Netherlands Commission for Environmental Assessment
Dutch Sustainability Unit

Climate Change Profile: MALI

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September 2016
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Advisory Report by the Dutch Sustainability Unit

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Sahelian Mali is subject to frequent droughts and experiences a significant variability in annual rainfall. Climate change is expected to increase local temperatures, the variability of rainfall, and the magnitude of extreme weather events. These climate related changes are already being felt and have led to a steady relocation of fishing, agricultural, and livestock keeping activities southwards where the population density is much higher, increasing the conflicts between pastoralists, fishermen, and farmers. The recent history of violent civil conflicts is hampering the development of Mali and threatening food security, livelihoods, and local economies. In the future, these developments will continue, with severe climate change effects especially in the north of the country where temperatures will further increase and rainfall will decrease (see Map 1). Food crops will be less productive, and a gradual shift to pastoralism is likely.

Overall ranking

Mali ranks 156 out of 180 countries in the ND-GAIN index[1] (2014), a slight improvement from 2013 (rank 159). Mali is the 19th most vulnerable country and the 46th least ready country- meaning that it is extremely vulnerable to, yet unready to address climate change effects. *Vulnerability* measures the exposure, sensitivity, and ability to cope with climate related hazards by accounting for the overall status of food, water, environment, health, and infrastructure within a country. *Readiness* targets those portions of the economy, governance and society that affect the speed and efficiency of adaptation.

Biophysical vulnerability

Current climate. Mali is located in West Africa and is home to the inner delta of the Niger River that runs through nine countries (see Map 2). The north of the country is part of the Sahara Desert and the Sahel climate, whereas the southern regions experience a wetter, more tropical, climate[2]. There are four climate types distinguished in Mali[3], from north to south:

- the Saharan climate with less than 200 mm of precipitation per year;
- the Sahel climate with precipitation between 200 and 600 mm per year;
- the Sudanese climate with annual precipitation between 600 and 1000 mm;
- the Sudano-Guinean climate with annual precipitation over 1000 mm.

Mali is influenced by the Inter-Tropical Conversion Zone (ITCZ), creating both winds from the Ocean as well as winds from the Sahara region that are more dusty and warmer. These two opposing wind directions cause the annual West African Monsoon – resulting in a dry **season** for a period between 6 (in the south) and 9 (in the north) months (November to March) and a wet season of 3 to 4 months between June and October, mostly in the southern regions of Mali. In the dry season, almost no rain falls at all. Moreover, variations in the latitudinal movements of the ITCZ from one year to another cause large inter-annual variability in wet-season rainfall, which means that Mali suffers from recurring drought[4]. For the whole of Mali, the annual mean **temperature** is 28 °C, with higher average temperatures in the north and lower in the south.

[1] GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. http://index.gain.org/country/mali

[2] McSweeney, C., New, M. & Lizcano, G. (2010): *UNDP Climate Change Country Profiles: Mali*. http://country-profiles.geog.ox.ac.uk/

[3] Mali Ministry of Environment and Sanitation (2013): *Les Changements Climatiques au Mali*. http://www.changementsclimatiques-mali.org

[4] McSweeney et al. (2010)

The absolute maximum temperature is 51 °C, whereas the minimum temperature has not been below 10 °C, causing high rates of evapotranspiration[5].

Current trends. The mean annual **temperature** in Mali has increased by 0.7 °C since 1960, an average rate of 0.15 °C per decade. There are some differences per region and season, with summer temperatures in the north increasing by as much as 0.5°C per decade (see Map 4). While the frequency of hot days[6] has not increased significantly in most seasons, the frequency of hot nights has increased significantly in all seasons except winter with an average number of 'hot' nights per year increased by 55 (an additional 14.9% of nights) between 1960 and 2003[7]. The frequency of 'cold' days has decreased significantly only in summer, and the frequency of cold nights has decreased significantly in all seasons except winter where the average number decreased by 31 which equals 8.6% of days.

Sahelian **rainfall** is characterised by high variability on inter-annual and inter-decadal timescales, which can make long-term trends difficult to identify. Especially in the beginning of the rain season the precipitation distribution is highly uncertain and unpredictable. Overall, according to the National Direction of Meteorology, rainfall is decreasing since 2001 (analysed from 1961). Precipitation used to vary between 500 and 1500 mm per year in the 1950s; during the last 15-20 years, however, the maximum has not exceeded 1300 mm. The area receiving more than 1200 mm has decreased significantly (see Map set 5). Effects of this are already being noticed: for example, it is likely to have contributed (among other factors) to the inundated surface of the central Inner Niger Delta being reduced from 36000 km2 in 1969-70 to 8500 km2 in 1972-73[8].

Mali is prone to extreme climatic events, especially droughts. Their incidence is increasing due to the temperature and rainfall effects described above (see Map 6 for drought hotspots). During rainy seasons, many people are exposed to floods along the two great rivers Niger and Senegal and their tributaries.

