NIGER

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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ACKNOWLEDGEMENT

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1. BACKGROUND

1.1 Geographic and socio-economic context

The Republic of Niger (henceforth 'Niger', shown below in Figure 1-1) is a landlocked country in West Africa. Niger is bordered by Libya to the northeast, Chad to the east, Nigeria and Benin to the south, Burkina Faso and Mali to the west, and Algeria to the northwest. Niger covers a land area of almost 1,270,000 km2, making it the largest country in West Africa, with over 80 percent of its land area covered by the Sahara Desert. Niger has a population of ~21,500,000 people, ~18% of which are urban. Niger's urban population is proportionally one of the smallest in Africa, however at present the country has the 6th fastest urbanisation rate on the continent (5.3%) and the fastest population growth rate (~4.1%). Niger has the highest level of gender inequality in Africa with a gender inequality index of 71.3, and ~70% of the urban population lives in slums. Niger also has a relatively low GINI coefficient of 34.0 indicating a wide disparity in wellbeing, income and access to opportunity between different groups. Niger is a developing country and is consistently one of the lowest-ranked in the United Nations' Human Development Index (HDI); it is ranked 52nd in Africa with an HDI of 0.35. Much of the non-desert portions of the country are threatened by periodic drought and desertification and as a result, a cumulative total of ~20,000,000 people (equivalent to almost the whole population of Niger) were affected by drought in the period ~1996–2016. The ND-GAIN index for Niger is 35.6, one of the lowest in Africa. This index summarizes the country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience and, in the case of Niger, indicates that the country has both a great need for investment and innovations to improve readiness and a great urgency for action. Key socio-economic and demographic indicators are further presented and summarised in Table 1-1, below.

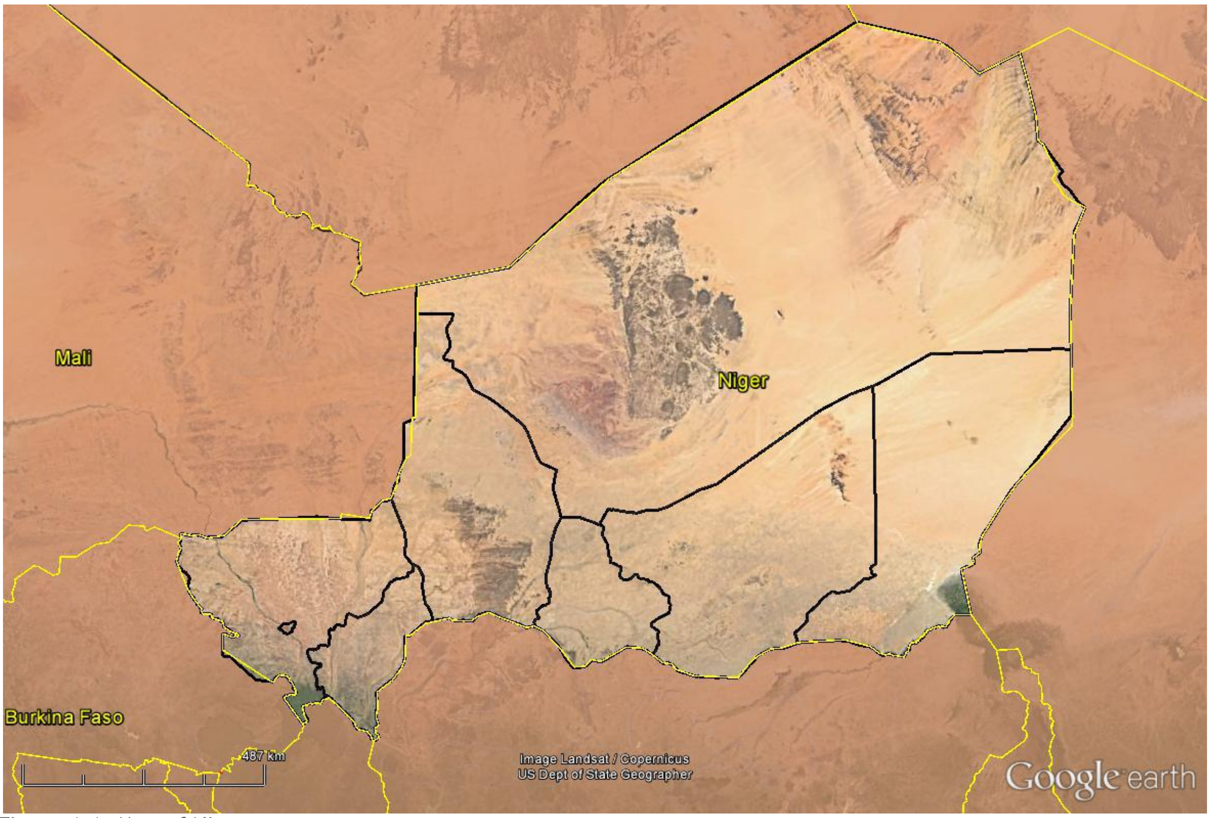

Figure 1-1: Map of Niger

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

<table>
<tr><th colspan="2">VARIABLE</th><th>SCORE/TOTAL</th><th>UNIT</th><th>RANK (IN AFRICA)</th></tr>
<tr><td colspan="5">Geography, Socio-Economy and Demographics</td></tr>
<tr><td colspan="2">Population[1]</td><td>21,563,607</td><td>people</td><td>18</td></tr>
<tr><td colspan="2">Population growth rate[1]</td><td>4.1</td><td>% population. yr-1</td><td>1</td></tr>
<tr><td colspan="2">Population density[1]</td><td>17</td><td>People/km2</td><td>44</td></tr>
<tr><td colspan="2">Land area[1]</td><td>1,268,447</td><td>km2</td><td>5</td></tr>
<tr><td colspan="2">% Urban population[1]</td><td>17.7</td><td>% population</td><td>52</td></tr>
<tr><td colspan="2">% Urbanisation rate[2]</td><td>5.3</td><td>% population. yr-1</td><td>6</td></tr>
<tr><td colspan="2">Economy: total GDP[2]</td><td>7.5</td><td>USD billions. yr-1</td><td>34</td></tr>
<tr><td colspan="2">Economy: GDP by PPP[2]</td><td>20</td><td>billion international dollars. yr-1</td><td>35</td></tr>
<tr><td colspan="2">Economy: GDP/capita[2]</td><td>363</td><td>USD per capita/yr.</td><td>49</td></tr>
<tr><td colspan="2">Population below the poverty line[3]</td><td>45.7</td><td>% below USD 1.90 per day</td><td>18</td></tr>
<tr><td colspan="2">Gender Inequality Index[3]</td><td>71.3</td><td></td><td>1</td></tr>
<tr><td colspan="2">GINI co-efficient[3]</td><td>34.0</td><td></td><td>41</td></tr>
<tr><td colspan="2">HDI[4]</td><td>0.35</td><td></td><td>52</td></tr>
<tr><td colspan="2">Access to electricity[5]</td><td>14.3</td><td>% population</td><td>46</td></tr>
<tr><td colspan="5">Summary indicators of climate change vulnerability</td></tr>
<tr><td colspan="2">Workforce in agriculture[6]</td><td>56.9</td><td>% workforce</td><td>17</td></tr>
<tr><td colspan="2">Population undernourished[7]</td><td>9.5</td><td>% population</td><td>29</td></tr>
<tr><td colspan="2">Number of people affected by drought[8]</td><td>20,081,186</td><td>people</td><td>3</td></tr>
<tr><td colspan="2">Number of people affected by flood events[8]</td><td>1,678,692</td><td>people</td><td>10</td></tr>
<tr><td colspan="2">Population living in informal settlements[5]</td><td>70.1</td><td>% urban population</td><td>14</td></tr>
<tr><td colspan="2">Incidence of malaria[7]</td><td>357</td><td>cases per 1000 population at risk</td><td>5</td></tr>
<tr><td colspan="2">Workforce in agriculture[6]</td><td>56.9</td><td>% workforce</td><td>17</td></tr>
<tr><td rowspan="3">ND-Gain Vulnerability Index[10]</td><td>Total</td><td>35.6</td><td></td><td>42</td></tr>
<tr><td>Readiness</td><td>0.33</td><td></td><td>27</td></tr>
<tr><td>Vulnerability</td><td>0.62</td><td></td><td>9</td></tr>
</table>

