Federal Ministry for Economic Cooperation and Development

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Climate Risk Profile: Senegal

Summary

This profile provides an **overview of projected climate parameters and related impacts** on different sectors in Senegal until 2080 **under different climate change scenarios** (called Representative Concentration Pathways, RCPs). RCP2.6 represents the low emissions scenario in line with the Paris Agreement; RCP6.0 represents a medium to high emissions scenario. **Model projections do not account for effects of future socio-economic impacts.**

Agro-ecological zones might **shift, affecting ecosystems, biodiversity** and **crop production**. Models project varying trends in species richness, depending on the region in Senegal, while projections of tree cover are uncertain.

Agriculture, biodiversity, health, infrastructure and water are highly vulnerable to climate change. The **need for adaptation in these sectors should be represented in the German development cooperation portfolio** in Senegal.

Per capita water availability will decline by 2080 mostly due to population growth. Model projections indicate that **water saving measures are expected to become more important all over Senegal after 2025**.

Depending on the scenario, **temperature** in Senegal is projected to **rise by between 1.8 and 3.6 °C by 2080**, compared to pre-industrial levels, with higher temperatures and more temperature extremes projected for the north-eastern and eastern part of the country.

The **population share affected** by at least one **heatwave** per year is projected to **rise** from 3.5 % in 2000 to 13.6 % in 2080. This is related to 82 more very hot days per year over this period. As a consequence, **heat-related mortality** is estimated to **increase by a factor of three** by 2080.

Precipitation trends are uncertain with projections indicating a **decrease in annual precipitation of up to 53 mm by 2080**. Future dry and wet periods are likely to become **more extreme**.

Under RCP6.0, the **sea level** is expected to **rise by 38 cm** until 2080. This threatens Senegal's coastal communities and may cause saline intrusion in coastal waterways and groundwater reservoirs.

Climate change is likely to cause **severe damage to the infrastructure sector** in Senegal including roads and bridges. As roads are the backbone of the country's transportation network, investments will need to be made into building climate-resilient roads and other infrastructure.

The models project an **increase in crop land exposure to drought**. Yields of millet and sorghum are projected to decline, while yields of groundnuts, rice and cow peas are projected to benefit from CO_2 fertilisation. Farmers will need to adapt to these changing conditions.

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Context

The Republic of Senegal is located in the **western most part of Africa** and bordered by Mauritania, Mali, Guinea and Guinea-Bissau. The country has a **population of 16.7 million** with an annual demographic **growth rate of 2.7 %** [1]. The **majority of the population lives on the Atlantic coast**, especially in the Dakar area, which makes up only 0.3 % of the country's territory, while hosting one third of its population [2]. With a real GDP per capita of 1 356 USD in 2020 [1], the country is a **least developed country**(LDC). Senegal's economy is dominated by the services sector, contributing 49.0 % to the country's GDP in 2020, followed by the industrial sector with 23.1 % and the agricultural sector with 15.8 % [3]. Due to its coastline, the **fisheries sector** is one of the backbones of the economy, constituting an important source of employment and contributing around 12.5 % to Senegal's total export value in 2019 [4]. Other **key exports include gold, petroleum, phosphoric acid and groundnuts**, the latter of which is mostly exported to China [4]. Due to poor soil quality and erratic precipitation, the **agricultural sector** accounts for only 17.5 % of the national GDP [5], [6]. However, the sector is the **primary means of livelihood** for Senegal's population, especially in rural areas. Important **staple crops are millet, rice, cow peas, maize and sorghum** while groundnuts, sugar cane and cotton constitute major cash crops [5], [7]. The agricultural sector faces major challenges including poor access to water: Currently, only 2.1% of the total national crop land is equipped for irrigation. The estimated land that could be irrigated has an area of 409 000 ha, out of which only 17% is actually irrigated. [8], [9]. As **agricultural production** in Senegal is primarily **subsistence-based and rainfed**, especially smallholder farmers suffer from the impacts of climate change. In addition, one of the largest food security challenges lies in the country's **high dependence on food imports**, especially that of rice [4]. Moreover, overfishing, pollution and the effects of climate change put increasing pressures on Senegal's **fisheries** which, globally, are **among the most vulnerable to the impacts of climate change** [10]. Furthermore, the ND-GAIN Country Index ranks Senegal as the 32nd most vulnerable country and the 65th least ready country in the world regarding its readiness to improve resilience [11].

Senegal also serves as a **destination for approximately 275 000 migrants and refugees**, especially from Guinea, Mauritania and Mali [12]. Many Senegalese migrate to Gambia, which is geographically surrounded by Senegal, or to Europe, where the main destinations include France and Italy [12]. In this way, Senegalese contributed a total of **2.6 billion USD in remittance inflows** in 2020, which accounted for 10.5 % of the GDP in that year [13].

Quality of life indicators [11], [14]–[16]

Human Development Index (HDI) 2019	ND-GAIN Vulnerability Index 2019	Gini Index 2011	Real GDP per capita 2020	Poverty headcount ratio 2011	Prevalence of undernourishment 2017–2019
0.512 **168 out of 189** (0 = low, 1 = high)	**40.8** **135 out of 181** (0 = low, 100 = high)	**40.3** (0–100; 100 = perfect inequality)	**1 356 USD** (constant 2015 USD)	**38.5 %** (at 1.9 USD per day, 2011 PPP) [1]	**9.4 %** (of total population)

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[1] Poverty headcount ratio for the year 2012 adjusted to 2011 levels of Purchasing Power Parity (PPP). PPP is used to compare different currencies by taking into account national differences in cost of living and inflation.

