed livestock and crop production. Furthermore, the urban population of Mauritania is growing at a rate of ~3.8% per annum as rural households increasingly move towards paid employment as a source of income.

As a result of the country's harsh semi-arid and arid climates, the majority of the population is exposed to some form of risk related to drought and rainfall variability (particularly the rural population which is dependent on rainfed agriculture and pastoral grazing of rangelands). It is estimated that in the period 1996-2016, drought impacted ~2.58 million Mauritanians (over half the population). Furthermore, as a result of the comparatively dense urban populations in the coastal urban cities of Nouadibhou and Nouakchott (~1,1 million Mauritanians live within 100km of the coast), the onset of the rainy season is frequently characterised by urban flooding of low-lying areas, resulting in negative impacts on ~173,000 people in the period from ~1996 to 2016.

Mauritania has one of the lowest GINI coefficients in Africa (32.4) and a high gender inequality index, indicating a wide disparity in wellbeing, income and access to opportunity between different social and gender groups. The country's ND-GAIN index is also low (33.4) and represents the country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. In the case of Mauritania, the vulnerability component of the index is high, and the readiness component is low.

Key socio-economic and demographic indicators are further presented and summarised in Table 1-1, below.

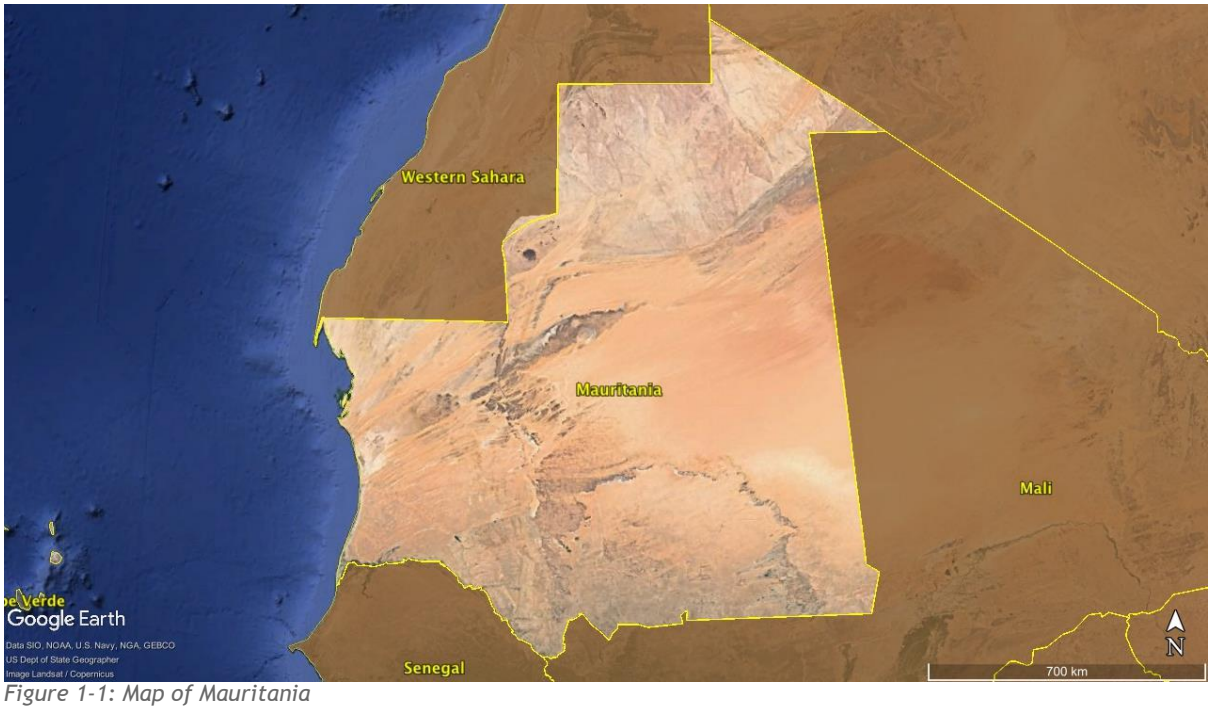


Figure 1-1: Map of Mauritania

Table 1-1: Socio-Economic Context of Mauritania (reference year ranges from 2014 – 2017)

VARIABLE	SCORE/TOTAL	UNIT	RANK (OUT OF 54)
Geography, Socio-Economy and Demographics			
Population[1]	4,266,448	people	40
Population growth rate[1]	2.4	% population .yr-1	31
Population density[1]	4	People/km2	51
Land area[1]	1,040,597	km2	10
% Urban population[1]	59.2	% population	11
% Urbanisation rate[2]	3.8	% population .yr-1	25
Economy: total GDP[2]	4.6	USD billions .yr-1	37
Economy: GDP by PPP[2]	17	billion international dollars .yr-1	35
Economy: GDP/capita[2]	1,078	USD per capita/yr	23
Population below the poverty line[3]	5.9	% below USD 1.90 per day	44
Gender Inequality Index[3]	61.0		13
GINI co-efficient[3]	32.4		47
HDI[4]	0.51		25
Access to electricity[5]	38.8	% population	28

VARIABLE		SCORE/TOTAL	UNIT	RANK (OUT OF 54)
Summary indicators of climate change vulnerability				
Population undernourished[6]		5.6	% population	34
Number of people affected by drought[7]		2,582,400	people	20
Number of people affected by flood events[7]		172,819	people	31
Population living within 100 km of coast[8]		1,094,274	people	30
Population living in informal settlements [5]		79.9	% urban population	8
Incidence of malaria[6]		74	cases per 1000 population at risk	35
ND-Gain Vulnerability Index[9]	Total	33.4		46
	Readiness	0.32		34
	Vulnerability	0.65		7

2. CLIMATE AND WEATHER

The climate of Mauritania varies from desert over the northern and central parts to higher rainfall over the far south. Rainfall generally increases from the north to the south. Mauritania has a very long dry season and a short wet season (July – September), and precipitation is low and extremely irregular in both space and time.

The water region or river catchments of Mauritania cover the country and extend south into Mali. Variations in rainfall are relatively large and therefore the country is divided into three sub-regions. The Mauritania region is illustrated in Figures 2-1 and 2-2, below, and summary descriptions can be found in Table 2-1 below.

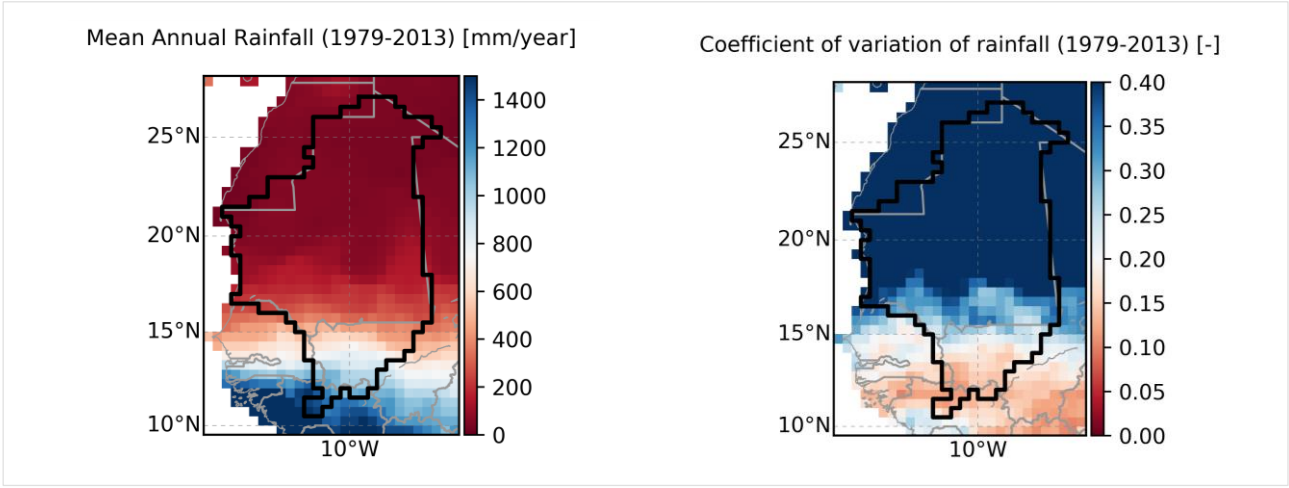
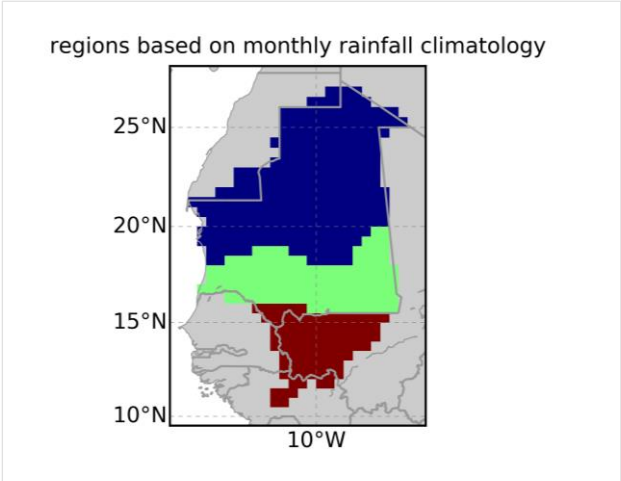