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2. CLIMATE AND WEATHER

Niger's climate is largely hot and dry with the northern half being classified as a desert and most of the southern parts having a semi-arid climate. Rainfall generally occurs during boreal summer with little rainfall occurring during the long dry winter season. The daily mean temperatures are generally higher over the southern parts and show less seasonal variability than the northern parts, this is because the northern parts experience more extreme differences between daytime vs. night time temperatures and summer vs. winter temperature. The river catchment or water region of Niger extends to the south-west to include the Niger River headwaters. This region is more tropical with higher rainfall which occurs over a longer summer season. Temperatures are also slightly warmer and peak at the beginning and to a lesser degree at the end of the rainy season.

Niger and its water region can be divided into three climatic regions based on annual total rainfall as well as variations in the seasonal cycle of rainfall. These zones are illustrated in Figures 2-1 and 2-2, below, and summary descriptions can be found in Table 2-1 below.

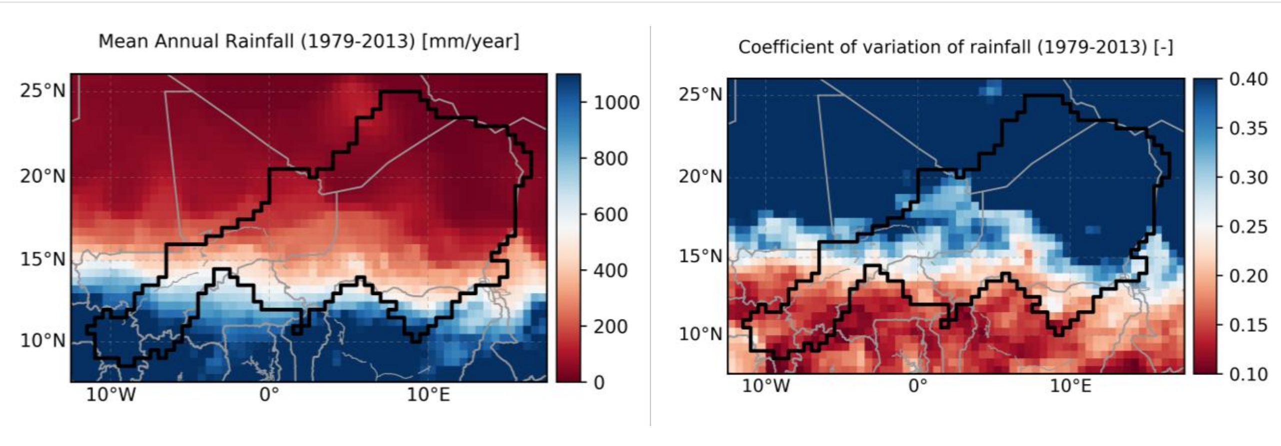
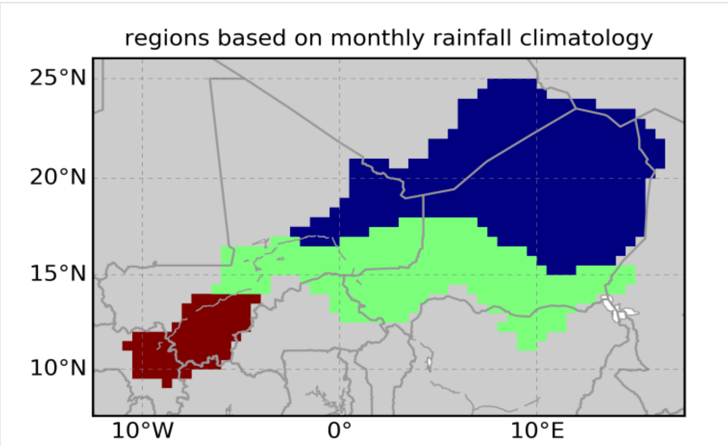


Figure 2-1: Main characteristics (magnitude and variability) of rainfall in Niger and its region



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

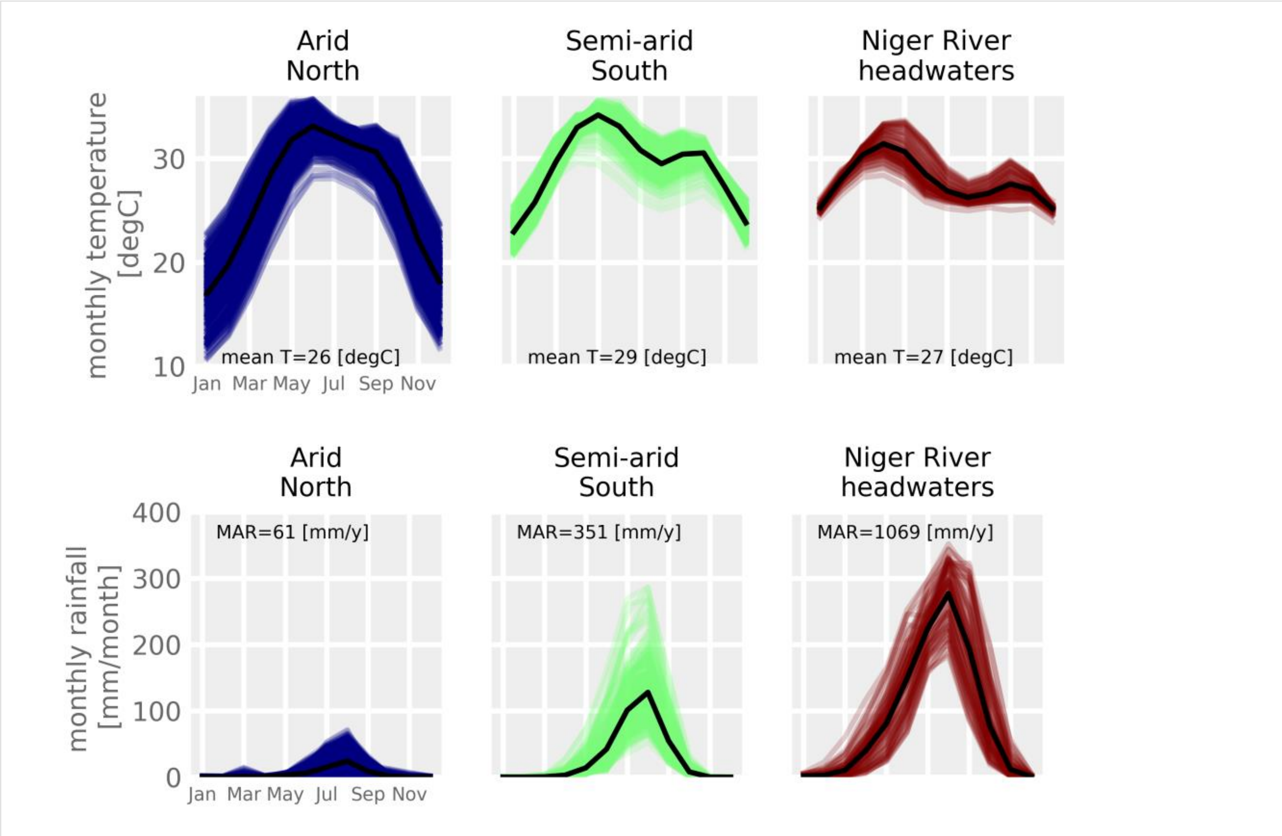


Figure 2-2: Rainfall regions of Niger based on similarity of standardised rainfall climatology, and their rainfall and temperature climatologies