Topography and environment

Senegal's topography is mostly flat and consists predominately of rolling sandy plains but rises to hills in the south east. The lowest point of the country is on the Atlantic coast, while the highest point lies at 648 m close to the border with Guinea. **The country has a mostly arid and semi-arid Sahelian climate** defined by dry winds which originate in the continental interior and maritime winds which bring precipitation. Especially **the north of the country is very dry**, part of which can be ascribed to the **north-eastern trade winds and the harmattan**, a dry wind, which is strongest from late November to mid-March and carries large amounts of sand and dust [10]. The **south of the country has higher amounts of precipitation**. Accordingly, Senegal can be divided into **four Agro-Ecological-Zones** (AEZs): Arid/Sahel, Semi-arid/Sudan Savannah, Northern Guinea Savannah and Southern Guinea Savannah (Figure 1) [17][1]. Each of these zones is characterised by specific temperature and moisture regimes, and consequently specific patterns of crop production and pastoral activities. While Senegal has **abundant renewable water resources**, surface and groundwater availability display a high **seasonal and regional variability**. Major rivers are the **Senegal River**, which is shared with Mauritania and Mali, and the **Gambia River**, which is shared with Guinea and The Gambia. Major environmental challenges especially concern the country's water resources and include **salinisation, nitrate pollution and eutrophication**, which result from over-abstraction of water as well as from untreated wastewater from urban centres [18]. Salinity affects both surface water in coastal areas of the Casamance and Sine Saloum deltas as well as groundwater in coastal regions and in arid central western Senegal [18]. Especially around Dakar, groundwater is at risk of overexploitation and bacteriological contamination [18]. In addition, the **spread of aquatic plant invasions** in the Senegal River and Lake Guiers limit biodiversity as well as the potential for fishing, irrigation and drinking water [18]. Climate change is expected to further **limit water availability**. At the same time, the frequency and intensity of **flooding is likely to increase**, highlighting the **need for adaptation measures to protect biodiversity and maintain fragile ecosystems and their services**.

Present climate [19]

Senegal's climate is largely influenced by the proximity to the Atlantic Ocean coast and latitude. Mean annual temperatures range from 25 °C to 30 °C with lower values closer to the coast and higher values further inland.

Annual precipitation sums range from 250 mm in northern Senegal, which has an arid desert climate, to 1 450 mm in the south-western part of the country, which is characterised by a more tropical climate.

Senegal has a single rainy season (unimodal precipitation regime) from April to November in the southern part of the country, with decreasing length and precipitation amounts towards the north.

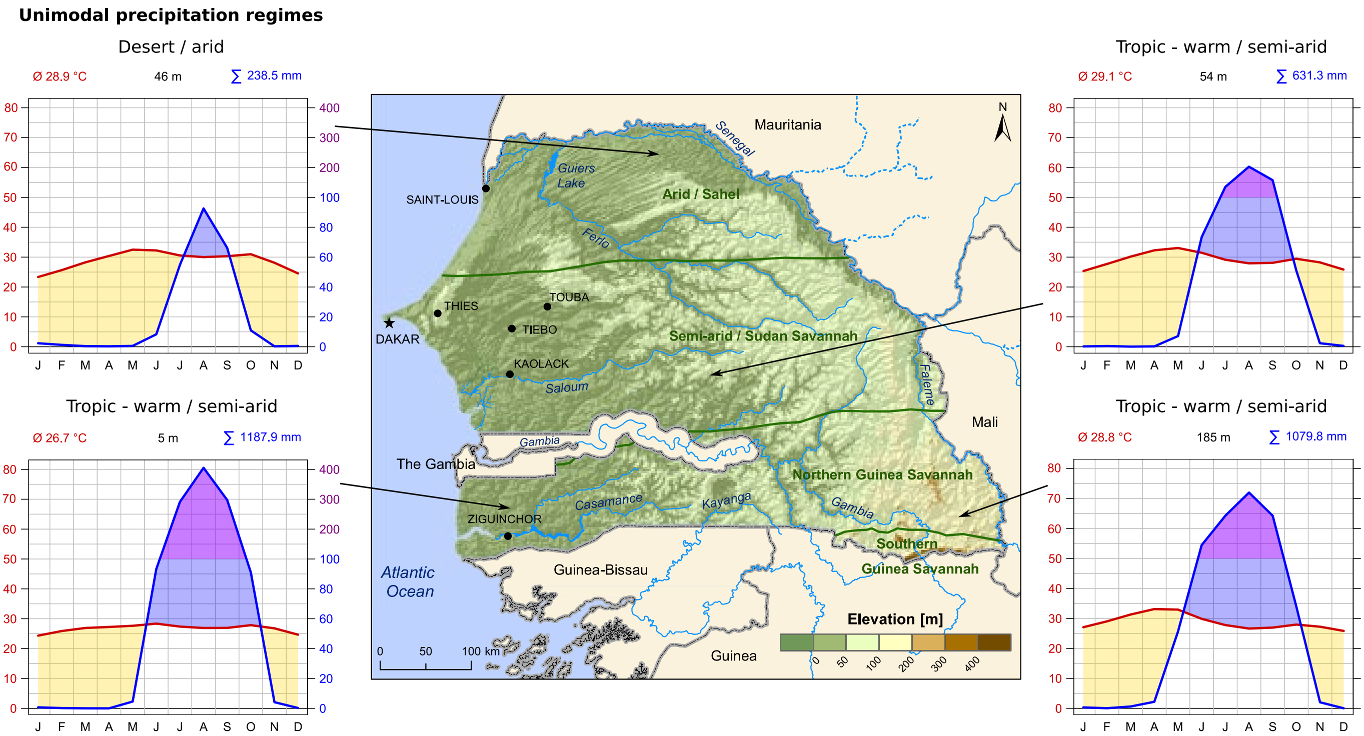

Figure 1: Topographical map of Senegal with agro-ecological zones and existing precipitation regimes.[3]