Climate change. Projected changes in mean annual **rainfall** range from -22 to +25% by the 2090s, depending on 'wet' or 'dry' scenarios (see Map set 7) with the most likely change between 0 and -11%. The largest decreases are expected in the north of Mali. Fluctuation in rainfall causes unpredictable patterns with large variation in time and place. Different models project either decreases or increases for the proportion of total rainfall that falls in heavy events if considered over the whole of the country. However, annually, these values tend to increase in the south of the country (indicating an increase in heavy rainfall events), but to decrease in the north[9]. This has been one of the factors leading to a decrease in the average flow of the Niger River in Mali, from 1300 m^3/second in 1978 to 895 m^3/second in 2002[10]. Moreover, the inundated surface of the central Inner Niger Delta is likely to decrease even more after severe

[5] Mali Ministry of Environment and Sanitation (2008): *Elements of National Policy of Adaptation to Climate Change.* http://www.undp-alm.org/sites/default/files/downloads/mali_-_national_policy_2008.pdf

[6] 'Hot' day or 'hot' night is defined by the temperature exceeded on 10% of days or nights in current climate of that region and season (see footnote 2)

[7] McSweeney et al. (2010)

[8] Mali Ministry of Environment and Sanitation (2008)

[9] McSweeney et al. (2010)

[10] Republique du Mali (2007) : *Programme d'Action National d'Adaptation aux Changements Climatiques*. http://www.preventionweb.net/files/8537_mli01f.pdf

droughts that are projected effects of climate change in the coming decades[11]. The mean annual **temperature** is projected to increase by 1.2 to 3.6 °C by the 2060s, and 1.8 to 5.9 °C by the 2090s, the projected rate of warming being similar in all seasons and regions of Mali[12].

While spatial patterns of vulnerability vary significantly within Mali, the northern parts of Mali, already at the edges of productivity, are among the most vulnerable (see Map 8). The north of the country is threatened by encroaching deserts, the borderline of which gradually shifts to lower latitudes, while agricultural production capacity in the intensively cultivated south is endangered by increasing pressure on natural resources. Under climate change, this situation is likely to worsen, with accelerated **desertification** and limited water availability in the north (especially in already water scarce areas, see Map 9) and more frequent torrential rains and **floods** (extreme weather events) in the south[13].

Socio-economic vulnerability

Key facts:

GDP (PPP) per capita (2015)[14]:	USD 2,428
Population (June 2016)[15]:	18,134,835
Projected population (2050)[16]:	45,403,630
Population density per km² (2014)[17]:	14
Human Development Index (2014)[18]:	179 out of 188 countries
Corruption Perceptions Index (2015[19]):	95 out of 168 countries
Gender Inequality Index (2014)[20]:	150 out of 188 countries
Adult literacy (2015)[21]:	38.7% (male 48.2%; female 29.2%)

Mali's physical vulnerability is accentuated by socioeconomic and environmental factors, mainly 1) the dependence on rain fed agriculture; 2) a high poverty rate and low Human Development Index; 3) people settling in flood plains, combined with weak land use planning; and 4) environmental degradation[22].

After strong GDP growth rates in 2015 (6.1%) and 2014 (7.5%), Mali's GDP growth should return to a steady state of 5.2% in 2017[23]. Poverty declined from 55.6% in 2001 to 43.6% in 2010, before rebounding to 45% in 2013. The main drivers of domestic activity over the near term will be the agricultural and tertiary sectors. Mali's economy will continue to be exposed to

[11] Mali Ministry of Environment and Sanitation (2008)
[12] McSweeney et al. (2010)
[13] Global Climate Change Alliance (2014): *Global Climate Change Alliance in Mali*, http://www.gcca.eu/national-programmes/africa/global-climate-change-alliance-in-mali
[14] World Bank Data – GDP per capita, PPP. http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD
[15] World Population Review – Mali, http://worldpopulationreview.com/countries/mali-population/
[16] UNDESA (2015): *World Population Prospects: The 2015 Revision*, http://esa.un.org/wpp/
[17] World Bank Data – Population density, http://data.worldbank.org/indicator/EN.POP.DNST
[18] UNDP (2015): http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components
[19] Transparency International (2015) http://www.transparency.org/cpi2015/results
[20] UNDP (2015): http://hdr.undp.org/en/content/table-4-gender-inequality-index
[21] CIA (2015). The World Factbook – Mali. Available via https://www.cia.gov/library/publications/the-world-factbook/geos/ml.html
[22] Global Facility for Disaster Reduction and Recovery (2012): *Mali Country Update*. http://www.gfdrr.org/sites/gfdrr.org/files/MALI.pdf
[23] CIA (2015). The World Factbook – Mali. Available via https://www.cia.gov/library/publications/the-world-factbook/geos/ml.html

security and climatic shocks, with limited ability to mitigate them. For example, economic activity was severely affected by low rainfall in 2011 and 2013[24].

Various sectors of Mali's economy will be influenced by climate change. Agriculture is the key livelihood in Mali, followed by livestock breeding and fishery, all of which largely depend on suitable temperatures and precipitation. Agriculture and related activities, which are strongly resource-dependent, make up 80% of Mali's labour force and provide 38.5% of the GDP[25]. This indicates the vulnerability of the Malian economy to climate extremes in general and climate change in particular. Livestock constitutes 10% of the GDP, and beef is the third export product of Mali after gold and cotton[26]. Production of gold (which increased in the west and the south of the country since 2002[27]) and of cotton is highly water demanding and may compete with food security, especially if climate change limits water availability. Energy supply generated by the Selingue dam is potentially also decreasing, due to reduced discharge of the Niger River that is caused, among others, by decreasing precipitation[28].