Figure 2-1: Main characteristics (magnitude and variability) of rainfall in Mauritania and its region



Coloured regions on the map (above) correspond to the colours used in rainfall and temperature graphs (below)

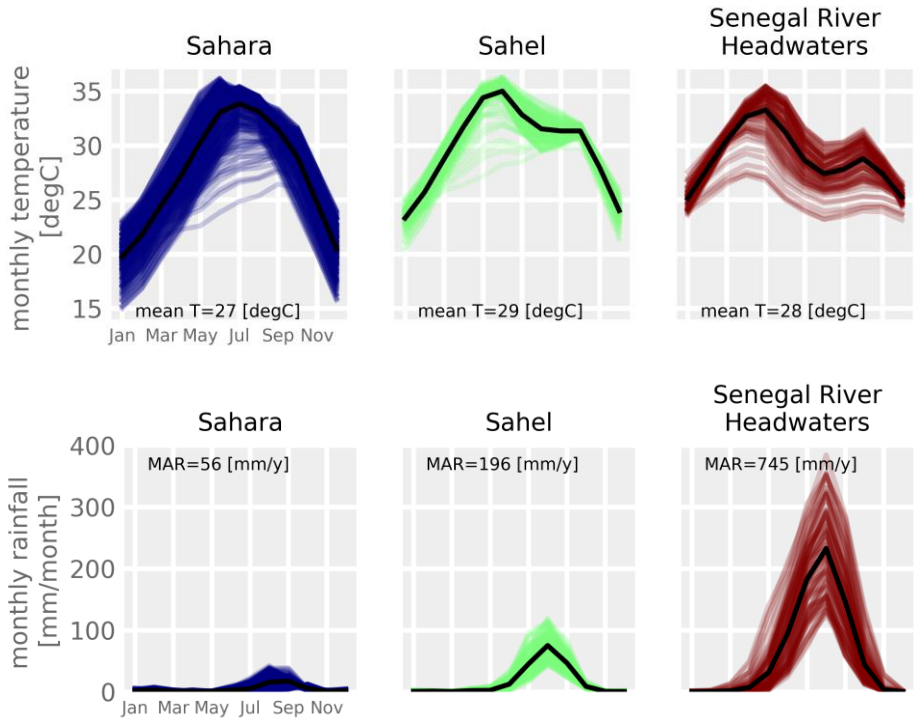


Figure 2-2: Rainfall regions of Mauritania based on similarity of standardised rainfall climatology, and their rainfall and temperature climatologies. Coloured regions on the graphs above correspond to the colours used the map (previous page)

Table 2-1: Main characteristics of rainfall of Mauritania region

SAHARA	A large desert region where the mean annual total rainfall only reaches 56 mm/year and daily mean temperatures average 27° C. Rainfall is highly variable from year to year and can be completely absent in some years. A very small rainfall season occurs from July to September. Temperature shows a strong seasonal cycle (~14°) with warmest temperatures during boreal summer and coolest temperatures during winter. The daily cycle of temperature is also very pronounced (not shown here). Temperature also shows clear spatial differences.
SAHEL	A dry region where the mean annual total rainfall reaches around 200 mm/year and daily mean temperatures average 29° C. Rainfall increases from north to south and there is relatively high to moderate variability of rainfall from year to year. Rainfall occurs during a short rainy season from July to September. Temperature shows a strong seasonal cycle (~12°) with warmest temperatures during boreal summer and coolest temperatures during winter. The daily cycle of temperature is also pronounced (not shown here).
SENEGAL RIVER HEADWATERS	A relatively wet region where the mean annual total rainfall reaches 750 mm/year and daily mean temperatures average 28° C. Rainfall generally increases from north to south and interannual variability of rainfall decreases from moderate in the north to relatively low in the south. Temperature shows a strong seasonal cycle (~9°) with warmest temperatures during boreal summer (though the peak is at the start of the rainy season (May-June) and coolest temperatures during winter.

2.1 Observed historical climate variations and climate change trends

The majority of Mauritania experiences **high rainfall variability** on an inter-annual basis, with the exception of the far south. On **decadal time scales** Mauritania also experiences **clear variability** with some periods being relatively drier or wetter than others. This variability can be seen in the supporting evidence plots provided in the supplementary Appendix **(Figures A-1 to A-4).**

Long term trends across the regions show **increasing temperatures** over the period 1979 – 2015, although that trend appears to be weaker in the last decade of that period. The warming trends are all statistically significant and largest over the hot Sahara region and smallest over the cooler Senegal River Headwaters. Long term trends in total annual rainfall are all relatively strong upward trends and statistically significant. The long-term increases in total rainfall are associated with increases in the frequency of rainfall and extreme rainfall events in all three regions. Long term trends and variability in the Mauritania region are summarized in **Table 2-2** below and illustrated further in the supplementary Appendix **(Figures A-1 to A-4).**

Table 2-2: Summary of trends in rainfall and temperature attributes in Mauritania (1979 - 2015)

REGION	MEAN T [DEG C/DECADE]	TOTAL RAINFALL [MM/DECADE]	EXTREME RAINY DAYS [DAYS/DECADE]	RAINY DAYS [DAYS/DECADE]
Sahara	+0.38	+6.9	+1.3	+1.3
Sahel	+0.22	+24.4	+1.9	+2.6
Senegal River Headwaters	+0.16	+38.6	+2.3	+3.1

2.2 Projected (future) climate change trends, including temperature, precipitation and seasonality

Projected changes in main attributes of climate for the Mauritania region are summarized in Table 2-3, below, and described in Sections 2.2.1 and 2.2.1. Additional analysis and visualisation of projections be found in **Figures A-5 to A-8** in the supplementary Appendix.

2.2.1 Projected changes in precipitation from present to 2100

Rainfall projections across the Mauritania regions do not show a consistent signal in projections in annual total rainfall or in the frequency of rainfall events or extreme rainfall events.

2.2.2 Projected changes in temperature from present to 2100

Air temperature is projected to be about 1 to 3°C warmer in the Mauritania region by the 2050s. By 2100 the range of projected temperatures is greater showing projected increases of 3°C to 6°C.