[2] It should be noted that there are different classifications of AEZs in Senegal. We focused on a commonly used classification of four zones.

[3] The climate diagrams display temperature and precipitation values which are averaged over an area of approximately 50 km × 50 km. Especially in areas with larger differences in elevation, the climate within this grid might vary.

Projected climate changes

How to read the line plots

historical — best estimate
RCP2.6 — likely range
RCP6.0 — very likely range

Lines and shaded areas show multi-model percentiles of 31-year running mean values under RCP2.6 (blue) and RCP6.0 (red). In particular, lines represent the best estimate (multi-model median) and shaded areas the likely range (central 66 %) and the very likely range (central 90 %) of all model projections.

How to read the map plots

Colours show multi-model medians of 31-year mean values under RCP2.6 (top row) and RCP6.0 (bottom row) for different 31-year periods (central year indicated above each column). Colours in the leftmost column show these values for a baseline period (colour bar on the left). Colours in the other columns show differences relative to this baseline period (colour bar on the right). The presence (absence) of a dot in the other columns indicates that at least (less than) 75 % of all models agree on the sign of the difference.
For further guidance and background information about the figures and analyses presented in this profile kindly refer to the supplemental information on how to read the climate risk profile.

Temperature

In response to increasing greenhouse gas (GHG) concentrations, **air temperature over Senegal is projected to rise by 1.8 to 3.6 °C (very likely range) by 2080** relative to the year 1876, depending on the future GHG emissions scenario (Figure 2). Compared to pre-industrial levels, median climate model temperature increases over Senegal amount to approximately 1.7 °C in 2030, 2.1 °C in 2050 and 2.2 °C in 2080 under the low emissions scenario (RCP2.6). Under the medium/high emissions scenario (RCP6.0), median climate model temperature increases amount to 1.8 °C in 2030, 2.2 °C in 2050 and 3.3 °C in 2080.

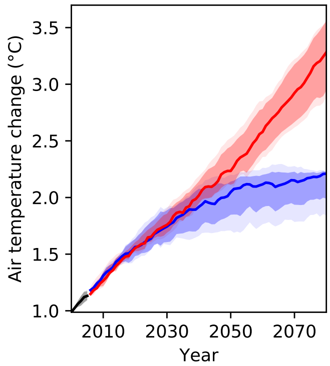

Figure 2: Air temperature projections for Senegal for different GHG emissions scenarios.[4]

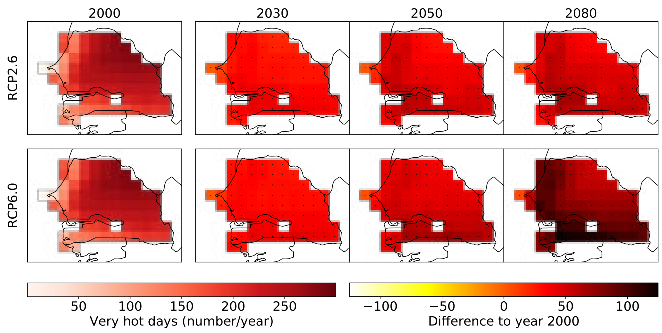

Figure 3: Projections of the annual number of very hot days (daily maximum temperature above 35 °C) for Senegal for different GHG emissions scenarios.

Very hot days

In line with rising mean annual temperatures, the annual number of very hot days (days with daily **maximum temperature above 35 °C**) is projected to rise substantially and with high certainty, in particular over western and southern Senegal (Figure 4). Under the medium/high emissions scenario, the multi-model median, averaged over the whole country, projects **31 more very hot days per year in 2030 than in 2000**, **47 more in 2050** and **82 more in 2080**. In some parts, especially in north-eastern Senegal, where the number of very hot days is already high today, this could amount to a total of **up to 336 very hot days** per year by 2080.

Sea level rise

In response to globally increasing temperatures, the sea level off the coast of Senegal is projected to rise (Figure 3). Until 2050, very similar sea levels are projected under both emissions scenarios. Under RCP6.0 and compared to year 2000 levels, the median climate model projects **a sea level rise by 11 cm in 2030, 20 cm in 2050, and 38 cm in 2080**. This threatens Senegal's coastal communities and may cause saline intrusion in coastal waterways and groundwater reservoirs.

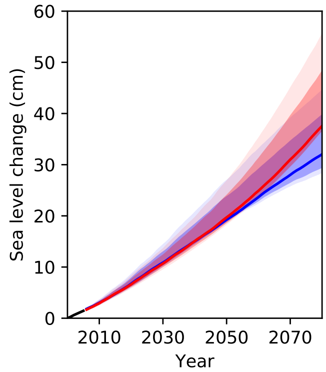

Figure 4: Projections for sea level rise off the coast of Senegal for different GHG emissions scenarios, relative to the year 2000.