The majority of Malian agriculture is subsistence farming, primarily in rain fed fields. In a study on 'competing claims' between agriculture/food security and other interests in Mali, four 'claims' on land and water were identified that may compete with local food security interests. These are 1) biodiversity conservation; 2) large-scale irrigated agriculture; 3) national/international investments in land for food or biofuels; and 4) land claims of farmers versus herders, leading to conflicts[29]. These competing claims are aspects of vulnerability of food security in Mali, including vulnerability to climate change effects.

Increasing temperatures and decreasing precipitation will affect agriculture and food security. Overall, under climate change, crop yields were projected to change by −17% to +6% at national level, increasing the percentage of population at risk of hunger from a current estimate of 34% to an after climate change level of 64-72%[30] (it should be noted that this study is over 10 years old and figures may no longer be valid). Climate change will affect crops differently. In the southern Sudanic area, cotton, rice, millet, sorghum, groundnuts and vegetables are predominant. In the Sahelian area, millet, sorghum and some rice are grown. In the Saharan area, pastoralism is the only viable livelihood[31] (see Map 10). Specific projections for climate change effects on these crops in Mali are as follows:

[24] World Bank (2015): *Mali Overview.* http://www.worldbank.org/en/country/mali/overview

[25] CIA (2015). The World Factbook - Mali. Available via https://www.cia.gov/library/publications/the-world-factbook/geos/ml.html

[26] Mali Ministry of Environment and Sanitation (2008)

[27] Groupe de la Banque Africaine de Développement (2011): *Mali Profil du Genre Pays*, http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Mali_-_2012_-_Profil_du_genre_pays.pdf

[28] Mali Ministry of Environment and Sanitation (2008)

[29] Van Berkum, S.; Van Dijk, M.; Van Bodegom, A.J.; Jongschaap, R.; Arets, E.; Bindraban, P. (2011): *Competing claims and food security in Ghana and Mali*. LEI report 2011-086. http://edepot.wur.nl/201405

[30] Butt, T.A.; McCarl, B.A.; Angerer, J.; Dyke, P.T.; Stuth, J.W. (2005): *The economic and food security implications of climate change in Mali*. http://link.springer.com/article/10.1007%2Fs10584-005-6014-0

[31] FAO (2012): *Potential Impacts of Climate Change on Food Security in Mali*. http://www.fao.org/docrep/016/i2856e/i2856e.pdf

- **Cereals**: for the productivity of cereals in general (specifically millet and sorghum), decreases are expected due to declines in rainfall in the north of Mali[32]. Specifically, annual rainfall totals under 400 mm (for millet) and 500 mm (for sorghum) will have significant effects on productivity[33].
- **Rain fed rice**: yields in the Sahel will decrease significantly if annual rainfall drops below 1500 mm[34] – which is already the case in most of Mali. Another source projects yields in Mali to increase up to 2050, due to modernisation, but the increase will slow down after 2050 so that production in 2080 is only 2% higher than to date[35]. This will be insufficient for the country's growing population.
- **Irrigated rice**: if sufficient irrigation is provided (which will become harder under decreased precipitation and increasing evapotranspiration), yields of irrigated rice will continue to increase – by 4% by 2020, 18% by 2050, and 25% by 2080[36]. Again, however, this is not enough if the population will triple, as projected, by 2050.
- **Maize**: a slight decrease in maize productivity is expected due to diminishing rainy season length[37], while a drop of annual rainfall below 600 mm in some areas would significantly affect productivity[38].
- **Cotton**: cotton productivity will also decrease under a reduction in length of the rainy season[39], and will become significantly less productive in areas where annual rainfall will drop below 750 mm[40].

The effects of climate change may also lead to new areas being gained for production of specific crops. However, that requires adaptation of farmers' crop selection, which is not automatically done and requires good information and resources. It is important to note that the yield of the main crops that ensure food security has remained the same over the past 50 years (except for rice) despite agricultural innovations. This indicates that the agricultural sector is insufficiently developing to keep up with the increasing population. The lack of processing infrastructure of agricultural products contributes to an unstable food economy, partly because of the absence of an adequate energy network that can ensure large-scale food processing to meet the current food demand.

The livestock sector will also be impacted by climate change – potentially even more severely. Under climate change, forage yields are expected to fall by 5 to 36% while livestock animal weights are likely to be reduced by 14 to 16%[41]. The pastoralist culture of transhumance, following the rains for both humans and cattle, is a common practice in Mali and may be impacted by climate change (as well as other factors). In 2012, for example, the extreme drought in the

[32] Mali Ministry of Environment and Sanitation (2008)

[33] Del Rio, A.; Simpson, B.M. (2014): Agricultural Adaptation to Climate Change in the Sahel: A Review of Fifteen Crops Cultivated in the Sahel. USAID. http://community.eldis.org/.5b36f801/A%20Review%20of%2015%20Crops%20SAHEL_CLEARED.pdf

[34] Del Rio and Simpson (2014)

[35] ECOWAS (2008): *Climate and Climate Change*. http://www.oecd.org/swac/publications/40121025.pdf

[36] ECOWAS (2008)

[37] Ministry of Environment, Ministry of Education (2003): Vulnerabilite et adaptation du mais et du coton aux changements climatiques au Mali. http://www.nlcap.net/fileadmin/NCAP/Countries/Mali/O-2-9Fr-032135.0610xx.MAL.CON-02.Output9_Francaise.pdf

[38] Del Rio and Simpson (2014)

[39] Ministry of Environment, Ministry of Education (2003)

[40] Del Rio and Simpson (2014)

[41] Butt et al. (2005)

Sahel region in combination with political instability and conflicts caused the displacement of 100,000 people to neighbouring countries in addition to 95,000 people that moved within the country that suffered from drought in practically all regions[42]. Some drought hotspots identified for the Sahel region are indeed located in Mali's pasture lands (see Map 11).