Table 2-1: Main rainfall regions of Niger

ARID NORTH	A very dry region where the mean annual total rainfall is only 60 mm/year and the daily mean temperature averages 26° C. Rainfall decreases from south to north over the region and interannual variability is high, especially in the north. What rainfall does occur, normally occurs during boreal summer (July – September). Temperature varies through the year by around 15° C averaging above 33° C during summer (May – September) and reaching a minimum of around 18° C in winter (December – January).
SEMI-ARID SOUTH	A semi-arid region where the mean annual total rainfall is around 350 mm/year and the daily mean temperature averages 29° C. Rainfall decreases and interannual variability of rainfall increases from south to north. Rainfall occurs during summer (June – September) peaking at around 120 mm/month during August. A long dry season occurs from October to April. Temperatures vary through the year by around 13° C and are generally above 30° C from April to October with cooler temperatures of around 22° C during boreal winter.
NIGER RIVER HEADWATERS	A tropical region where the mean annual total rainfall is around 1070 mm/year and the daily mean temperature averages 27° C. Rainfall decreases and interannual variability increases from low to moderate from south-west to north-east over the region. Rainfall occurs primarily during summer (May – October) peaking at around 280 mm/month during August. A relatively dry season occurs from November to March. Temperatures vary through the year by around 6° C with warmest temperatures (31° C) occurring at the start of the rainy season (March – May) with a smaller secondary peak at the end of the rainy season in October. Coolest temperatures occur during boreal winter (December – January).

2.1 Observed historical climate variations and climate change trends

As with many semi-arid to arid climate regions, the majority of Niger experiences **moderately high rainfall variability** on an inter-annual basis. On **decadal time scales** Niger 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 three regions show consistent upward and clear trends of **increasing temperatures** over the period 1979 - 2015 with the most rapid increases observed in the Arid North Region and lest over the Niger River Headwaters. Long term trends in annual total rainfall are strong and statistically significant over the Semi-arid South Region and to a lesser extend in the Arid North. No trend is evident over the Niger River Headwaters Region. No statistically significant trends are evident in rain day frequency, but statistically significant trends are seen in the extreme rainy-day frequency with the Arid North showing a decreasing trend while the other two regions show an increasing trend over the last 35 years. Long term trends and variability across the six climate regions 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 Niger (1979 - 2015)

REGION	MEAN T [DEG C/DECADE]	TOTAL RAINFALL [MM/DECADE]	EXTREME RAINY DAYS [DAYS/DECADE]	RAINY DAYS [DAYS/DECADE]
Arid North	+0.23	+7.7	-2.0	slight downward
Semi-arid South	+0.21	+26.3	+2.3	-2.1
Niger River Headwaters	+0.07	Not evident	+3.0	-3.1

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

Projections of future climate based on CMIP5 GCM simulations[1] under the RCP8.5 pathway[2] indicate that all six regions show strong similarities with respect to both rainfall and temperature projections. Projected changes for the six regions 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

Future projections of annual total rainfall for the Arid North and Semi-arid South display a common message of **potential increased rainfall** emerging from as early as the 2020s in some regions. No consistent message is evident over the Niger River Headwaters Region. The frequency of rainfall events is projected to remain constant or increase over the two more arid regions and to possibly decrease over the Niger River Headwaters. All three regions project a possible increase in the frequency of extreme rainfall events into the future. It must be noted that these results are derived from GCM projections which may not accurately represent changes in extreme rainfall dynamics. Other studies have suggested that increased convective rainfall intensity (e.g. thunderstorm-related rainfall) should generally be expected in a warmer climate.

[1] The fifth iteration of the Couple Model Inter-comparison Project (CMIP) is a coordinate activity amongst international modeling centres to produce a suite of climate simulations using common experimental parameters. CMIP5 is currently the primary source of global to regional scale climate projections and extensively informed the IPCC Fifth Assessment Report (AR5)

2 Although this emissions/development pathway represents the “worst-case scenario” amongst the pathways simulated by the IPCC CMIP5 models, at this stage it is the most realistic reflection of the recent progression of anthropogenic emissions. It is presented here, in spite of the Paris agreement, as effects of its commitments remain to be shown.

2.2.2 Projected changes in temperature from present to 2100

Projected changes in temperature are similar across all regions with temperatures projected to be 2°C to 3°C warmer in most regions by the 2050s, however the spread of values is wider for the Niger River Headwaters Region. By 2100 the range of projected temperatures is greater the regions showing projected increases of 2°C to 4°C by 2100 and the inland regions showing increases of 3°C to 6°C by 2100.

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

REGION	AVERAGE TEMPERATURE [°C]	TOTAL ANNUAL RAINFALL [MM/YEAR]	NUMBER OF HEAVY RAINFALL [DAYS/YEAR]	RAINY DAYS [DAYS/YEAR]
Arid North	**Increasing** +2°C to +2.5°C by 2050s but changes evident in next decades	**Normal to increasing**, generally ranging from no change to an increase of up to 100% by 2050 and even stronger by the end of the century	**Normal to increasing**, generally ranging from no change to an increase of up to 50% by 2100, but some strong outlier models project even higher.	**Normal to increasing**, ranging from no change to a decrease of up to 30% by 2050. No consistent signal in projections after 2060
Semi-arid South	**Increasing** +2°C to +2.5°C by 2050s but changes evident in next decades	**Normal to increasing**, generally ranging from no change to an increase of up to 50% by 2050 and even stronger by the end of the century	**Normal to increasing**, generally ranging from no change to an increase of up to 50% by 2100, but some outlier models project even higher	**Normal to increasing**, ranging from no change to a decrease of up to 50% by 2100
Niger River Headwaters	**Increasing** +1°C to +4°C by 2050s but changes evident in next decades	No consistent signal in projections	**Normal to increasing**, generally ranging from no change to increasing by up to 50% by 2100. Some outlier models project strong decreases.	**Normal to decreasing**, generally ranging from no change to decreasing by up to 25% by 2100. Some outlier models project moderate increasing.

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 warm and arid Niger, where the Sahara Desert covers a large proportion of the land area, increasing temperature trends are likely to increase the pressure on water resources despite indications that rainfall trends may be normal to increasing into the future. Increasing temperatures and more extreme rainfall is of further concern for both the economy and for food security, given the dominating role of agriculture, a highly climate sensitive sector which engages around half of Niger's work force. While Niger has a relatively small urban population, over two thirds of the urban population lives in slums, with lack of proper access to critical services such as health care, water supply and proper housing, deeming them vulnerable to extreme temperatures and rainfall events, as well as the slower knock-on effects that climate change may have on the economy. With inequality levels the highest in Africa, people's capacity to adapt to increasing temperatures and more extreme rainfall varies widely.