[4] Changes are expressed relative to year 1876 temperature levels using the multi-model median temperature change from 1876 to 2000 as a proxy for the observed historical warming over that time period.

Precipitation

Future projections of precipitation are less certain than projections of temperature change due to high natural year-to-year variability (Figure 5). Out of the four climate models underlying this analysis, three models project a decrease in mean annual precipitation over Senegal and one model projects an increase. Median model projections show a **precipitation decrease of 105 mm towards 2065, with a subsequent increase and an overall decrease of 53 mm by 2080**, compared to the year 2000 (RCP6.0). Under RCP2.6, median model projections show an increasing trend towards 2028, after which precipitation levels start to decrease, reaching an eventual decrease of 33 mm at the end of the century and compared to the year 2000. Higher greenhouse gas emissions suggest an **overall drier future** for Senegal.

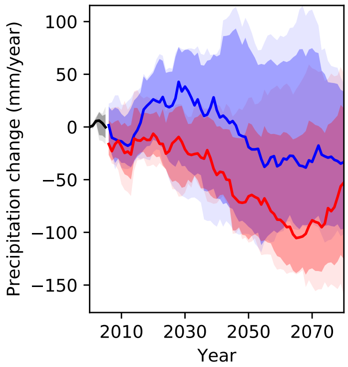

Figure 5: Annual mean precipitation projections for Senegal for different GHG emissions scenarios, relative to the year 2000.

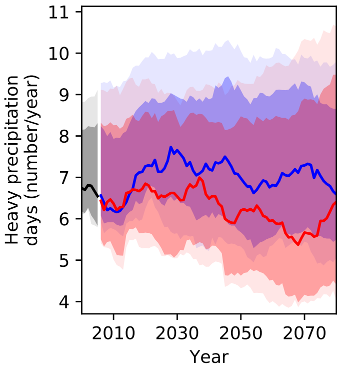

Figure 6: Projections of the number of days with heavy precipitation over Senegal for different GHG emissions scenarios, relative to the year 2000.

Heavy precipitation events

In response to global warming, **heavy precipitation events are expected to become more intense** in many parts of the world due to the increased water vapour holding capacity of a warmer atmosphere. At the same time, the number of days with heavy precipitation events is expected to increase. This tendency is only partly reflected in climate projections for Senegal, due to low model agreement (Figure 6). While the median shows little change in the number of heavy precipitation days for either RCP, the very likely range widens from 6.1–8.8 days in 2000 to **4.0–10.7 days in 2080**, indicating different possible, although **uncertain trends** under RCP6.0.

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Soil moisture

Soil moisture is an important indicator for drought conditions. In addition to soil parameters and management, it depends on both precipitation and evapotranspiration and therefore also on temperature, as higher temperatures translate to higher potential evapotranspiration. Projections for annual mean soil moisture for a soil depth of up to 1-metre **show no change under RCP2.6 and a decrease of 4.4 % under RCP6.0** by 2080 compared to the year 2000 (Figure 7). However, looking at the different models underlying this analysis, there is large year-to-year variability and modelling uncertainty, with some models projecting a much stronger decrease in soil moisture.

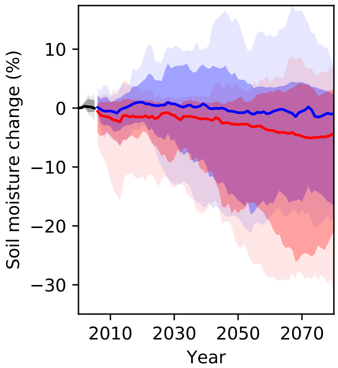

Figure 7: Soil moisture projections for Senegal for different GHG emissions scenarios, relative to the year 2000.

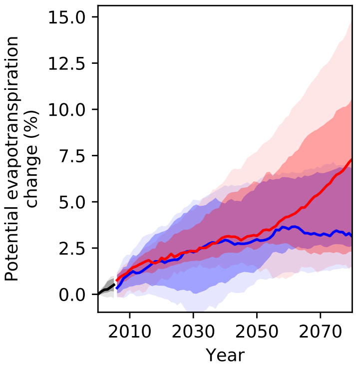

Figure 8: Potential evapotranspiration projections for Senegal for different GHG emissions scenarios, relative to the year 2000.

Potential evapotranspiration

Potential evapotranspiration is the amount of water that would be evaporated and transpired if sufficient water was available at and below land surface. Since warmer air can hold more water vapour, **it is expected that global warming will increase potential evapotranspiration in most regions of the world.** In line with this expectation, hydrological projections for Senegal indicate a stronger rise of potential evapotranspiration under RCP6.0 than under RCP2.6 (Figure 8). Under RCP6.0, **potential evapotranspiration is projected to increase by 2.3 % in 2030, 3.2 % in 2050 and 7.3 % in 2080** compared to year 2000 levels.