Table 2-3: Summary of projected climate changes across regions of Mauritania for key climate variables by 2050

REGION	AVERAGE TEMPERATURE [°C]	TOTAL ANNUAL RAINFALL [MM/YEAR]	EXTREME RAINY DAYS [DAYS/YEAR]	RAINY DAYS [DAYS/YEAR]
Sahara	**Increasing** +2°C to +3°C by 2050s but changes evident in next decades	No consistent signal in projections	No consistent signal in projections	No consistent signal in projections
Sahel	**Increasing** +2°C to +3°C by 2050s but changes evident in next decades			
Senegal River Headwaters	**Increasing** +1°C to +2.5°C by 2050s but changes evident in next decades			

2.3 Expected climate vulnerabilities

NOTE: Determining vulnerability of different sectors to climate variations or change is extremely challenging as there are many factors involved in vulnerability and different approaches can yield different results. The vulnerabilities presented here are based on UNFCCC reporting documents such as national communications or national adaptation plans of action where available, and other literature where UNFCCC documents are not available.

In sparsely populated, arid Mauritania, the increasing temperature trend is likely to increase the pressure on water resources, irrespective of rainfall projections for which the future direction of change is inconclusive. With an economy heavily dependent on climate sensitive sectors such as crop and livestock agriculture, as well as fisheries, increasing temperatures and potentially changing rainfall patterns is a concern for both households and for the economy at large. Due to a combination of socio-climatic reasons nomadic and transient pastoral production is already shifting towards more sedentary forms of mixed livestock and crop production, with complicated and potentially a combination of positive and negative implications in terms of climate vulnerability. Around half the Mauritanian population is already prone to the impacts of droughts and increasing temperatures and possible changes to rainfall patterns is set to increase food insecurity and malnutrition. Human settlements and associated developments are further vulnerable to sea-level rise and associated stresses, with Mauritania's two largest urban centres located on the Atlantic coast, where frequent flooding is already impacting a lot of people.

Table 2-4: Broad scale sectoral vulnerabilities and potential climate change impacts in Mauritania

SECTOR	IMPACTS
Agriculture	– Reduced agricultural production owing to flash flooding, salt water intrusion and drought – Decreased water availability and/or groundwater depletion – Degradation and loss of agricultural land – Changes to pastures and livestock production – Changes to food security
Fisheries	Reduced productivity of fisheries
Water resources	– Increased variability in run-off, leading to increased variability in surface water availability, owing to both drought and flooding – Decreased water availability and/or groundwater depletion – Decreased water quality owing to pollution – Changes in river morphology – Loss of water bodies
Built infrastructure and human settlements	– Loss of coastal land areas owing to coastal inundation – Increased potential for human resettlement
Human health	– Not addressed in NAPA. Possible impacts may include: – increased incidence and changed distribution of malaria and insect-borne diseases – negative health impacts resulting from deteriorating water quality – increased incidence of heat stress and stroke

3. CLIMATE CHANGE MITIGATION, GREENHOUSE GAS EMISSIONS AND ENERGY USE

The major carriers of Mauritania's energy mix, and the energy demands of major economic sectors, are summarised in Section 3.1, below. The major sources of GHG emissions, described by fuel source and sector, are described in Section 3.2. The latter section also includes summarised statistics on Mauritania's agriculture sector, historical land use change and vegetation cover. Unless stated otherwise, all energy figures are derived from UN Stats (2014) [10]; World Energy Council (2016); [11]; and the World Resources Institute (2013) [12]. Agriculture & forestry-related emissions are also reported from Food and Agriculture Organisation (2014-2017) [14] and Global Forest Watch. (2015-2017) [15].

3.1 National energy production and consumption

The energy sector of Mauritania is characterised by a split between the production of oil, primarily from the country's Chinguetti offshore production facilities, and the domestic use of biofuels by the majority of the population (UN Stats, 2014; World Energy Council, 2016). There is a lack of updated statistics on Mauritania's production of electricity, however total national consumption of electricity is estimated to contribute only ~10% to total national energy consumption.

Unless stated otherwise, all energy figures are derived from UN Stats (2014) [10]; World Energy Council (2016); [11]; and the World Resources Institute (2013) [12]. Agriculture & forestry-related emissions are also reported from Food and Agriculture Organisation (2014-2017) [14] and Global Forest Watch. (2015-2017) [15].

The tables and figures below describe Mauritania's energy sector, including total national energy production, primary energy supply and national energy consumption by fuel carrier and sector. Mauritania's total annual energy production of ~0.7 MTOE includes 0.3 MTOE contributed by national oil reserves (Table 3-1). Total national consumption of energy, estimated to be ~1 MTOE per annum, is supplemented by imported oil to meet total national demand for oil of ~0.6 MTOE (Table 3-2). Approximately ~75% of Mauritania's electricity is generated by fuel combustion, which is supplemented by imported hydroelectricity generated by the Manantali dam in Mali. The residential sector accounts for the majority of Mauritania's energy consumption (~40%) and primarily consumes biomass for cooking (IEA, 2014). The sectors of transport (~30%) and industry (~20%) are responsible for the next largest consumption of energy, which includes consumption of oil as well as consumption of electricity by the energy-intensive mining and mineral processing industries. The remaining ~0.1 MTOE of national energy consumption is accounted for by the sectors of agriculture, forestry and fisheries (~0.05 MTOE), commercial and public services (~0.04 MTOE) and other non-energy uses (0.01 MTOE) (Table 3-4). The total annual GHGs emitted by the abovementioned sectors and fuel carriers are described further in Section 3.2

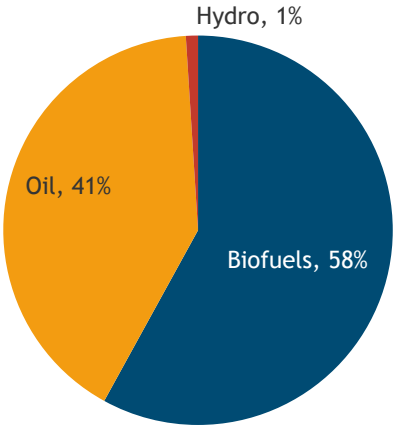


Figure 3-1: Distribution of Mauritania's national energy production between major energy carriers (based on from 2014-2016

Table 3-1: National energy and electricity production in Mauritania (based on data from 2014-2016)

NATIONAL ENERGY PRODUCTION		
Source	**Total (MTOE) [1]**	**% of total energy production**
Oil[10]	0.3	41.4
Hydro[11]	0.01	1.3
Biofuels[10]	0.4	58.6
Total national energy production	0.7	100.0

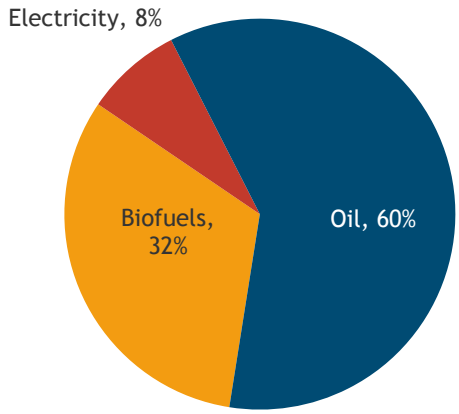


Figure 3-2: Distribution of Mauritania's national energy consumption by major energy carriers

Table 3-2: Mauritania's national energy consumption by energy source (based on 2014-2016)

CONSUMPTION BY ENERGY SOURCE[10]	
Source	**Total (MTOE)**
Oil	0.6
Biofuels	0.3
Electricity	0.1
Total national energy consumption by source	1.0

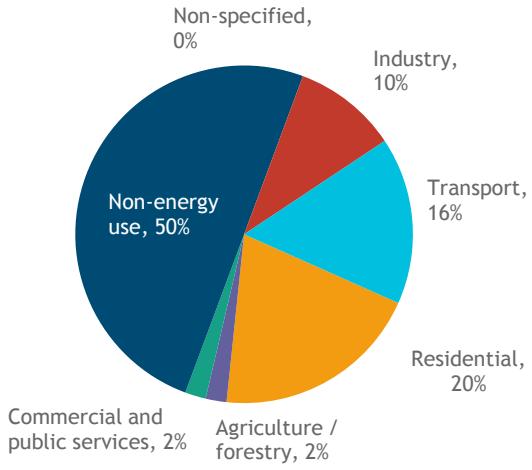


Figure 3-3: Distribution of Mauritania's national energy consumption by sector (based on 2014-2016)