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

Sector	Impacts
Agriculture	- Crop loss and reduced yields owing to increased temperatures, changing rainfall patterns, and increased water stress - Increased incidence of pests and diseases - Increased potential for conflict between farmers and pastoralists - Shifting agricultural seasons due to changes in seasonal rainfall patterns - Desertification and loss of agricultural and grazing land - Increased migration from rural to urban areas
Fisheries	- Reduced size of Lake Chad, reducing fisheries catches - Encroachment of aquatic weeds - Increased migration of fishermen in search of more productive waters - Reduced fishery productivity owing to increased water temperatures and decreased river flows
Water resources	- Increased variability of run-off, leading to increased variability in surface water availability - Increased demand for irrigation water coupled with reduced irrigation water potential - Increased potential for conflict over limited water resources
Built infrastructure and human settlements	- Increased potential for damage to infrastructure, especially in urban areas and near the Niger river, owing to flooding - Increased potential for negative impacts on some infrastructure owing to extreme temperatures - Damage to or destruction of roads owing to increased intensity of extreme rainfall events - Increased potential for migration from rural to urban areas
Human health	- Increased risk of water-borne diseases, such as cholera and diarrhoea - Increased prevalence of vector-borne diseases such as malaria - Increased potential for malnutrition and stunting, especially during drought - Increased prevalence of respiratory diseases due to increased Harmattan winds

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

The major carriers of Niger'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 Niger's agriculture sector, historical land use change and vegetation cover.

3.1 National energy production and consumption

The energy sector of Niger is characterised by a split between the commercial fossil fuel industry that drives the formal economy and the domestic use of biofuels by the majority of the population. The majority of energy production (~70%) and consumption (~78%) is attributed to the burning of biomass for domestic energy needs (IEA, 2014). However, Niger also has a significant reliance on oil of which ~1/3 is used for domestic consumption. Coal contributes over 70% of Niger's electricity generation – however, coal only contributes ~2% to Niger's total energy production, indicating that electricity only accounts for a small share of total national energy production. Electricity in Niger is also generated from oil (~27%) and a small amount is generated from renewable energy (~0.6%) (World Bank, 2013). The split between Niger's formal and informal energy sectors is further reflected in the distribution of national energy consumption between sectors. The residential sector accounts for the majority of energy consumption (~81%) and primarily consumes biomass for cooking (IEA, 2014). The sectors of transport (~15%) and industry (~4%) are responsible for the next largest consumption of energy, and represent the formal energy sector (IEA, 2014). The total annual GHGs emitted by the abovementioned sectors and fuel carriers are described further in Section 3.2.

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 Niger's energy sector, including total national energy production, primary energy supply and national energy consumption by fuel carrier and sector.

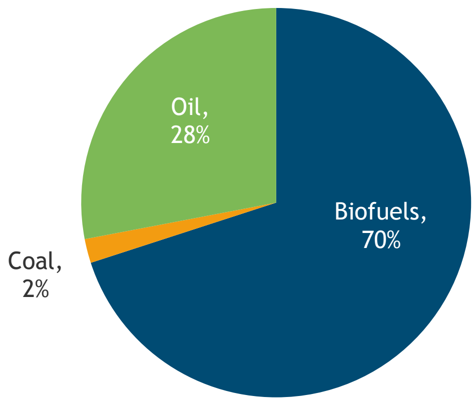

Figure 3-1: Distribution of Niger's national energy production between major energy carriers (2014-2016)

Table 3-1: National energy and electricity production in Niger (2014-2016)

NATIONAL ENERGY PRODUCTION		
Source	**Total (MTOE) [3]**	**% of total energy production**
Coal[10]	0.1	2.5
Oil[10]	0.9	27.8
Biofuels[10]	2.1	69.7
Total national energy production	3.1	
Electricity[5]	Non-Hydro renewable	0.6
	Coal	71.6
	Oil	27.8

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

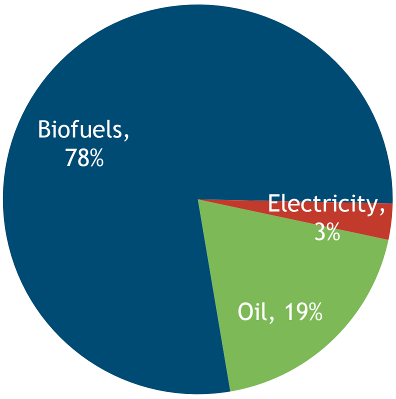

Figure 3-2: Distribution of Niger's national energy consumption by major energy carriers

Table 3-2: Niger's national energy consumption by energy source

CONSUMPTION BY ENERGY SOURCE[10]	
Source	**Total (MTOE)**
Oil	0.5
Biofuels	2.1
Electricity	0.1
Total national energy consumption by source	2.6

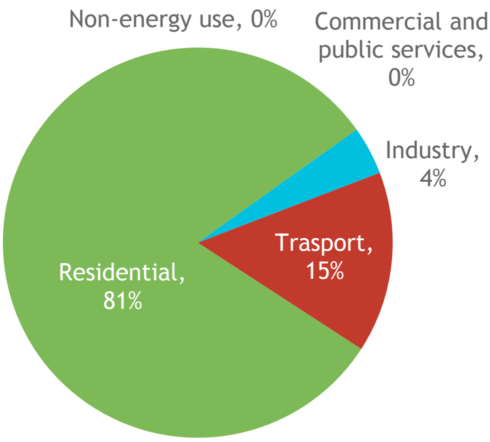

Figure 3-3: Distribution of Niger's national energy consumption by sector (2014-2016)

Table 3-3: Niger's national energy consumption by sector (2014-2016)

CONSUMPTION BY ENERGY SOURCE[10]	
Source	**Total (MTOE)**
Industry	0.1
Transport	0.4
Residential	2.1
Commercial and public services	<0.01
Non-energy use	0.01
Total national energy consumption by sector	2.6

Table 3-4: Niger's national total primary energy supply (estimated for 2014-2016)

TOTAL PRIMARY ENERGY SUPPLY[10]		
Source		**Total (MTOE)**
Coal		0.1
Oil	Crude Oil	0.8
	Oil Products	-0.2
Biofuels		2.1
Electricity		0.1
Total primary energy supply		2.9

3.2 National greenhouse gas emissions by source and sector

Oil is the largest contributor to Niger's greenhouse gas (GHG) emissions from fuel combustion (~1.6 MT CO_2e), followed by coal (0.3 MT CO_2e) (IEA, 2013). The sectors that account for the largest proportion of national GHG emissions from fuel combustion are road transport (1.1 MT CO_2e), electricity and heat production (0.5 MT CO_2e), and manufacturing industries and construction (0.2 MT CO_2e) (IEA, 2013). The largest sources of GHG emissions are however from agriculture (22 MT CO_2e), waste (1.9 MT CO_2e) and land use change and forestry (1.6 MT CO_2e) (CAIT, 2013).