Sector-specific climate change risk assessment

a. Water resources

Current projections of water availability in Senegal display high uncertainty under both GHG emissions scenarios. Assuming a constant population level, multi-model median projections show a decrease from 3 548 m³ in per capita water availability in the year 2000 to 2 898 m³ under RCP2.6 and 2 092 m³ under RCP6.0 by the end of the century (Figure 9A). Yet, when accounting for population growth according to SSP2 projections[5], **per capita water availability for Senegal is projected to decline** more dramatically under both RCPs (Figure 9B). It will reach 943 m³ under RCP2.6 and 681 m³ under RCP6.0 until the end of the century, both of which is below the threshold for water stress (1 700 m³) and water scarcity (1 000 m³). While this decline is primarily driven by population growth rather than climate change, it highlights the **urgency to invest in water saving measures and technologies for future water consumption after 2025**.

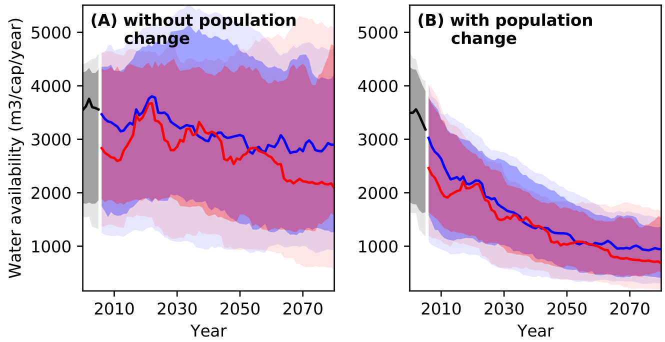

Figure 9: Projections of water availability from precipitation per capita and year with (A) national population held constant at year 2000 level and (B) changing population in line with SSP2 projections for different GHG emissions scenarios.

Projections of future water availability from precipitation vary depending on the region and scenario (Figure 10). Furthermore, they are subject to **low model agreement** with agreement on few areas in Senegal: Under RCP2.6, runoff is projected to increase on the northern coast by up to 28 % and to decrease in the south-eastern part of Senegal by up to 27 %. However, under RCP6.0, model agreement is generally low and only high in the south-east, which is projected to see **decreases of up to 40 %** under that scenario. The partial increase in water availability projected under RCP2.6 is based on a constant population level. Hence, **water saving measures are likely to become important for Senegal's rapidly growing population**.

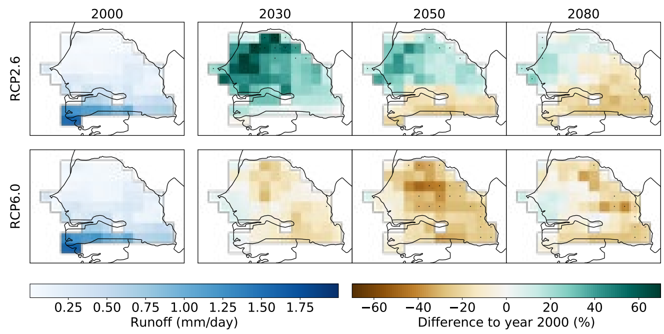

Figure 10: Water availability from precipitation (runoff) projections for Senegal for different GHG emissions scenarios.

Senegal is **relatively abundant in surface water resources**, due to the Senegal, Gambia and Kayanga rivers and associated basins with an estimated renewable per capita water availability of 4 700 m³, which nevertheless has been **steadily decreasing** since the 2000s [20], [21]. Most of Senegal's freshwater resources are bound in transboundary riparian systems and river basins whose management and protection are jointly administered with neighbouring Guinea, Mauritania and Mali [20]. River runoff depends on climatic and related evapotranspirative conditions: While the Gambia River flows more or less perennially, the Senegal River experiences high seasonal variability in river runoff. Such variability can cause **severe drought conditions in the dry season** when water demand is highest as well as **extreme flooding in the rainy season**, with little national capacity to store or redirect excess water [20], [22]. Agriculture accounts for 85–90 % of Senegalese water withdrawals from the Senegal Basin, which has experienced a **drying trend** [20], [22]. This drying trend is coupled with a rapidly **increasing domestic demand** for water due to population growth, which in turn has led to **encroachment of agriculture on biodiverse wetland areas**. Furthermore, **inefficient irrigation systems** are said to lose further water, all of which makes water scarcity and consequently food insecurity ever more likely, particularly for northern Senegal [20]–[22].

[5] Shared Socio-economic Pathways (SSPs) outline a narrative of potential global futures, including estimates of broad characteristics such as country-level population, GDP or rate of urbanisation. Five different SSPs outline future realities according to a combination of high and low future socio-economic challenges for mitigation and adaptation. SSP2 represents the "middle of the road"-pathway.

b. Agriculture

Smallholder farmers in Senegal are increasingly challenged by the uncertainty and variability of weather caused by climate change [23]. Since **crops are predominantly rainfed**, yields highly depend on water availability from precipitation and are prone to drought. However, both the length and the intensity of the rainy season are becoming more and more unpredictable and the availability and **use of irrigation facilities remains limited**: Currently, only 2.1 % of the total national crop land and 17 % of the estimated irrigation potential of 409 000 ha are equipped for irrigation and actually irrigated [8], [9]. Constraints to the implementation of adaptation strategies usually include limited access to financing and credit, productive resources and technical advice as well as tenure insecurity [6]. The **main irrigated crop**, especially for more commercial production, is **rice**, which is often intercropped with maize and sorghum [6]. Among smallholder subsistence farmers, irrigated **vegetables** are more common and dominated by **onion and tomato** [6].