Adverse effects of climate change may alter the composition of farming systems. Specifically, a reduction in length of the growing season and increases in the frequency of failed seasons are likely to make farmers change from mixed crop-livestock to more livestock dominated food production. Transition zones, where livestock keeping is projected to replace crop cultivation by 2050, include the West African Sahel[43]. However, as described above, livestock keeping is also vulnerable to climate change and may prove not to be a sustainable source of food security.

Fishing dependent communities in the Inner Delta that undertake seasonal fishing migrations have found there is little opportunity to modify migration routes or find new settlements sites inside the delta because of the high population density in this area. Therefore, although adoption of diversified and spatially discrete patterns in livelihood activities is often presented as a strategy to reduce vulnerability to climate change, such a strategy does not appear sufficient for fishers of the delta[44].

These effects on agriculture and related sectors will have implications for food security in Mali. According to the Global Food Programme, most Malians already live in a situation of chronic food insecurity and experience difficulties in ensuring enough food every third year[45]. To date, 2.7 million people (25%) of the rural population are food insecure, and 3.5 million people (32%) living in rural households are in a vulnerable position, especially children suffering from high malnutrition (11%). The regions with the highest food insecurity and vulnerability to the effects of climate change are located in the north (Kayes, Koulikoro, north of Segou, Dogon, Mopti, Timbuktu). These areas are not densely populated (two-thirds of the country's land is home to only 10% of the country's population), but nevertheless climate change impacts may be severe. Moreover, they are not only highly vulnerable but also lack adaptive capacity to react to climate change effects (see Map set 12).

Climate change has an important gender dimension. In agriculture, women are represented along the entire value chain yet lack the required resources such as access and control of land and production methods. The predominantly masculine labour migration influences household structures and in many cases increases women's burdens. In general, women in Mali are re-

[42] Hummel et al., 2012 in CEDEM (2014): *Catastrophes, Changement Climatique et Déplacements forcés Dynamiques régionales de mobilité en Afrique de l'Ouest*. http://www2.nanseninitiative.org/wp-content/uploads/2015/02/West-Africa-Background-Paper-FINAL-FRENCH.pdf

[43] Niang, I.; Ruppel, O.C.; Abdrabo, M.A.; Essel, A.; Lennard, C.; Padgham, J.; Urquhart, P. (2014): Africa. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects*. Contribution to the 5th Assessment Report of the IPCC, pp. 1199-1265. https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap22_FINAL.pdf

[44] Morand, P.; Kodio, A.; Andrew, N.; Sinaba, F.; Lemoalle, J.; Béné, C. (2012): *Vulnerability and adaptation of African rural populations to hydro-climate change: experience from fishing communities in the Inner Niger Delta (Mali)*. http://link.springer.com/article/10.1007%2Fs10584-012-0492-7

[45] Programme Alimentaire Mondial (2005): *Mali, Analyse de la sécurité alimentaire et de la vulnérabilité (CFSVA)*. http://catalog.ihsn.org/index.php/catalog/4144/download/55408

sponsible for small livestock keeping, fish processing, and sale of processed food. These activities are mostly not assigned a value nor accounted for, but are vital to tackle food insecurity[46]; at the same time, they are vulnerable to climate change effects because of their high resource dependence.

As mentioned before, migration may be triggered by climate change. The large agricultural production zones of Sikasso (south-east) and Segou (north-east of Bamako), as well as the region of Kidal (north-east) where transhumant pastoralism is widely practiced, are expected to experience relatively little food insecurity. However, they may have to cope with increasing influx of people migrating from other areas where climate change impacts are more severe.

Resource scarcity, especially if combined with migration, easily leads to conflicts. Simultaneously, conflict situations make people very vulnerable to shocks – including those caused by climate change – because they affect people's livelihoods, assets, and safety nets. The recent conflicts in the north of Mali take place primarily in the regions that are also most strongly affected by decreasing rainfall – indicating a high vulnerability both in biophysical and in socio-economic terms. Political instability and lack of security are very serious issues which overshadow longer-term climate change issues. Under a situation of political instability and insecurity it will be very difficult to implement adaptation programmes in the north.

National government strategies and policies

Numerous action plans and policy documents have been formulated by the Government of Mali, including a National Policy for Climate Adaptation, a Climate Change Scenario Elaboration, Sub-Regional Action Programme for the Reduction of the Vulnerability to Climate Change as well as Initial and Second National Communication documents that are currently under implementation. Mali also ratified the UN Convention on Biological Diversity (CBD) in 1995 for which it had a National Biodiversity Strategy and Action Plan approved in 2001[47], the Convention to Combat Desertification (CCD) in 1995 for which it developed a National Action Programme in 1998[48], and the Framework Convention on Climate Change (UNFCCC) in 1994[49]. For the latter it developed a National Adaptation Programme of Action in 2007, in which the sectors of agriculture and health were identified as first priority, and fisheries, energy, water resources and others as secondary priorities. Eighteen priority activities were listed, among which the most important were:

- diversification of animal and crop production, including the use of improved species that are adapted to climate change;
- diversification of livelihoods, with specific attention to gardening, fish farming and micro credit;
- creation of cereal banks;
- agro-meteorological advice;
- construction of micro dams and other water supply structures[50].