Table 3-3: Mauritania's national energy consumption by sector (based on 2014-2016)

CONSUMPTION BY SECTOR[10]	
Source	**Total (MTOE)**
Industry	0.2
Transport	0.3
Residential	0.4
Commercial and public services	0.04
Agriculture / forestry / fishing	0.05
Non-energy use	0.01
Total national energy consumption by sector	1.0

1 Energy is expressed in 'Megatonnes of Oil Equivalent', where 1 Tonne Oil Equivalent = 11,630 KiloWatt hours (KWh)

Table 3-4: Mauritania's national total primary energy supply (based on 2014-2016)

TOTAL PRIMARY ENERGY SUPPLY[10]	
Source	**Total (MTOE)**
Oil	0.8
Biofuels	0.4
Electricity	0.0
Total primary energy supply	1.2

3.2 National greenhouse gas emissions by source and sector

Section 3.2.1, below, describes GHG emissions from all sectors of national energy consumption, which therefore includes emissions from fuel combustion, industrial/manufacturing processes, household-level energy consumption and AFOLU (Agriculture, Forestry and Other Land Use). These figures are compiled by the World Resources Institute's Climate Access Indicator Tools (CAIT).

3.2.1 Total GHG emissions from fuel combustion and secondary activities, by source and sector

As described in Sections 3.1 and 3.2, above, Mauritania's GHG emissions from fuel combustion are primarily driven by biomass fuels, used by the domestic/residential sector, and oil for use by the residential, transport and industrial sectors. In addition, as an oil-producing country, Mauritania's major sources of GHG emissions are also likely to include process-based emissions from extraction, processing and transport of fuel.

There is limited data available to estimate the total GHGs emitted by the energy consumption of Mauritania's residential, industrial, transport and commercial sectors (Table 3-5), however the total emissions generated by the energy sector are estimated to be ~0.7 MT CO_2e of which 0.6 MT CO_2e are generated by fugitive emissions (likely attributable to secondary activities such as gas flaring and refinement by-products generated by the extraction and refining of crude oil).

Mauritania's energy sector is estimated to contribute a relatively small proportion (~9%) to the total national GHG emissions of 7.35 MT CO_2e per annum. Table 3-5 indicates that the sector that accounts for the majority of Mauritania's GHG emissions is agriculture (~7.8 MT CO_2e). As described in Section 1, agriculture (particularly livestock production) is one of the main sources of livelihood of Mauritania's rural population and a major contributor to GDP – as a result the majority of emissions from the agriculture sector are attributable to the livestock production sector. Section 3.2.2 provides additional details on Mauritania's Agriculture, Land Use and Land Use Change (AFOLU) sectors. In addition to the energy sector, secondary emissions from the sectors of industry (~0.3 MT CO_2e) and waste (~0.1 MT CO_2e) contribute to Mauritania's total national GHG emissions of 7.35 MT CO_2e per annum. Some statistics indicate that the land use change and forestry sector has negative emissions (~-1.52 MT CO_2e) and therefore contributes to carbon sequestration (Table 3-5, however these figures are contradicted by other resources (Section 3.2.2, further below).

Table 3-5: Mauritania's national greenhouse gas emissions from primary energy consumption (based on 2014-2016)

NATIONAL GHG EMISSIONS FROM FUEL COMBUSTION BY FUEL SOURCE AND SECTOR[12]		
Source / Sector		**Total emissions (MT CO_2e)**
Energy	Other fuel combustion	0.06
	Fugitive emissions	0.6
	Energy sub-total	0.65
Industrial processes		0.34
Agriculture		7.75
Waste		0.12
Land use change and forestry (LUCF)		-1.52
Total emissions (including LUCF)		7.35

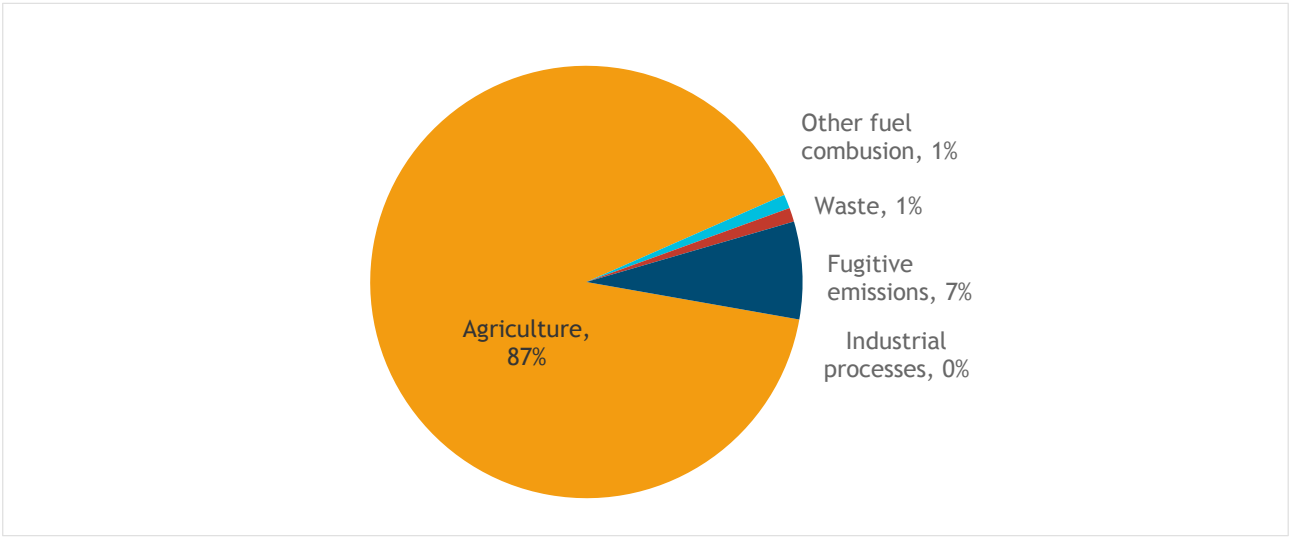


Figure 3-4: Distribution of Mauritania's GHG emissions by major sectors (excluding LUCF which has negative emissions)

3.2.2 GHG emissions from agricultural practices

Table 3-6, below, summarises GHG emissions from Mauritania's agriculture sector (derived from Food and Agriculture Organisation statistics). Mauritania's agriculture sector contributes ~7.7 -7.8 MT CO_2e (Tables 3-5 and 3-6). Activities contributing to emissions including multiple sources related to the livestock sector, including enteric fermentation, manure left on pastures and various other manure management practices (contributing 4.4, 2.7, and 0.28 MT CO_2e, respectively). Rice cultivation, which is largely confined to the irrigable land in the vicinity of the Senegal River in the south, contributes an additional 0.25 MT CO_2e. The total GHGs emitted by other agricultural practices such as fertiliser use, and crop residue management are small enough as to be almost negligible.