Currently, the high uncertainty of projections regarding water availability (Figure 10) translates into high uncertainty of drought projections (Figure 11). According to the median over all models employed, **the national crop land area exposed to at least one drought per year will increase from 3.8 % in 2000 to 4.7 % and 4.3 % in 2080 under RCP2.6 and RCP6.0, respectively.** Under RCP6.0, the likely range of drought exposure of the national crop land area per year widens from 0.44–11.17 % in 2000 to 0.31–28.16 % in 2080. The very likely range of drought exposure widens from 0.00–16.26 % in 2000 to 0.02–60.06 % in 2080. This means that **some models project almost a fourfold increase of drought exposure over this time period.**

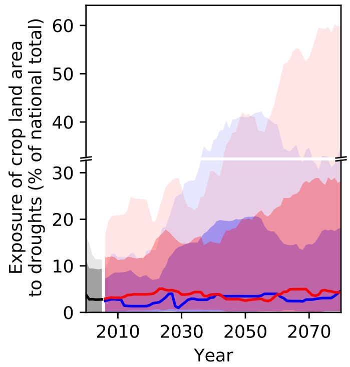

Figure 11: Projections of crop land area exposed to drought at least once a year for Senegal for different GHG emissions scenarios.

In terms of yield projections, model results indicate a **negative trend for millet and sorghum** under both RCPs (Figure 12)5. By 2080, compared to the year 2000, yields of millet and sorghum are projected to decrease by 2.0 % under RCP2.6 and by 4.7 % under RCP6.0. Yields of **groundnuts, rice and cow peas**, on the other hand, are **projected to increase** by 13.5 %, 4.8 % and 1.9 % under RCP2.6 and 31.6 %, 7.0 % and 20.4 % under RCP6.0. A possible explanation for the more positive results under RCP6.0 is that groundnuts, rice and cow peas are so-called C3 plants, which follow a different metabolic pathway than, for example, millet and sorghum (C4 plants), and benefit more from the CO_2 fertilisation effect under higher concentration pathways. Although some yield changes may appear small at the national level, such as for rice, they will likely increase more strongly in some areas and, conversely, decrease more strongly in other areas as a result of climate change.

Overall, adaptation strategies such as switching to improved varieties in climate change-sensitive crops need to be considered, yet should be carefully weighed against adverse outcomes, such as a resulting decline of agro-biodiversity and loss of local crop types.

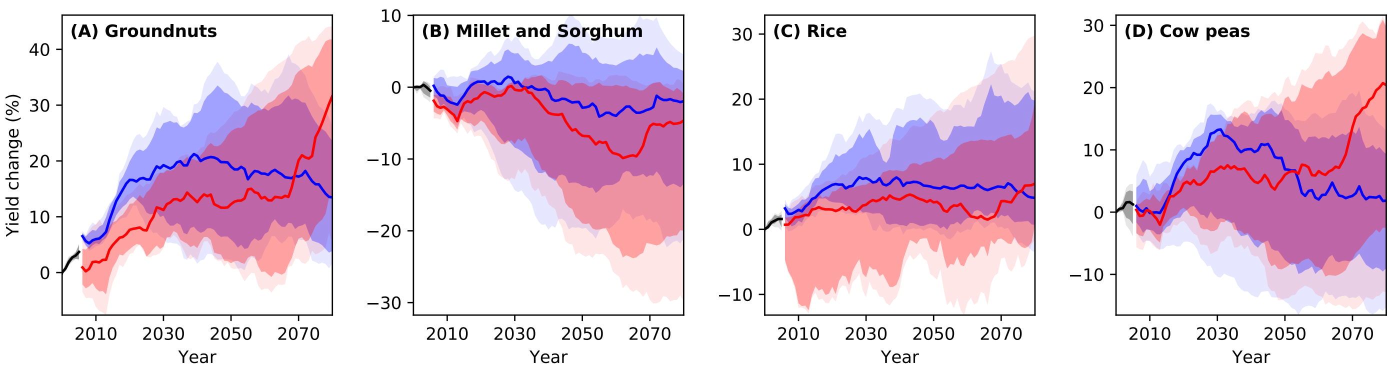

Figure 12: Projections of crop yield changes for major staple crops[8] in Senegal for different GHG emissions scenarios assuming constant land use and agricultural management, relative to the year 2000.

[8] Modelling data is available for a selected number of crops only. Hence, the crops listed on page 2 may differ.

c. Infrastructure

Climate change is expected to significantly affect Senegal's infrastructure through extreme weather events. High precipitation amounts can lead to the **flooding of roads**, while high temperatures can cause **roads, bridges and coastal infrastructures to develop cracks and degrade more quickly**. This will require earlier replacement and lead to **higher maintenance and replacement costs**. The poorly developed railway network increases Senegal's reliance on road transportation [24]. Senegal's roads, however, are in a relatively poor condition, largely due to lack of investment and overload of major regional corridors. Furthermore, Senegal's **road network is characterised by an asymmetry in coverage between the coastal areas and inland areas**, with a much higher connectivity in coastal areas [24]. Especially during the rainy season, many of the inland **rural roads are inaccessible**, cutting off villages and communities. Investments will have to be made to build climate-resilient road networks.