[46] Groupe de la Banque Africaine de Développement (2011)

[47] Convention on Biological Diversity: *Mali – Main Details.* https://www.cbd.int/countries/profile/?country=ml

[48] Republique du Mali (1998) : *Programme National d'Action Environnementale*. http://www.unccd.int/ActionProgrammes/mali-fre2000.pdf

[49] UNFCCC : *Mali*. http://maindb.unfccc.int/public/country.pl?country=ML

[50] Republique du Mali (2007)

In 2011 the Malian Ministry of Environment and Sanitation launched its National Climate Change Strategy (NCCS), a strategy that is developed with a main objective to face the climate change challenges and to ensure sustainable development of the country. The strategy works towards the year 2025 by evaluating the progress made every 5 years in order to revise the eight axes of which the strategies consist, including the implementation of a national institutional framework on climate change, organisation of access to international climate funds, national capacity building, and stimulation of climate change consideration within activities in different sectors and at all administrative levels. The main elements for action are 1) securing agricultural productivity and production, 2) implementing a sovereign energy strategy, and 3) capacity building for the benefit of climate change research[51]. This strategy resulted in the establishment of the Institutional Framework on Climate Change (SNCC – Strategic Area I) headed by a National Committee. The Environment and Sustainable Development Agency (AEDD) serves as the Secretariat to this Committee.

The National Policy on Climate Change focuses on combating desertification and other detrimental transnational effects of climate change within the overall objective to eliminate poverty[52]. As is the case in many West African countries, Mali is in the process of decentralisation of water management tasks. Therefore, local capacity building is also one of the vital aspects of improved natural resources management and thereby management of climate change effects.

Intended Nationally Determined Contribution (INDC)

In its INDC Mali presents itself as being highly vulnerable to the negative effects of climate change, resulting in overexploitation of natural resources and land degradation[53].

Mitigation. Mali commits to an average reduction in GHG emissions by **27%** by 2030, compared to a Business-as-Usual (BAU) scenario. This target is divided across several sectors: a reduction of 29% in agriculture, 31% in the energy sector, 21% in forestry and land use. Overall costs of mitigation measures are estimated at USD 34.68 million. A 60% reduction is conditional upon international support, although 40% can be met unconditionally by the Mali government.

Adaptation. The INDC also includes a section on adaptation, in which Mali prioritizes development of a green and climate smart economy. Focus sectors for adaptation are forestry, climate smart agriculture, renewable energy, pastoral management and Integrated Water Resources Management (IWRM). Estimated cost of adaptation measures are USD 1.06 billion, covering a period from 2015 to 2020.

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

[52] Mali Ministry of Environment and Sanitation (2008)

[53] Republique du Mali (2015). Contribution prevue determine au niveau national (CPDN). Available via http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Mali/1/CPDN_MALI_VFsegal.pdf

Climate finance

In the last decade, there have been projects and programmes financed by donors aimed at improving Mali's climate adaptation, including extensive studies, capacity building of national and local governmental institutes, and agricultural and IWRM development.

The Ministry of Environment and Sanitation developed a National Climate Change Strategy (NCCS) in consultation with public and private sector partners as noted above. To maximize its ability to finance its national priorities for the period 2012-2017, the Government of Mali requested the Multi-Partner Trust Fund Office of United Nations Development Programme (MPTFO) to develop a national climate fund to combine financing from bilateral and multilateral sources as well as from the public and private sectors[54]. The Mali Climate Fund is the first public-private fund in Africa to strategically leverage funds for pilot and test interventions that can identify and scale resilience for the country at-large, in the face of immense climate impacts[55]. The Mali Climate Fund received its first contribution in late 2013 from Sweden. It launched its first call for proposals in March 2014. As a result, three projects were selected, on sustainable agriculture, land restoration and solar energy.

As for the use of international climate funds, according to the Overseas Development Institute (ODI), Mali received USD 31.2 million in climate funds between 2004 and 2014 – placing it at number 36 of the climate finance approved ranking list of 135 countries[56].

Mali joined the GEF in 1994 and completed GEF enabling activities (to qualify for funding from GEF), including its National Adaptation Programme of Action (NAPA), National Biodiversity Strategy and Action Plan (NBSAP)[57] and country self-assessment. Since 1994, GEF allocated to Mali USD 13.7 million for biodiversity projects, 32.4 million for climate change projects, 8.1 million for land degradation projects and 11.2 million for multi focal area projects. On top of this, there are GEF country allocations to Mali – among others USD 3 million for climate change under GEF-6, reported in 2014[58].

Mali has received a grant from the World Bank Climate Investment Fund's Scaling Up Renewable Energy in Low Income Countries Program (SREP). This USD 40 million grant targets a set of transformative investments to create an enabling environment for the large-scale development of Mali's renewable energy sector. SREP financing is expected to leverage over USD 215 million in additional co-financing for investments[59]. In September 2015 Mali received readiness funding from the Green Climate Fund (GCF) to form a dedicated GCF team within its Agency for Environment and Sustainable Development[60].