Statistics on Mauritania's national GHG emissions from land use change and forestry are somewhat contradictory and require substantial groundtruthing and updates - Mauritania's last national forest inventory was undertaken in 1982, and as a result there is a lack of updated surveys or groundtruthing to inform an accurate assessment of the extent of remaining forests and woodlands. National statistics provided in the Third National Communication to UNFCCC[13] indicate that Mauritania's land use change and forestry sector is a net sink of GHG emissions, however, the latter estimates

do not include the removals of biomass for energy which are estimated to be ~10 times larger than net sequestration by forested areas. Furthermore, alternative resources such as the FAO and CAIT WRI databases on land use change both respectively indicate that Mauritania forests are undergoing net negative changes (Tables 3-6 and 3-7, below). Global Forest Watch reports the total aboveground carbon stock of Mauritania's forest biomass as ~8.96 million tonnes, however the same resource also estimates that all woodlands with canopy cover greater than 30% have been effectively reduced to 0 hectares (Table 3-7). The southern third of the country bordering Senegal and Mali formerly was characterised by sparse Sahelian savanna woodlands with stands of commercially useful tree such as *Ziziphus* sp., *Balanytes* sp., and *gomme Arabique*-generating *Acacia* species, while stands of gallery forest were reportedly found in the narrow extent of the Senegal River Valley in the south. However, the former woodland areas are now largely degraded and converted to steppe vegetation and sand dunes, whereas the latter gallery forests are reportedly converted to comparatively sparse stands of *Acacia nilotica*.

Table 3-6: National annual greenhouse gas emissions from agricultural practice, forestry and other land use in Mauritania (estimated for 2014-2017)

VARIABLE		ANNUAL EMISSIONS (MT CO_2E)
Annual GHG emission from agricultural practices [14]	Burning - crop residues	<0.01
	Burning - savanna	0.05
	Crop residues	0.03
	Enteric fermentation	4.41
	Manure management	0.22
	Manure applied to soils	0.06
	Manure left on pasture	2.68
	Rice cultivation	0.25
	Sub-total (Agricultural practices)	7.69
Annual GHG emission from land use change [14]	Forest land	-1.52
	Burning biomass	<0.01
	Sub-total (Land use change)	-1.52
Total emissions		6.18

Table 3-7: Vegetation cover and land use change in Mauritania (estimated for 2015)

VARIABLE			TOTAL (HECTARES)	TOTAL (% OF LAND AREA)	UNIT
Total tree cover [15]	10-30% canopy cover		11	0.00	% of total land area
	30-50% canopy cover		0	0.0	
	50-100% canopy cover		0	0.0	
	Total		4	0.0	
Land use change and agricultural expansion	Historical annual rate of deforestation[16]	10-30% canopy cover		3.7	% of previous year
		30-50% canopy cover		7.1	
		50-100% canopy cover		7.1	
	Area of agricultural land[17]		39,712,871	38.5	% of total land area

4. SUMMARISED NATIONAL PRIORITIES FOR CLIMATE CHANGE ADAPTATION AND MITIGATION

Mauritania's main priority actions related to climate change are described in the country's submissions to the UNFCCC through the Intended Nationally Determined Contributions (NDC) document. The document includes brief descriptions of the country's major commitments and priorities related to GHG mitigations (Table 4-2, below) as well as major priorities related to adaptation, derived from the draft National Adaptation Plan (NAP) (Table 4-3, further below).

The Islamic Republic of Mauritania intends to contribute to the Paris Climate Agreement by reducing its greenhouse gas emissions by 22.3% in 2030 or by 4.2 million tons of carbon dioxide equivalent (MtCO2e) compared to projected emissions for the same year in a business as usual scenario which would increase from 6.6 MtCO2e in 2010 to 18.84 MtCO2e in 2030. Thus, for the period from 2020 to 2030 avoided accumulated emissions by the proposed mitigation measures are about 33.56MtCO_2e.

The total investment costs for Mauritania's objectives (including adaptation and mitigation) is estimated to be ~ USD 18.7 billion, of which ~12% is unconditional and the remaining ~88% is conditional on identifying sources of international support. Investment costs for Mauritania's proposed mitigation actions are estimated to be ~USD 9.3 billion dollars, of which ~USD 8.2 billion are intended to be identified from conditional funding support. With respect to investment costs needed for adaptation, Mauritania's NDC estimates investment costs of ~USD 9.4 billion.

Table 4-1, below, gives details on Mauritania's GHG reduction targets outlined in the country's NDC, with information on target gases and sectors, the use of international markets in achieving targets (e.g. the use of carbon credits), and accounting methods used to quantify GHG emissions (e.g. inclusion of land use and land use change).

Table 4-1: Summary of Mauritania's NDC commitments for reduction of GHG emissions (2016)

GHG EMISSIONS REPORTED IN NDC (MT CO2E/YR)	BASE LEVEL	REDUCTION TARGET	TARGET YEAR	SECTORS AND GASES	USE OF INTERNATIONAL MARKETS	LAND-USE INCLUSION / ACCOUNTING METHOD
11.16	BAU	2.7 percent (unconditional); 22.3 percent (conditional)	2030	CO2, CH4, N2O; Energy, industrial processes products and uses, agriculture, forestry and land-use, waste	Not mentioned	Land-use included; accounting methodology not specified

4.1 National priorities for climate change mitigation

Mauritania chose to formulate its contribution in terms of reduction in relation to the reference scenario. The estimate was made on the basis of the projects planned during the period 2020-2030. The sectors concerned are all sectors emitting GHGs namely: (i) Energy; (ii) AFOLU; (iii) Industrial Processes and (iv) Waste. Proposed activities and investments within each sector are further categorised according to 'Technology Type', based on the categories of technologies listed by the Green Climate Fund's (GCF) impact indicators for mitigation projects (key for technology types provided in footnotes). The nature of the unconditional part of the contribution focuses on regulation (e.g. measures put in place in 2015 by the government to limit the age of imported vehicles to 8 years and the tax exemption on ex-factory buses used for public transport) and are in the form of priority actions for access to basic services to reduce rural poverty (e.g. rural electrification, equipment of water points with solar pumps, etc.).

Table 4-2: Mitigation priorities in Mauritania's NDC

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[2]
Energy	Rural electrification	1, 6
Water	Equipment of water points with solar pumps	1
Transport	Limit the importation of vehicles over 8 years old	5, 8
	Exempt from tax ex-factory buses used for public transportation	

4.2 National priorities for climate change adaptation

Mauritania's NDC identifies adaptation priorities for multiple vulnerable sectors, including coastal zones, agriculture, forestry, fisheries, livestock, water and human health. Proposed activities and investments related to adaptation are further categorised according to 'Technology Type', based on the categories of technologies listed by the Green Climate Fund's (GCF) impact indicators for adaptation projects (key for technology types provided in footnotes). The actions identified include a focus on safeguarding the livelihoods of vulnerable communities from the impacts of climate change, such as restoration and improved management of natural resources and ecosystem services in the water, livestock, agriculture, and fishery sectors. As a result of the risks of floods and resultant impacts on sanitation and human health, particularly in the coastal urban centres of Nouakchott and Nouadibhou, Mauritania's NDC prioritises actions to protect urban sanitation and infrastructure from coastal inundation and flooding, as well as improved integrated management of watersheds and wetlands. As a particularly arid and water-scarce country, Mauritania's adaptation measures include multiple actions to safeguard water supplies and increase accessibility of water, including fresh water for human consumption as well as for livestock and crop production. Additional information on Mauritania's proposed adaptation actions are detailed in Table 4-3, below.

[2] **GCF Technology Type Key (derived from GCF's Results Framework for adaptation)*

1. Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions.