Extreme weather events also have **devastating effects on human settlements and economic production sites**, especially in urban areas with high population densities like Dakar, Touba or Rufisque. **Informal settlements are particularly vulnerable to extreme weather events**: Makeshift homes are often built at unstable geographical locations including steep slopes or river banks, where strong winds and flooding can lead to loss of housing, contamination of water, injury or death. Dwellers usually have a low adaptive capacity to respond to such events due to high levels of poverty and lack of risk-reducing infrastructures. Although floods are a yearly occurrence in Senegal, the **2020 rainy season** brought much more precipitation than is usually received, causing severe **floods almost all over Senegal**, particularly in the Dakar and Thiès regions [25]. Almost 17 000 people were affected in these regions, with thousands homeless and **damages to infrastructure and settlements**, some of which were left enclaved, due to waterlogged streets and washed-out bridges [25].

Despite the risk of infrastructure damage being likely to increase due to climate change, precise predictions of the location and the extent of exposure are difficult to make. For example, projections of river flood events are subject to substantial modelling uncertainty, largely due to the uncertainty of future projections of precipitation amounts and their spatial distribution, affecting flood occurrence (see also Figure 4). In the case of Senegal, median projections show **little change in national road exposure to river floods** (Figure 13). In the year 2000, 0.68 % of major roads were exposed to river floods at least once a year. By 2080, this value is projected to increase to 0.97 % under RCP6.0 and to 0.50 % under RCP2.6. The **exposure of urban land area to river floods is projected to change only slightly** under both RCPs (Figure 14).

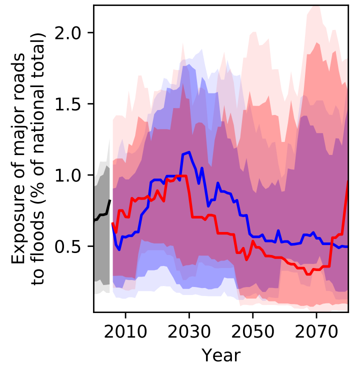

Figure 13: Projections of major roads exposed to river floods at least once a year for Senegal for different GHG emissions scenarios.

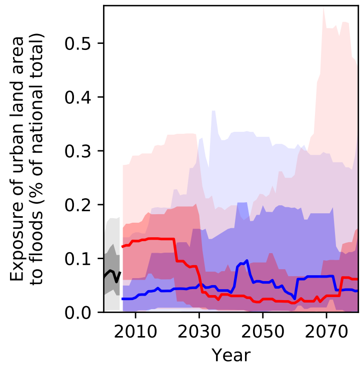

Figure 14: Projections of urban land area exposed to river floods at least once a year for Senegal for different GHG emissions scenarios.

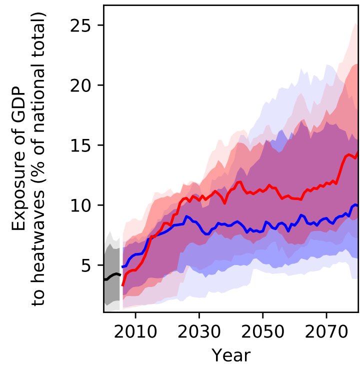

Figure 15: Exposure of GDP in Senegal to heatwaves for different GHG emissions scenarios.

With the **exposure of the GDP to heatwaves projected to increase** from around 3.8 % in 2000 to 9.9 % (RCP2.6) and 14.4 % (RCP6.0) by 2080 (Figure 15), it is recommended that policy planners start identifying heat-sensitive economic production sites and activities, and integrating climate adaptation strategies such as improved solar-powered cooling systems, "cool roof" isolation materials or switching the operating hours from day to night [26].

d. Ecosystems

Climate change is expected to have a significant influence on the ecology and distribution of tropical ecosystems, though the magnitude, rate and direction of these changes are uncertain [27]. With rising temperatures and increased frequency and intensity of droughts, **wetlands and riverine systems are increasingly at risk of being disrupted and altered,** with structural changes in plant and animal populations. Increased temperatures and droughts can also impact succession in forest systems while concurrently increasing the risk of invasive species, all of which affect ecosystems. In addition to these climatic drivers, low agricultural productivity and population growth might motivate unsustainable agricultural practices, resulting in increased deforestation, land degradation and forest fires, all of which will impact animal and plant biodiversity [28].

Model projections of species richness (including amphibians, birds and mammals) and tree cover for Senegal are shown in Figure 16 and 17, respectively. Results for this analysis show differences depending on the region: Under RCP2.6, species richness is expected to increase almost all over Senegal, except for the south-east, with increases of up to 77 % in northern Senegal (Figure 16). For RCP6.0, the picture is different: Models are far less certain, projecting **increases in northern Senegal** (58 %) and **decreases in the eastern part of the country** (18 %). **With regard to tree cover, model results are very uncertain** in most parts of the country under RCP2.6, while under RCP6.0, models agree on increases in most parts of Senegal, in particular in the south-east, which will see increases of up to 4 % (Figure 17).

It is important to keep in mind that the **model projections exclude any impacts on biodiversity loss from human activities such as land use**, which have been responsible for significant losses of global biodiversity in the past, and are expected to remain its main driver in the future [29]. In recent years, Senegal's vegetation has experienced profound disturbances due to population pressure and increasing **demand for firewood**, **extension of agricultural land and timber extraction**, which are among the main drivers behind deforestation [28]. The country has **lost 746 500 ha of tree cover** between 2001 and 2020, which is equivalent to a **8 % decrease** of national forest area [1].