Section 3.2.1, below, describes GHG emissions from fuel combustion – these figures include direct combustion of fuels as a primary energy carrier as well as conversion to other forms of energy (e.g. as electricity). The latter figures are based on statistics from the International Energy Agency (IEA). Section 3.2.2, further 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). The latter figures are compiled by the World Resources Institute's Climate Access Indicator Tools (CAIT), which employs different methodologies and reporting standards to the IEA. Therefore, while there is some resultant duplication between the two datasets, each provides slightly different approaches to categorisation of major GHG emitting sectors and are both included for consideration.

Section 3.2.3 provides additional details on Niger's Land Use and Land Use Change sector, including detailed summaries of emissions from the agriculture sector and historical land use changes.

3.2.1 GHG emissions from fuel combustion, by source and sector

Table 3-5: Niger's national greenhouse gas emissions from fuel combustion

NATIONAL GHG EMISSIONS FROM FUEL COMBUSTION BY FUEL SOURCE AND SECTOR [15]	
Source / Sector	**Total emissions (MT CO_2e)**
Coal	0.27
Oil	1.58
Total fuel source emissions	1.85
Electricity and heat production	0.45
Manufacturing industries and construction	0.25
Road transport	1.10
Residential	0.05
Total sector emissions	1.85

3.2.2 GHG emissions from primary energy consumption, by source and sector

Table 3-6: Niger's National Greenhouse Gas Emissions from Primary Energy Consumption (estimated for 2014-2016)

NATIONAL GHG EMISSIONS FROM PRIMARY ENERGY CONSUMPTION BY SOURCE AND SECTOR [12]		
Source / Sector		**Total emissions (MT CO_2e)**
Energy	Electricity and heat	0.38
	Manufacturing and construction	0.25
	Transport	1.10
	Other fuel combustion	0.92
	Fugitive emissions	0.06
	Energy sub-total	2.71
Industrial processes		0.05
Agriculture		22.00
Waste		1.85
Land use change and forestry (LUCF)		1.63
Total emissions (including LUCF)		28.25

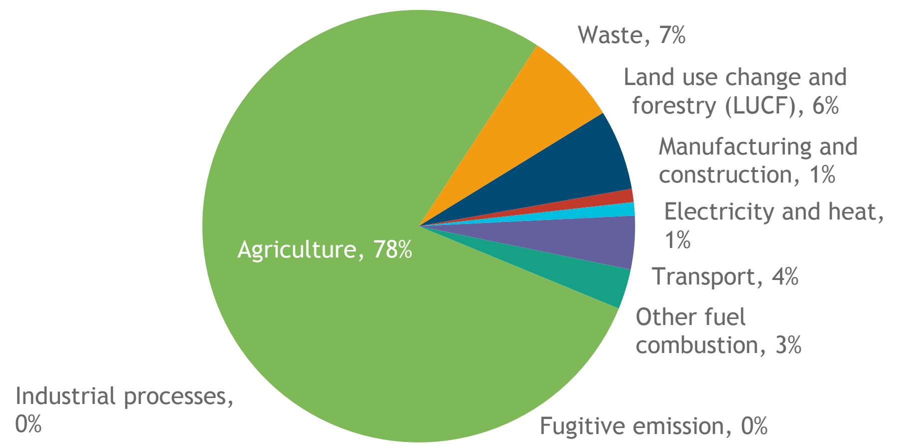

Figure 3-3: Distribution of Niger's GHG emissions by major sectors

3.2.3 GHG emissions from agricultural practices

Table 3-7, below, summarises GHG emissions from Niger's agriculture sector (derived from Food and Agriculture Organisation statistics). Although there are multiple agricultural practices that contribute to GHG emissions, in the case of Niger the livestock production sector is by far the largest contributor to agricultural GHG emissions. In particular, enteric fermentation and manure left on pastures contributes ~87% of total GHG emissions from this sector.

Table 3-7: National annual greenhouse gas emissions from agricultural practices, forestry and other land use in Niger (estimated for 2014-2017)

VARIABLE		ANNUAL EMISSIONS (MT CO_2E)
Annual GHG emission from agricultural practices [13]	Burning - Crop residues	<0.01
	Burning - Savanna	0.2
	Crop Residues	0.5
	Enteric Fermentation	12.8
	Manure Management	0.6
	Manure applied to Soils	0.2
	Manure left on Pasture	8.7
	Rice Cultivation	0.02
	Synthetic Fertilizers	0.1
	SUBTOTAL (Ag. practices)	23.13
Annual GHG emission from land use change [13]	Forest land	1.5
	Burning Biomass	0.1
	SUBTOTAL (Land use change)	1.55
Total		24.67

Table 3-8, below, summarises the recent historical changes in land use in Niger through analysis of land use change. Statistics derived from the Global Forest Watch database were used to summarise the total area of wooded vegetation in various categories of canopy cover density (where 10-30% canopy cover can be considered as savanna, 30-50% cover can be considered woodland and 50-100% cover can be considered dense forest), as well as the historical rates of change in each vegetation category. Global Forest Watch reports the total aboveground carbon stock of Niger's forest biomass as ~35.4 million tonnes.

Table 3-8: Vegetation cover and land use change in Niger (estimated for 2015)

VARIABLE		TOTAL (HECTARES)	TOTAL (% OF LAND AREA)	UNIT
Total tree cover [14]	10-30% canopy cover	24,181.2	0.02	% of total land area
	30-50% canopy cover	0.8	0.0	
	50-100% canopy cover	0	0.0	
	Total	24,182	0.02	
Land use change and agricultural expansion	Historical annual rate of deforestation[15]	10-30% canopy cover	0.0	% of previous year
		30-50% canopy cover	3.6	
	Area of agricultural land[16]	43,787,520.0	34.6	% of total land area

4. SUMMARISED NATIONAL PRIORITIES FOR CLIMATE CHANGE ADAPTATION AND MITIGATION

Niger'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. This document includes detailed descriptions of Niger'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).

Niger NDC indicates an unconditional reduction of 2.5% (BAU, 2020) and of 3.5% (2030) and a conditional reduction of 25% (BAU 2020) and 34.6% (2030, or a reduction of 33,400 GgCO2Eq). The NDC estimates that the total investment required for delivery of all adaptation and mitigation objectives to be at least USD 8.667 billion, of which at least USD 7.5 billion (87% of the total) is dependent on access to new sources of financing. Therefore, the unconditional financing coming from the government's own resources and public development aid is estimated at USD 1.167 billion, or 13% of the total cost.

A large proportion of required investment costs for Niger's mitigation-related objectives are intended to support the implementation of the National Action Plan for Sustainable Energy for All (SE4ALL) which is calculated to require investments of ~USD 6 billion by 2030. Niger's NDC estimates the total investment costs for all mitigation-related actions in the 'conditional' scenario at ~USD 6.25 billion, or 87% of the total, while unconditional domestic investments are estimated to be ~USD 827 million. With respect to investment needs for the adaptation sector, a significant proportion of Niger's adaptation-related activities are based on upscaling of good practices for Sustainable Land Management (SLM), the total investment requirements for which are estimated to be ~ USD 1.27 billion. This total investment cost includes mobilisation of ~10% from domestic budget, with additional actions being conditional on additional support for investments of at least USD 968 million.

Table 4-1, below, gives details on Niger'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 Niger's NDC commitments for reduction of GHG emissions

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
26.1	BAU	2.5 percent (unconditional); 25 percent (conditional)	2030	CO_2, CH_4, N_2O; Energy, industrial processes, agriculture, LULUCF, waste	Not mentioned	Land-use and forestry included; accounting methodology not specified

4.1 National priorities for climate change mitigation

Niger's major priorities for actions and investments related to climate change mitigation are summarised in Table 4-2 below, categorised according to sector. 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 below Table 4-2). The aforementioned technology types and specific actions represent Niger's immediate national priorities for investments in climate change mitigation and reflect recent and on-going policy-level measures to reduce GHG emissions and increase energy efficiency.