2. Increased resilience of health and wellbeing, and food and water security

3. Increased resilience of infrastructure and the built environment to climate change threats

4. Improved resilience of ecosystems and ecosystem services

5. Strengthened institutional and regulatory systems for climate responsive planning and development

6. Increased generation and use of climate information in decision making

7. Strengthened adaptive capacity and reduced exposure to climate risks

8. Strengthened awareness of climate threats and risk reduction processes

Table 4-3: Adaptation priorities in Mauritania's NDC

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[3]
Water	Implement sanitation networks (sewage and rainwater) in the cities of Nouakchott, Rosso, Kaedi, Kiffa, Nouadhibou, Nema, Aioun, Timbedra, Akjoujt and Atar	1, 2
	Administration of 300 studies for the exploration of aquifers, which can be transformed into boreholes and / or piezometers (of which 150 explore depths greater than 200m)	2,5
	Production of hydrogeological reports and assessment of water resources in difficult or vulnerable areas and the extension of regular monitoring to water catchments through remote transmission	
	Implementation of the drinking water supply project (AEP) in 4 wilayas in the North zone of the country	1, 2
	Implementation of desalination projects for coastal and other areas	
	Implementation of 2,000 small isolated drinking water supply networks (AEP) in rural areas equipped with solar	
	Management of small water bodies on pilot sites	
Institutional	Strengthening of the institutional and technical capacities on national and local levels in the planning, financing and implementation of climate change adaptation	5,7
Coastal Zone	Protection of the cities of Nouakchott and Nouadhibou against the risks of marine immersion and silting	3
Community based	The promotion of responsible fishing on Foum Gleita lake	1, 4
	Capacity building for monitoring and management of inland fisheries	4, 5, 7
	Promotion of fish farming to improve food security and reduce poverty in rural areas	1, 4
	Strengthening the resilience of the vulnerable population to climate change, particularly in rural areas	1
	Achieve a food requirement ratio of 117% for rice, 80% for 75% for traditional cereals; 160% for milk, 126% for white meat	1

[3] **GCF Technology Type Key (derived from GCF's Results Framework for adaptation)*

1. Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions.

2. Increased resilience of health and wellbeing, and food and water security

3. Increased resilience of infrastructure and the built environment to climate change threats

4. Improved resilience of ecosystems and ecosystem services

5. Strengthened institutional and regulatory systems for climate responsive planning and development

6. Increased generation and use of climate information in decision making

7. Strengthened adaptive capacity and reduced exposure to climate risks

8. Strengthened awareness of climate threats and risk reduction processes

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[4]
Health	Strengthening the nutrition and health of vulnerable households	1
AFOLU	Aerial seeding of degraded lands (10 000 ha / year) to promote regeneration of the natural environment	4
	Restoration of natural pastures (Protection and management of rangelands within the framework of land use climate plans)	1, 4
	Strengthening resilience of natural ecosystems to the effects of climate change	4
	The integrated and sustainable rehabilitation and management of wetlands against climate change impacts	4

[4] *GCF Technology Type Key (derived from GCF's Results Framework for adaptation)*

1. Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions.

2. Increased resilience of health and wellbeing, and food and water security

3. Increased resilience of infrastructure and the built environment to climate change threats

4. Improved resilience of ecosystems and ecosystem services

5. Strengthened institutional and regulatory systems for climate responsive planning and development

6. Increased generation and use of climate information in decision making

7. Strengthened adaptive capacity and reduced exposure to climate risks

8. Strengthened awareness of climate threats and risk reduction processes

5. ASSUMPTIONS, GAPS IN INFORMATION AND DATA, DISCLAIMERS

The observed and projected climate trends described in Section 2 'Climate and Weather' are derived from a combination of publicly-available observational data and CMIP5 climate models. Detailed information is included in Section 6. Appendix 1, including '6.1.b. Historical Trends and Variability Analysis' and '6.1.c. Climate Projections Visualisations'.

Unless stated otherwise, all statistics reported in Section 1 ('Geographic and Socio-Economic Context' and Section 3 'Climate change mitigation, greenhouse gas emissions and energy use') are derived from databases of publicly available datasets managed by international or multilateral agencies including inter alia The World Bank Group, the United Nations, World Resources Institute and International Energy Agency.

Unless stated otherwise, all energy and greenhouse gas emission figures are derived from UN Stats (2014); World Energy Council (2016); the World Resources Institute (2013), and the International Energy Agency (2016). Agriculture & forestry-related emissions are also reported from Food and Agriculture Organisation (2014-2017) and Global Forest Watch. (2015-2017). Full references are provided as a supplementary appendix.

As a result of the use of standardised methodologies and data sources across the 25 countries included in this AfDB Climate Change Profile, statistics and estimates reported herein may differ from other publicly available datasets or national estimates. Readers are advised to always check for updated publications and newly released national datasets.

This AfDB Climate Change Profile series is intended to provide a brief touch-stone reference for climate change practitioners, project managers and researchers working in African countries. The figures and estimates provided herein are intended to inform the reader of the main climate-related challenges and priorities, however these should be used to inform a process of additional research and in-country consultations. The University of Cape Town, the African Development Bank and its Boards of Directors do not guarantee the accuracy of figures and statements included in this work and accept no responsibility for any consequences of its use.

6. APPENDIX 1

1.a Supporting evidence

The climate projections detailed in Chapter 2 (above) are supported by rigorous analysis of observed and model projections data. More details of this analysis and supporting figures can be found below.

1.b Historical trends and variability analysis

The analysis of historical trends and variability of key climate variables is presented below. This analysis uses the WATCH Climate Forcing dataset which has been selected as the most broadly representative of station observations across Mauritania. Long term (1979 to 2015) trends as well as inter-annual variability (decade to decade) has been analysed for total annual rainfall, number of rainfall days, number of extreme rainfall days, and daily mean temperatures for each of the three climate regions across Mauritania. The plots below detail **inter-annual variability** (dotted lines), **decadal variability** (smooth bold solid curves) and **long term trends** (thin straight lines) for each region and statistic. This allows for comparison of different types of variability against the long term trend. It can be seen that for rainfall statistics, inter-annual and decadal variability are typically fairly large along with relatively large long term trends. For example, for total annual rainfall, the Sahel region has relatively high inter-annual (80mm in some years to 220mm in other years) and moderate decadal variability (100mm in some decades to 200mm in other decades). Long term trends are statistically significant could be around 75mm over the 30 year period.

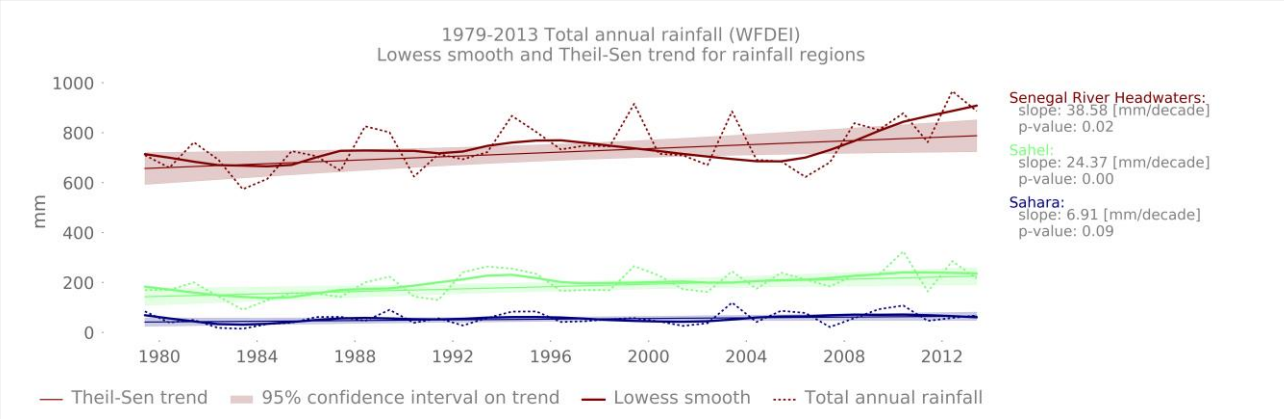


Figure A-1: Long term trends and variability in total annual rainfall for rainfall regions