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[54] UNDP (2013): *Mali Climate Fund factsheet*. http://mptf.undp.org/document/download/12430

[55] UNICEF (2014): *Using Sustainable Energy to Protect and Provide Water for Children, Spotlight on Mali*. http://www.unicef.org/environment/files/Mali_Climate_Fund_2014.pdf

[56] Nakhooda, S.; Norman, M. (2014): *Climate Finance: Is it making a difference? A review of the effectiveness of Multilateral Climate Funds.* ODI. http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9359.pdf

[57] Convention on Biological Diversity (2015): *NBSAPs*. https://www.cbd.int/doc/world/ml/ml-nbsap-v2-fr.pdf

[58] GEF (2013): *Country profile Mali.* www.TheGEF.org/gef/country_profile/ML

[59] Climate Investment Funds (2012): *Mali.* http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/SREP_Mali.pdf

[60] http://www.greenclimate.fund/-/mali-nda-signs-grant-agreement-during-visit-to-gcf-headquarters

Climate change projects

Since the civil conflicts in Mali in 2012, international funding has been limited and most of the programmes were suspended. On June 20th 2015 a peace agreement has been signed, paving the way for re-launching development aid in Mali. Climate change projects with a link to water and/or food security that are currently being implemented in Mali (either bilaterally, multilaterally or through NGOs) include:

- the Global Climate Change Alliance's project on mainstreaming REDD which include reforestation programmes as well as studies on carbon sequestration (€ 6.215 million, 2010-2017)[61];
- IFAD (International Fund for Agricultural Development) is working on the Fostering Agricultural Productivity Project, which is currently being implemented with total costs of USD 173.4 million[62];
- the EU pledged €1.28 billion to Mali in 2013 (of which 124.6 million has been paid under the 10th European Development Fund (EDF) programmes[63]), partly for peace and security but also partly to directly climate change related issues, including a project to support food security in the North (€30 million, to start in 2015)[64];
- GIZ is active in Mali with programmes such as Supporting the National Strategy for Adaptation to Climate Change (2014-2019) and Supporting the national programme for sustainable small-scale irrigation (2008-2023)[65];
- the Netherlands Embassy in Mali; an Integrated Water Resources Programme in 2015 together with the related Malian ministries (2015-2019);
- *Great Green Wall* financed by Multi Trust Fund (GEF), SCCF, World Bank, AfDB[66], a regional project aiming to strengthen local resilience to climate change, preserve rural heritage and improve livelihoods of local populations
- USAID's Feed the Future focuses on millet and sorghum, rice, and livestock for food security and poverty alleviation[67];
- USAID Mali's Global Climate Change Initiative addresses pressing climate adaptation issues through the extension of small irrigation infrastructure (rice), improved natural resources management practices and improved agronomic practices (links with Feed the Future programme, see above)[68]
- the Dutch WASH Alliance recently launched its 2016-2020 Mali country program, aiming to increase access to drinking water for 50,000 people and access to sanitation services for 100,000 people. The program focuses on development and implementation of a Recharge, Retention and Reuse (3R) approach on catchment scale[69];
- Mali Country Project of the Africa Hydromet Program – Strengthening Climate Resilience in Sub-Saharan Africa (2017-2020) was awarded a grant of USD22.75 million by the Green Climate Fund in June 2016 to develop the capacity of national hydro-meteorological and warning service, which will in turn support adaptation planning for public and private sector users.

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[61] Alliance globale contre le changement climatique (AGCC) au Mali, http://www.gcca.eu/fr/programmes-nationaux/afrique/amcc-mali

[62] IFAD: *La stratégie du FIDA au Mali*. http://operations.ifad.org/web/ifad/operations/country/home/tags/mali

[63] European Commission (2015): http://ec.europa.eu/europeaid/countries/mali_en

[64] European Union (2015): http://europa.eu/rapid/press-release_STATEMENT-15-5239_en.htm

[65] GIZ (2015): *Mali*. http://www.giz.de/en/worldwide/334.html

[66] GEF (2015): https://www.thegef.org/gef/project_detail?projID=4511

[67] USAID (2015): *Mali Agriculture and Food Security*. http://www.usaid.gov/mali/agriculture-and-food-security

[68] https://www.usaid.gov/mali/environment

[69] http://www.washalliance.nl/wp-content/blogs.dir/2/files/sites/2/2015/08/Country-2-pager-Mali.pdf

For a list of projects in Mali funded through bilateral/multilateral climate funds, see the Annex.