National priorities for mitigation of GHG emissions reflect Niger's dependence on biomass fuel. In the energy sector, Niger's mitigation priorities place emphasis on conserving, replacing and economising wood energy. There is also a large emphasis on a move towards different renewable energies. Niger's transport priorities are vague and involve the management of transportation and residential sub-sectors. In contrast, the priorities in the AFOLU sector are very specific regarding the area of land to be restored, regenerated and managed. The AFOLU priorities include the planting of multiple plant species, dune fixation, management of natural forests, and restoration of forest, agricultural and grazing land.

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

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[4]
Energy	Rural electrification and the conservation and replacement of wood energy	1, 4
	Economising the use of wood for cooking	1,4
	Transformation and dissemination of renewable energies	1
	Promoting solar photovoltaic for pumping and electrification	
	Construction of a nuclear power plant and a gas power plant	
	Exploitation of wind energy	
	Hydroelectricity	
	Energy efficiency	
	Use of biogas	
	Construction of frame-free buildings	
Transport	Management of the transportation and residential sub-sectors	2, 5

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

1. Reduced emissions through increased lower emission energy access and power generation.

2. Reduced emissions through increased access to low-emission transport.

3. Reduced emissions from buildings, cities, industries and appliances.

4. Reduced emissions from land use, deforestation, forest degradation, and through sustainable management of forests and conservation and enhancement of forest carbon stocks.

5. Strengthened institutional and regulatory systems for low-emission planning and development.

6. Increased number of small, medium and large low-emission power suppliers.

7. Lower energy intensity of buildings, cities, industries, and appliances.

8. Increased use of low-carbon transport.

9. Improved management of land or forest areas contributing to emissions reductions.

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE[5]
AFOLU	Restoration of agricultural, forest and grazing land: 1,030,000 ha.	4
	Assisted natural regeneration: 1,100,000 ha.	
	Management of natural forests: 2,220,000 ha.	
	Planting of multi-use species: 750,000 ha.	
	Dune fixation: 550,000 ha.	
	Hedgerows: 145,000 km.	
	Planting of Moringa oleifera: 125,000 ha.	
	Seeding of roadways: 304,500 ha.	
	Private forestry: 75,000 ha.	

4.2 National priorities for climate change adaptation

In terms of climate change adaptation, Niger has clear but undetailed priorities for the AFOLU sector. These include improving resilience of agriculture, animal husbandry and forestry, supporting household food security, sustainably managing natural forests, and developing local agro-climate information. Niger's other adaptation priorities are extending the electrical network and providing access to new information and communication technologies in the energy sector, increasing access to potable water and managing and developing the Badaguichiri watershed in the water sector, and socio-economically developing Kandadji in the institutional sector. Niger also emphasises the community-based PANA Resilience/FEM/ACDI project. Niger's proposed activities and investments related to adaptation are 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 below Table 4-3).

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

1. Reduced emissions through increased lower emission energy access and power generation.

2. Reduced emissions through increased access to low-emission transport.

3. Reduced emissions from buildings, cities, industries and appliances.

4. Reduced emissions from land use, deforestation, forest degradation, and through sustainable management of forests and conservation and enhancement of forest carbon stocks.

5. Strengthened institutional and regulatory systems for low-emission planning and development.

6. Increased number of small, medium and large low-emission power suppliers.

7. Lower energy intensity of buildings, cities, industries, and appliances.

8. Increased use of low-carbon transport.

9. Improved management of land or forest areas contributing to emissions reductions.

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

PRIORITY SECTOR	SECTOR-SPECIFIC ACTION	TECHNOLOGY TYPE6
Energy	Extension of the NIGELEC electrical network	1, 3, 5
	Access to new information and communication technologies (NICT) and energy equipment	3
AFOLU	Improving the resilience of the agriculture, animal husbandry and forestry sub-sectors	1, 2, 4
	Support for the food security of households	1, 2
	Strengthening of the good practices of assisted natural regeneration and recovery of degraded land	4, 5
	Improvement of the balance sheet of cereals and fodder along with food and nutritional security	1, 2
	Development of local agro-climate information	2, 6
	Management of the natural forests for the sustainable supply of wood energy to Sahelian cities	4, 5
Water	Development and management of the Badaguichiri watershed	2, 4
	Access to potable water education and health	1, 2
Community based	The PANA Resilience/FEM/ACDI project (since 2010) at the commune level in seven regions improves market gardening, seeding of degraded grazing areas and income-producing activities	1, 2, 4
Institutional	Socio-economic development of Kandadji	1,2

[6] **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 Niger. Long term (1979 to 2013) 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 (1979-2014) for each of the three climate regions across Niger. 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 compared to long term trends. For example, for total annual rainfall, the Semi-arid region has very high inter-annual (250mm in some years to 500mm in other years) and moderate decadal variability (300mm in some decades to 400mm in other decades). The long-term trend is statistically significant and could be around 75mm over the 30-year period.

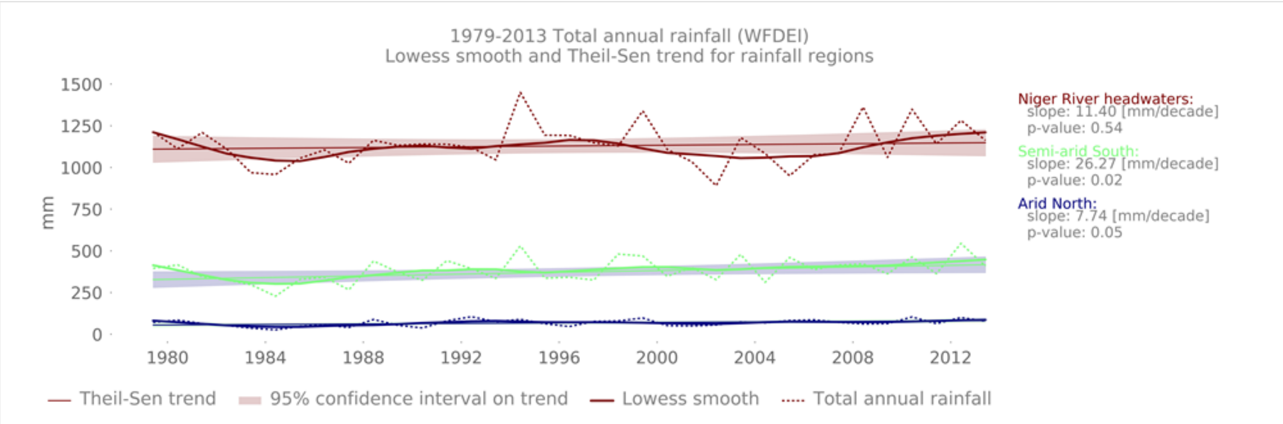

Figure A-1: Long term trends and variability in total annual rainfall for rainfall regions