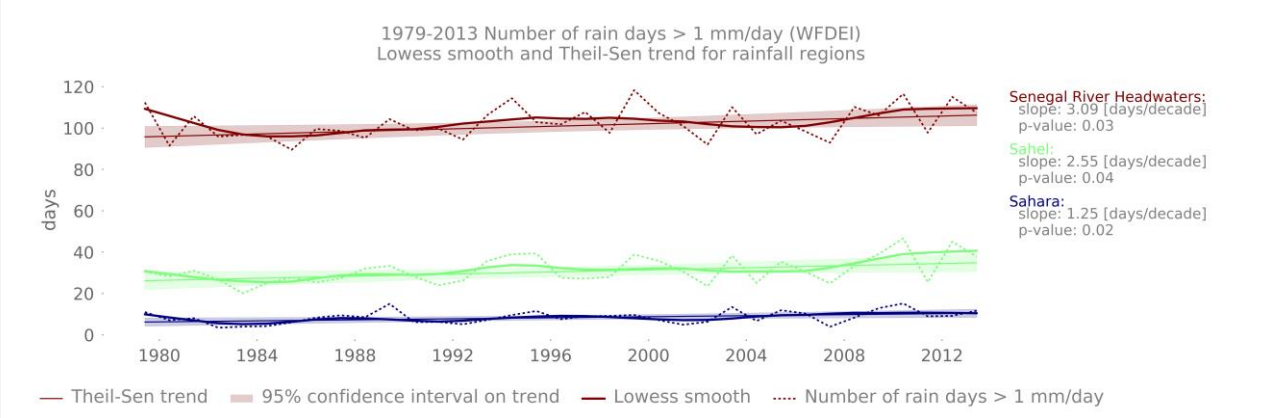


Figure A-2: Long term trends and variability in frequency of rainfall events for rainfall regions

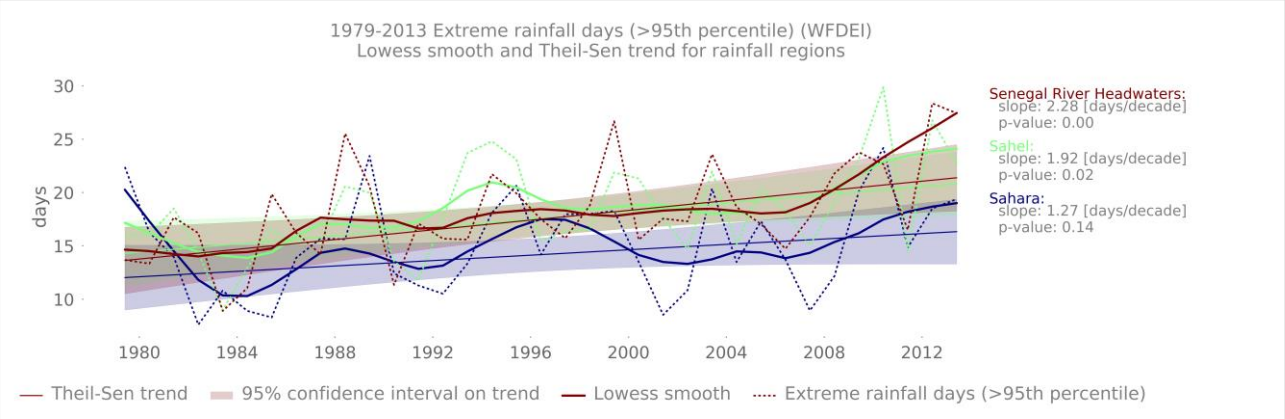


Figure A-3: Long term trends and variability in extreme rainfall events for rainfall regions

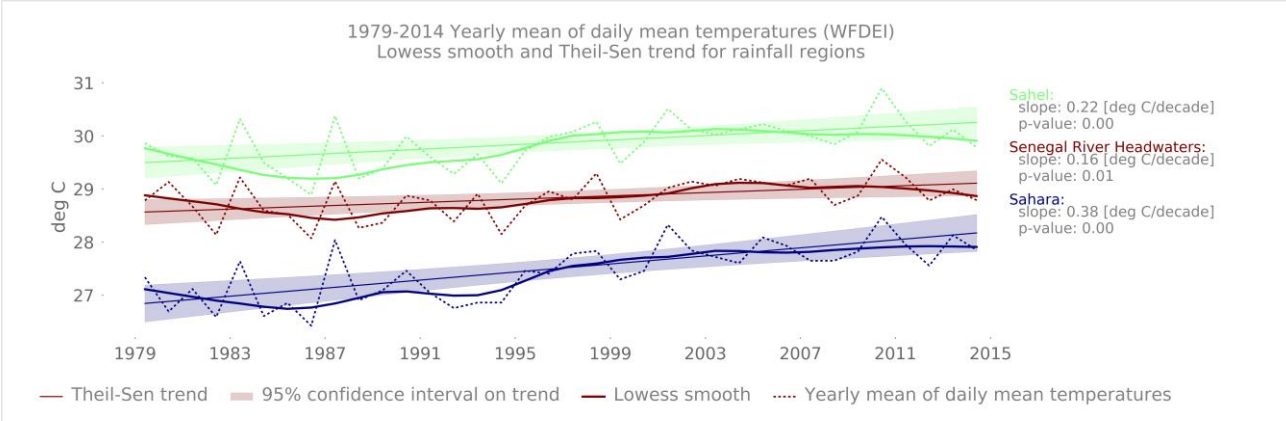


Figure A-4: Long term trends and variability in daily mean air temperatures for rainfall regions

1.c Climate projections visualizations

The plots below (Figures A-5 – A-8) are called plume plots and they are used to represent the different long term projections across the multiple climate models in the CMIP5 model archive used to inform the IPCC AR5 report. The plots show projected variations in different variables averaged over the climate regions. The blue colours indicate variations that would be considered within the range of natural variability, so in other words, not necessarily the result of climate change. The orange colours indicate projection time series where the changes would be considered outside of the range of natural variability and so likely a response to climate change. It is important to note that these are global climate model projections and so likely do not capture local scale features such as topography and land ocean boundary dynamics. They also may not capture small scale features such as severe thunderstorms that can have important societal impacts. Finally, these projections are averages over relatively large spatial areas and it is possible that different messages would be obtained at small spatial scales and if various forms of downscaling are performed.