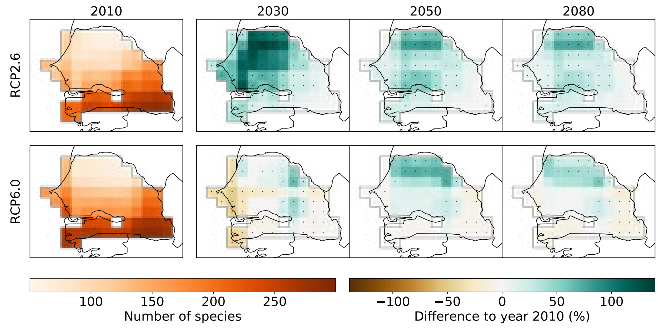

Figure 16: Projections of the aggregate number of amphibian, bird and mammal species for Senegal for different GHG emissions scenarios.

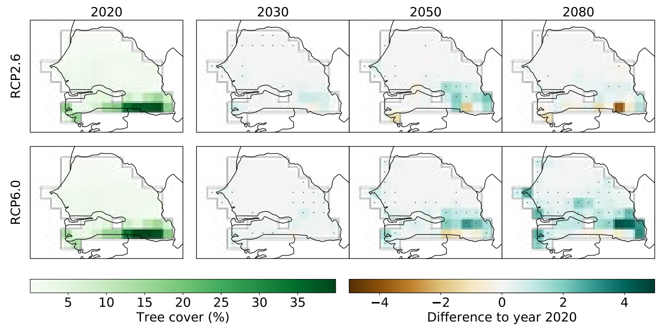

Figure 17: Tree cover projections for Senegal for different GHG emissions scenarios.

e. Human health

Senegal experiences many of the human health problems common in sub-Saharan Africa, such as a **high prevalence of vector- and water-borne diseases, malnutrition and lack of medical infrastructure or sanitation facilities** [30], [31]. Senegal's north-south climatic gradient has implications for the epidemiology of many vector-borne diseases which is most active during the rainy season from July to September, with the more **tropical south experiencing favourable conditions for malaria transmission** for at least five months of the year and the semi-arid to arid north experiencing favourable conditions for only two to three months of the year, especially along the Senegal River Basin [31]. While **malaria** is still the vector-borne disease with the **highest prevalence, morbidity and mortality** [30], [31], its relative importance has greatly diminished in the past decade due to the widespread use of insecticides and mosquito nets [30], [32]. **Borreliosis**, a tick-borne disease, is now considered to be the **most common cause for fever-related health consultations** in Senegal and all of West Africa but is comparatively understudied, especially with regards to the influence of climate change on its epidemiology [30]. The influence of climate change on vector-borne diseases is noticeably more complex and difficult to predict than its influence on physical symptoms associated with temperature increases, which have been projected for the whole Sahel region [31], [33]. Large **temperature increases**, especially in the more humid south, could be particularly **dangerous for the elderly, small children and already sick individuals** [33]. Water-borne diseases, such as **cholera**, are of particular relevance in the urban and peri-urban areas of the west and in coastal regions and may be exacerbated by more frequent floods [30], [31]. However, people in rural areas, who rely on unsafe water sources, such as along the Senegal River Basin, are also vulnerable to floods and their impacts, with **parasitic infections**, such as **Schistosomiasis**, occurring continuously throughout the year along the basin [30], [31]. In general, climate change will make rural populations more susceptible to diseases by endangering agricultural production, due to higher temperatures and rainfall variability and thus causing **malnutrition and hunger**. According to the World Food Programme, 19 % of children in Senegal suffered from chronic malnutrition in August 2021, which is likely to further exacerbate due to the **impacts of the COVID-19 pandemic** [34].

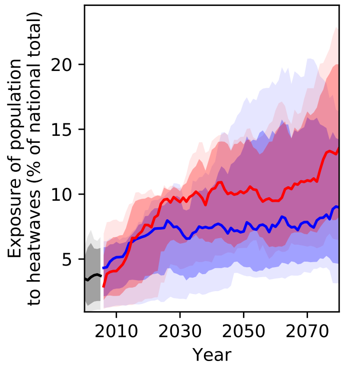

Figure 18: Projections of population exposure to heatwaves at least once a year for Senegal for different GHG emissions scenarios.

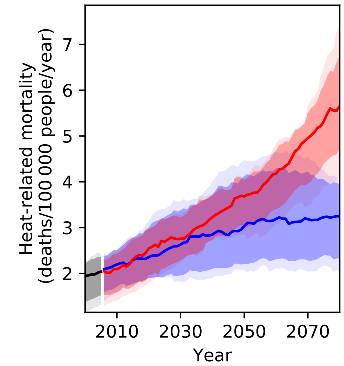

Figure 19: Projections of heat-related mortality for Senegal for different GHG emissions scenarios assuming no adaptation to increased heat.

Rising temperatures will result in **more frequent heatwaves** in Senegal, leading to **increased heat-related mortality.** Under RCP6.0, the **population affected by at least one heatwave per year is projected to increase from 3.5 % in 2000 to 13.6 % in 2080** (Figure 18). Furthermore, under RCP6.0, **heat-related mortality will likely increase from 1.9 to 5.7 deaths per 100 000 people per year by 2080**, which translates to an increase by a factor of 3 towards the end of the century compared to year 2000 levels, provided that no adaptation to hotter conditions will take place (Figure 19). Under RCP2.6, heat-related mortality is projected to increase to 3.3 deaths per 100 000 people per year in 2080.

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