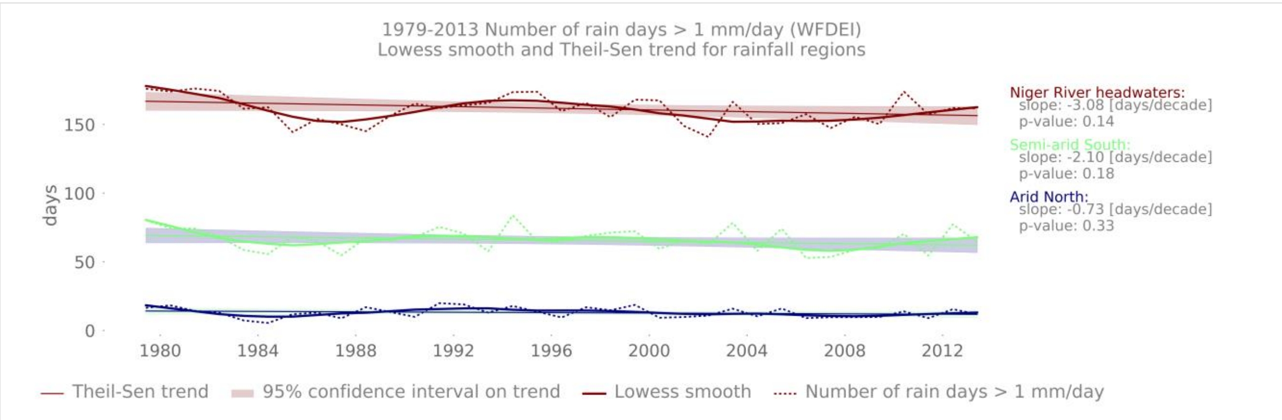

Figure A-2: Long term trends and variability in frequency of rainfall events for rainfall regions

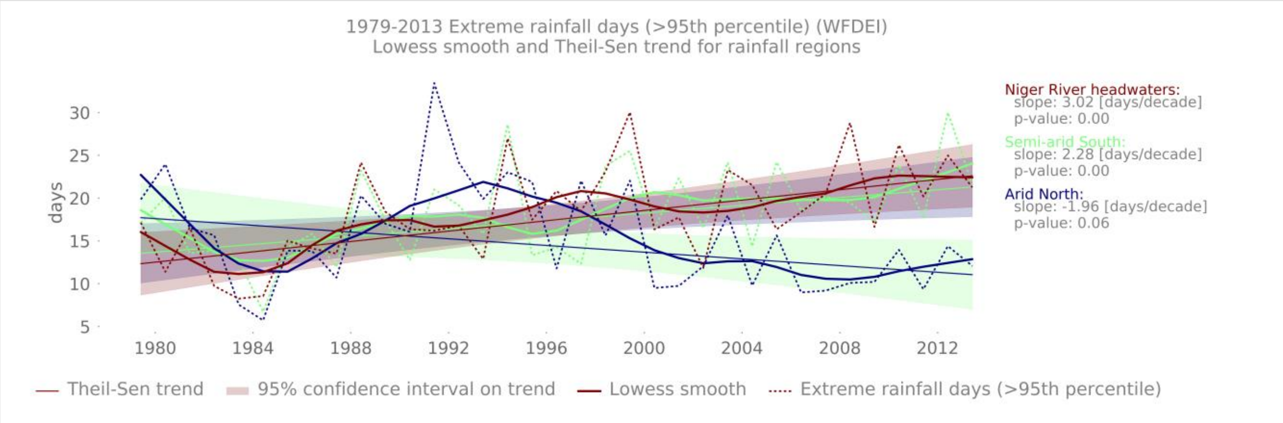

Figure A-3: Long term trends and variability in extreme rainfall events for rainfall regions

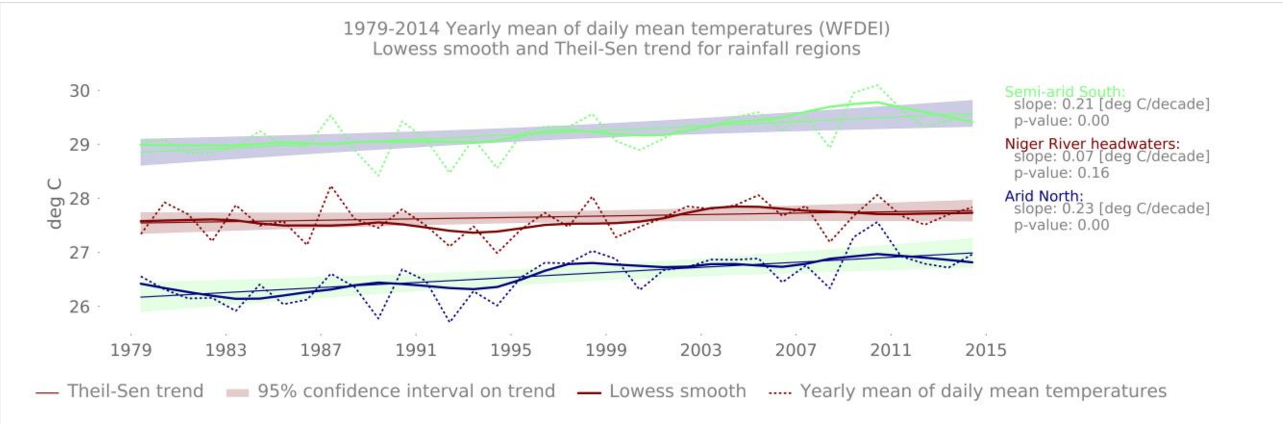

Figure A-4: Long term trends and variability in daily mean air temperatures for rainfall regions

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.