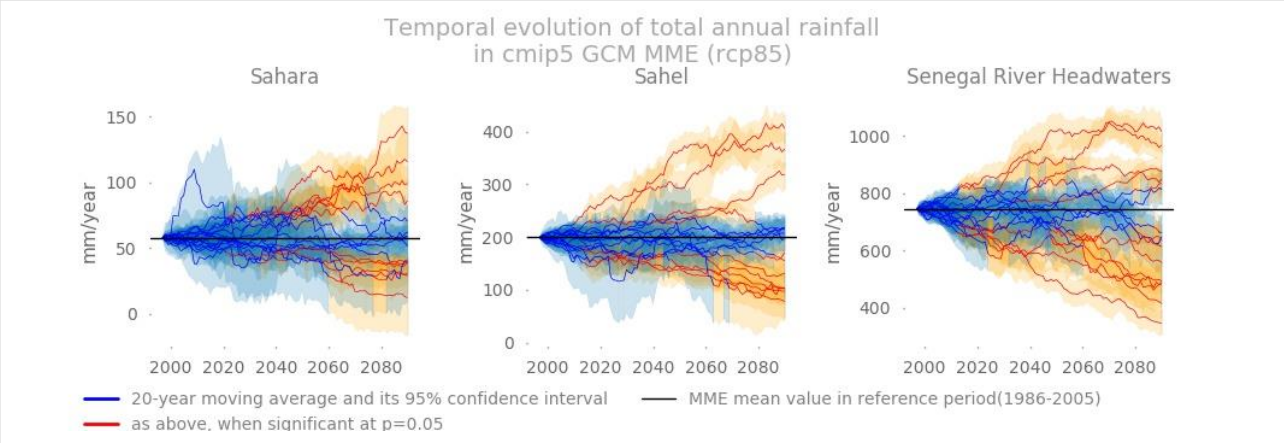


Figure A-5: Projected changes and emergence of changes in total annual rainfall

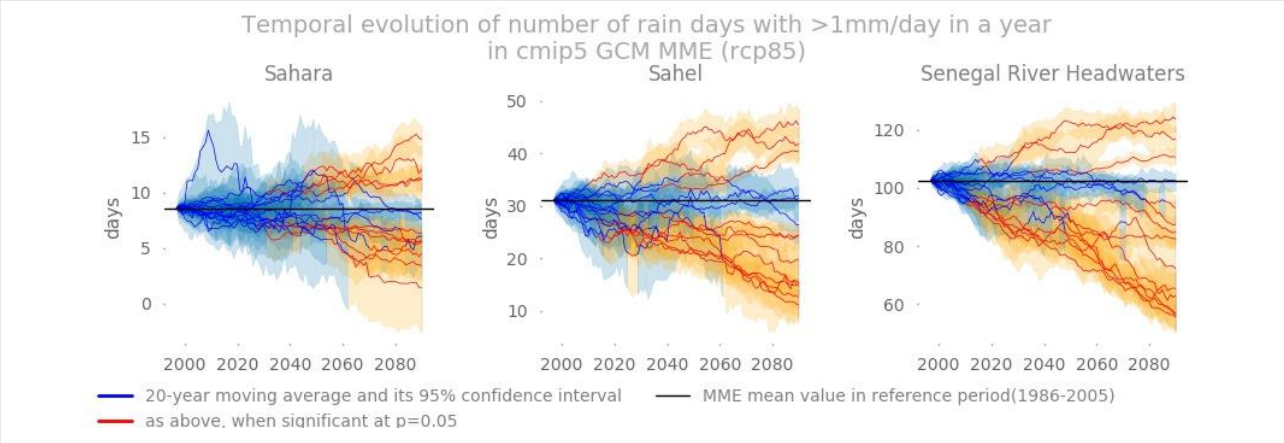


Figure A-6: Projected changes and emergence of changes in number of rain days per year

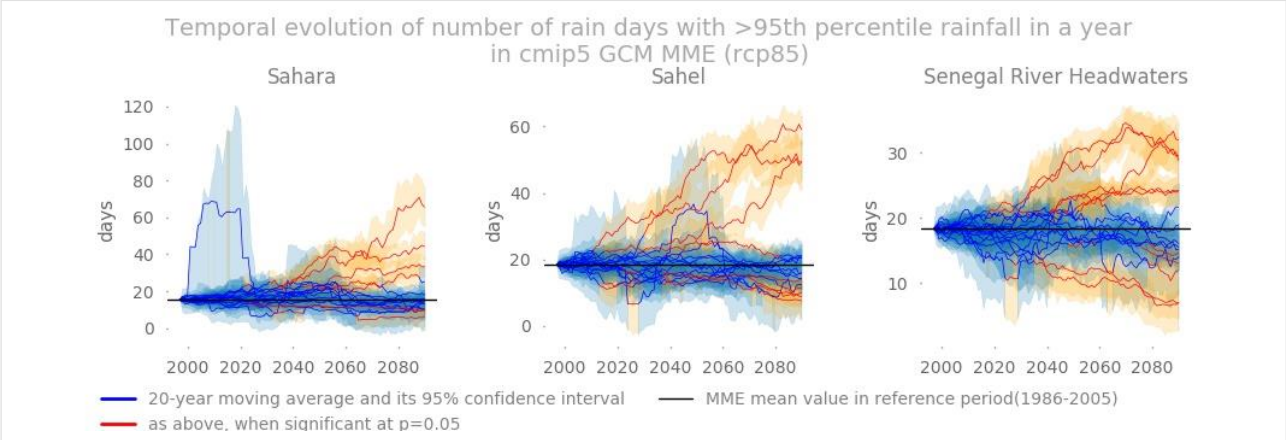


Figure A-7: Projected changes and emergence of changes in number of very heavy rainfall days (greater than 95th percentile) per year

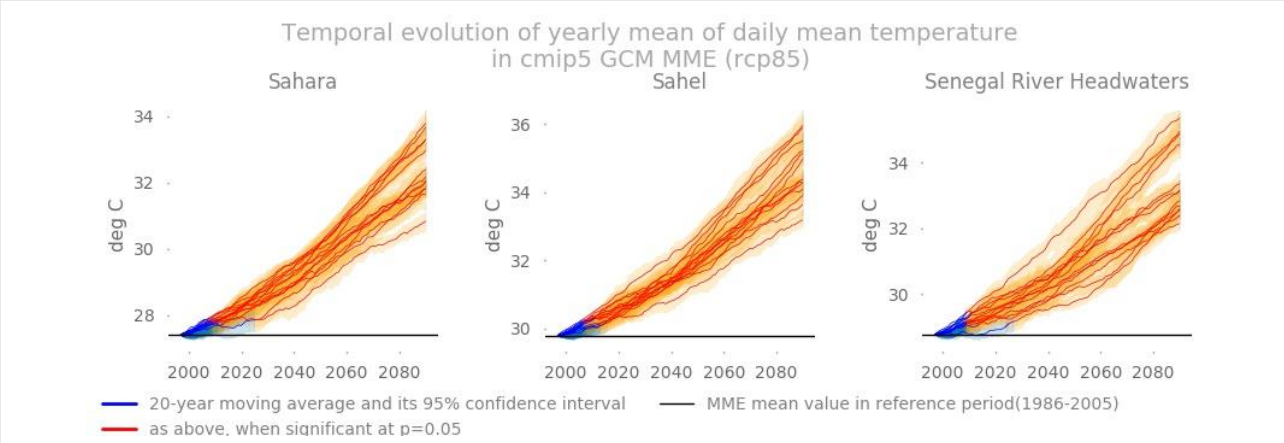


Figure A-8: Projected changes and emergence of changes in annual mean daily mean temperatures

7. REFERENCES

1. Worldometers. (2017). African countries by population. Retrieved from http://www.worldometers.info/population/countries-in-africa-by-population/
2. World Bank. (2016). Data Bank. Retrieved from http://databank.worldbank.org/data/home.aspx
3. African Economic Outlook. (2014). Statistics. Retrieved from http://www.africaneconomicoutlook.org/en/statistics
4. UNDP. (2016). *Human Development Report (Data for 2015)*. Retrieved from http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf
5. World Bank. (2014). Data Bank. Retrieved from http://databank.worldbank.org/data/home.aspx
6. World Bank. (2015). Data Bank. Retrieved from http://databank.worldbank.org/data/home.aspx
7. Emergency Events Database. (2017). Disaster List (1996-2016). Retrieved from http://emdat.be/emdat_db/
8. Socioeconomic Data and Applications Center. (2010). Population Landscape and Climate Estimates. Retrieved from http://sedac.ciesin.columbia.edu/data/set/nagdc-population-landscape-climate-estimates-v3/data-download
9. ND GAIN. (2015). Country Rankings. Retrieved from http://index.gain.org/ranking
10. UN Stats. (2014). Energy Balances. Retrieved from https://unstats.un.org/unsd/energy/balance/default.htm
11. World Energy Council. (2016). Dynamic Data. Retrieved from https://www.worldenergy.org/data/
12. World Resources Institute. (2013). CAIT Climate Data Explorer. Retrieved from http://cait.wri.org/
13. Islamic Republic of Mauritania. (2014). *Third National Communication*. Retrieved from http://unfccc.int/resource/docs/natc/mrtnc3.pdf
14. Food and Agriculture Organisation. (2014). FAOSTAT Data. Retrieved from http://www.fao.org/faostat/en/#data
15. Derived from Global Forest Watch. (2017). Country Profiles. Retrieved from http://www.globalforestwatch.org/
16. Derived from Global Forest Watch. (2015). Mean 2001-2014. Retrieved from http://www.globalforestwatch.org/
17. Food and Agriculture Organisation. (2011). FAOSTAT Data. Retrieved from http://www.fao.org/faostat/en/#data