Climate contribution of the Netherlands Embassy: Pitch & Bid

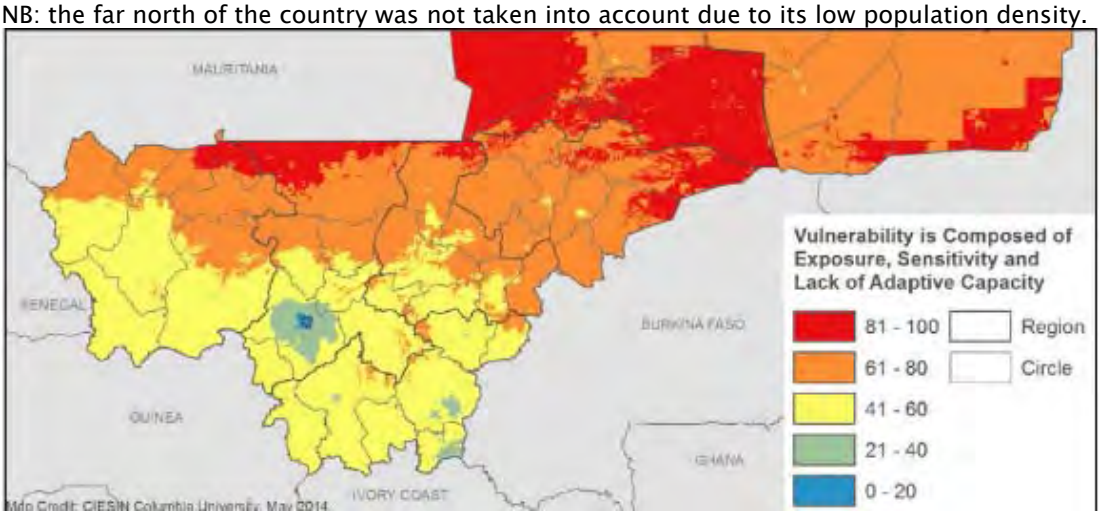
Beginning in 2014, embassies with development programs have annually been preparing a climate Pitch & Bid. The *Pitch* communicates the embassy's climate-smart actions that will address climate change. Based on the actions described in the Pitch, assignment of the Rio Markers and budget information, the embassy prepares a *Bid* which is an estimate of how much it is likely to spend on projects that are relevant for climate in the coming three years. For Mali the Bid estimates a climate contribution for 2016-2018 of €14.367.389 (2016, € 6.148.400; 2017, € 4.518.589; 2018, € 3.700.000). All of the contribution is for adaptation.

The Embassy's Pitch indicates the following focus areas for its climate contribution:

- **Efficient use of water in irrigation**: the Office du Niger is supported to better manage the various development interventions on irrigation and drainage infrastructure.
- **Diversification of crops and livelihoods:** promotion of diversification of crops and varieties to be grown to help people adapt to change in water availability (aiming to reduce the water footprint).
- **Enhancing resilience**: interventions include improving opportunities for sustainable irrigation development, supporting production of fodder grasses for livestock**,** and reconciliation and improved communication to assist populations who compete for the same resources to use these resources effectively and peacefully.
- **Improved value chains:** linked to the diversification of crops and improved agricultural production, improving the functioning of value chains to enable more benefits from agricultural enterprises.
- **Intensification and improved inputs:** the use of improved seeds and other inputs, as well as agricultural intensification, to strengthen farmers' resilience to climate change effects.
- **Education and capacity building:** curricula and trainings for sustainable land and water management to support improved understanding and ability to cope with climate change effects. This includes improving strategic planning for governments and communities to improve their knowledge on the available water resources (river basin approach) and assist their allocation and monitoring for different stakeholders (Gestion Integré des Resources en Eau, or GIRE, approach). Programs for Tombouctou, Gao and Plaines de Mande are under consideration.

Map 1: Overall vulnerability to climate change

NB: the far north of the country was not taken into account due to its low population density.



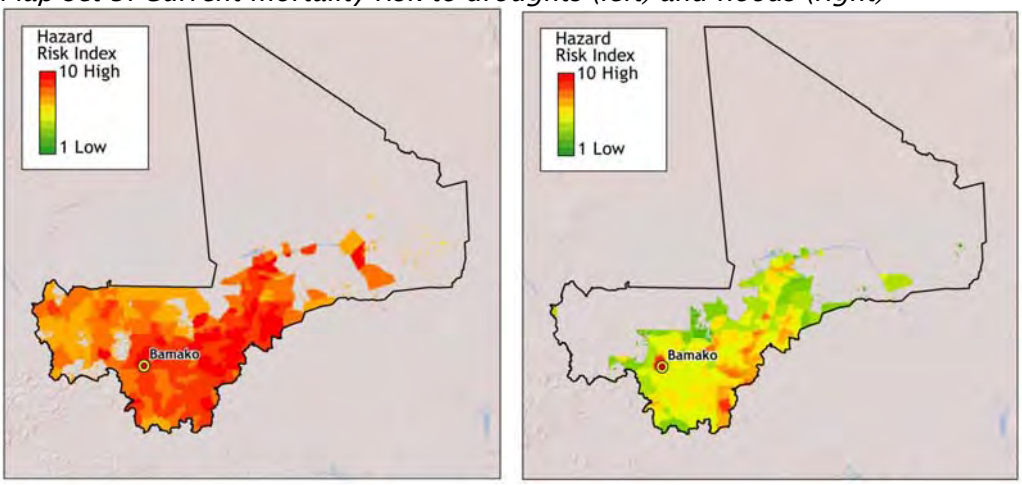
NB: a higher number signifies higher vulnerability, composed of various indicators for bio-physical exposure (see Map 8), socio-economic sensitivity and low adaptive capacity (see Map set 12).