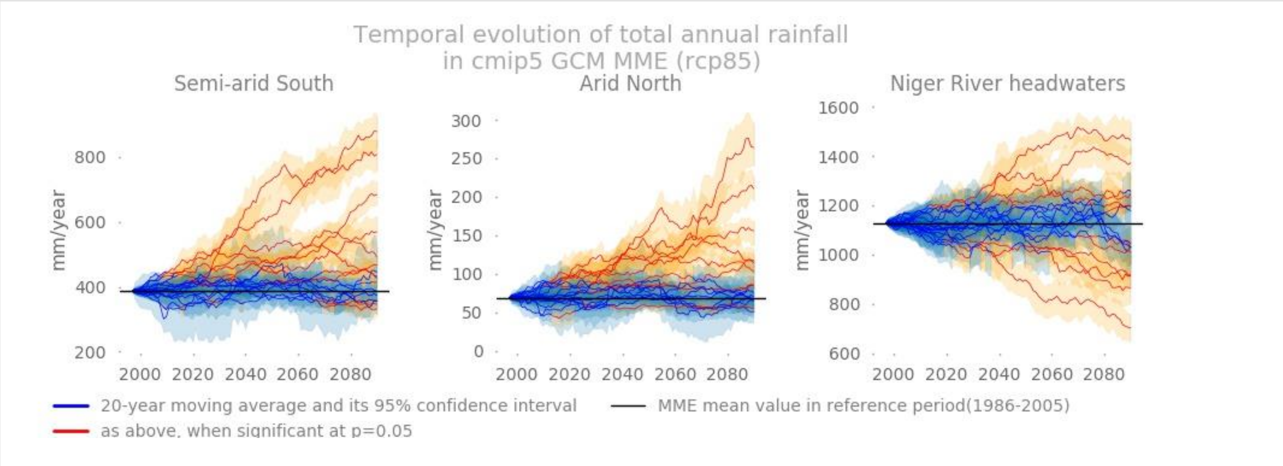

Figure A-5: Projected changes and emergence of changes in total annual rainfall

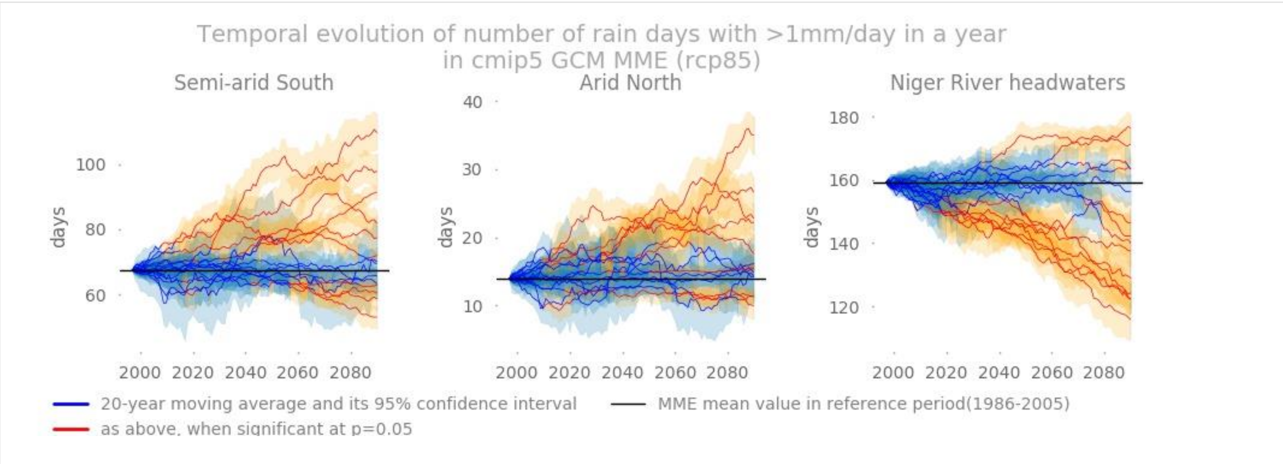

Figure A-6: Projected changes and emergence of changes in number of rain days per year

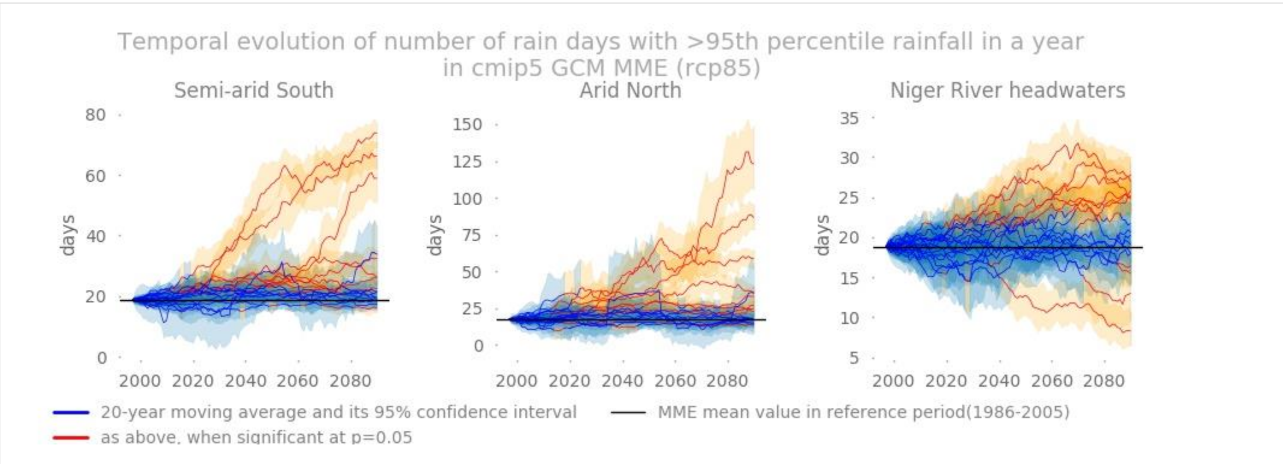

Figure A-7: Projected changes and emergence of changes in number of very heavy rainfall days (greater than 95th percentile) per year

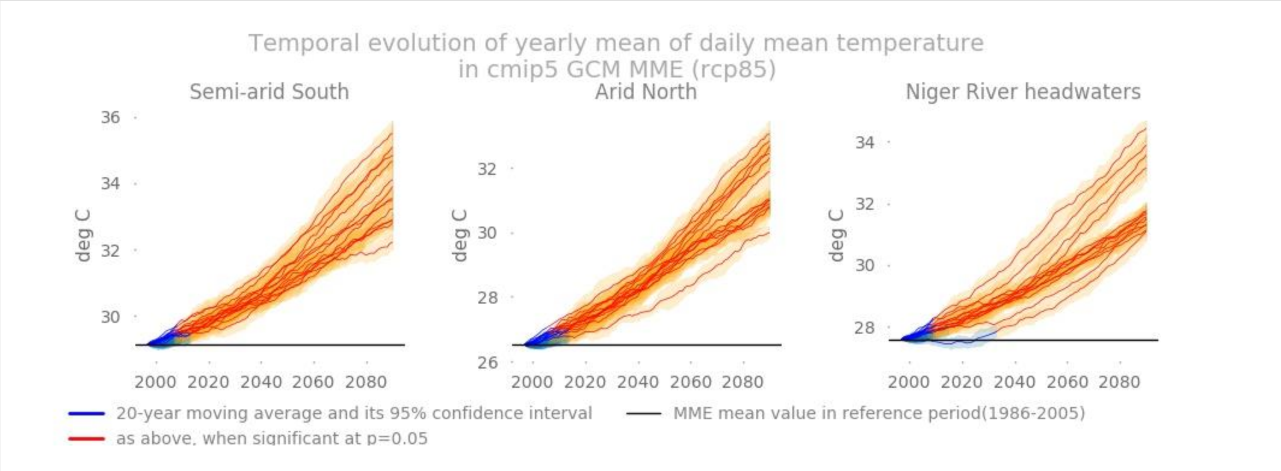

Figure A-8: Projected changes and emergence of changes in annual mean daily mean temperatures

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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. International Labour Organization. (2005). Employment in Agriculture. Retrieved from https://www.indexmundi.com/facts/indicators/SL.AGR.EMPL.ZS/rankings/africa
7. World Bank. (2015). Data Bank. Retrieved from http://databank.worldbank.org/data/home.aspx
8. Emergency Events Database. (2017). Disaster List (1996-2016). Retrieved from http://emdat.be/emdat_db/
9. ND GAIN. (2015). Country Rankings. Retrieved from http://index.gain.org/ranking
10. International Energy Agency. (2014). Energy balances. Retrieved from www.iea.org/statistics/statisticssearch/
11. International Energy Agency. (2013). CO2 emissions. Retrieved from http://www.iea.org/statistics/topics/CO2emissions/
12. World Resources Institute. (2013). CAIT Climate Data Explorer. Retrieved from http://cait.wri.org/
13. Food and Agriculture Organisation. (2014). FAOSTAT Data. Retrieved from http://www.fao.org/faostat/en/#data
14. Derived from Global Forest Watch. (2017). Country Profiles. Retrieved from http://www.globalforestwatch.org/
15. Derived from Global Forest Watch. (2015). Mean 2001-2014. Retrieved from http://www.globalforestwatch.org/
16. Food and Agriculture Organisation. (2011). FAOSTAT Data. Retrieved from http://www.fao.org/faostat/en/#data