Source: De Sherbinin, A.; Chai-Onn, T.; Giannini, A.; Jaiteh, M.; Levy, M.; Mara, V.; Pistolesi, L.; Trzaska, S. (2014): Mali Climate Vulnerability Mapping. *USAID.* http://community.el-dis.org/.5b9bfce3/Mali-CV-Mapping-Revised-CLEARED.pdf

Map 2: Geographic location in West Africa of Mali indicating the Niger River, Sahara and Sahel

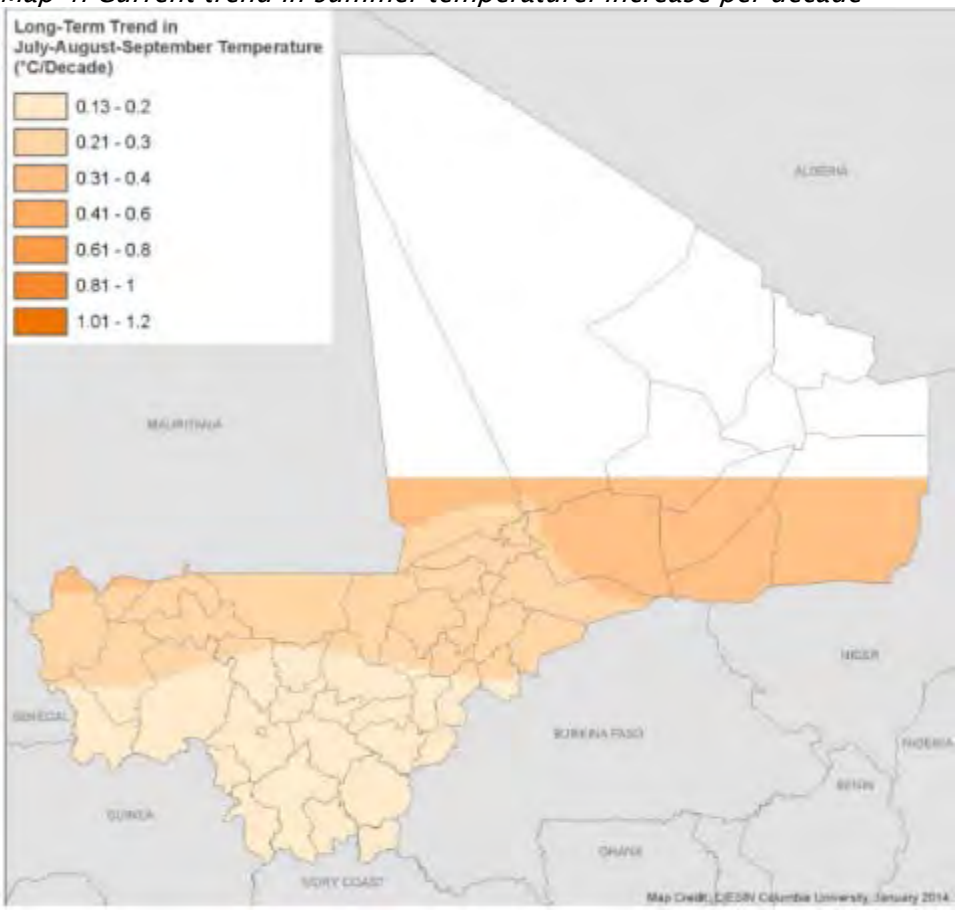
Source: Mali Ministry of Environment and Sanitation (2008)

Map set 3: Current mortality risk to droughts (left) and floods (right)



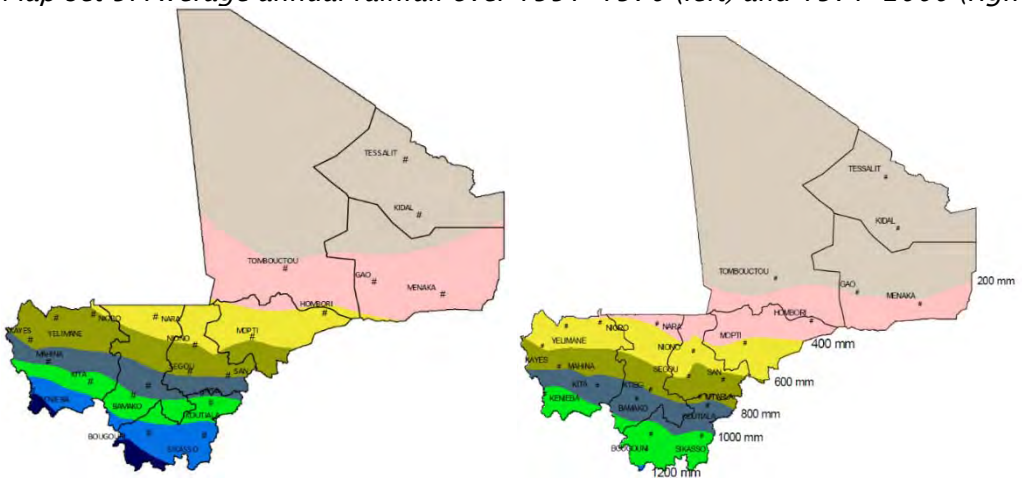
Source: World Bank (2011): *Vulnerability, Risk Reduction, and Adaptation to Climate Change: Mali*. Climate Risk and Adaptation Country Profiles. http://sdwebx.worldbank.org/climate-portalb/doc/GFDRRCountryProfiles/wb_gfdrr_climate_change_country_profile_for_MLI.pdf

Map 4: Current trend in summer temperature: increase per decade



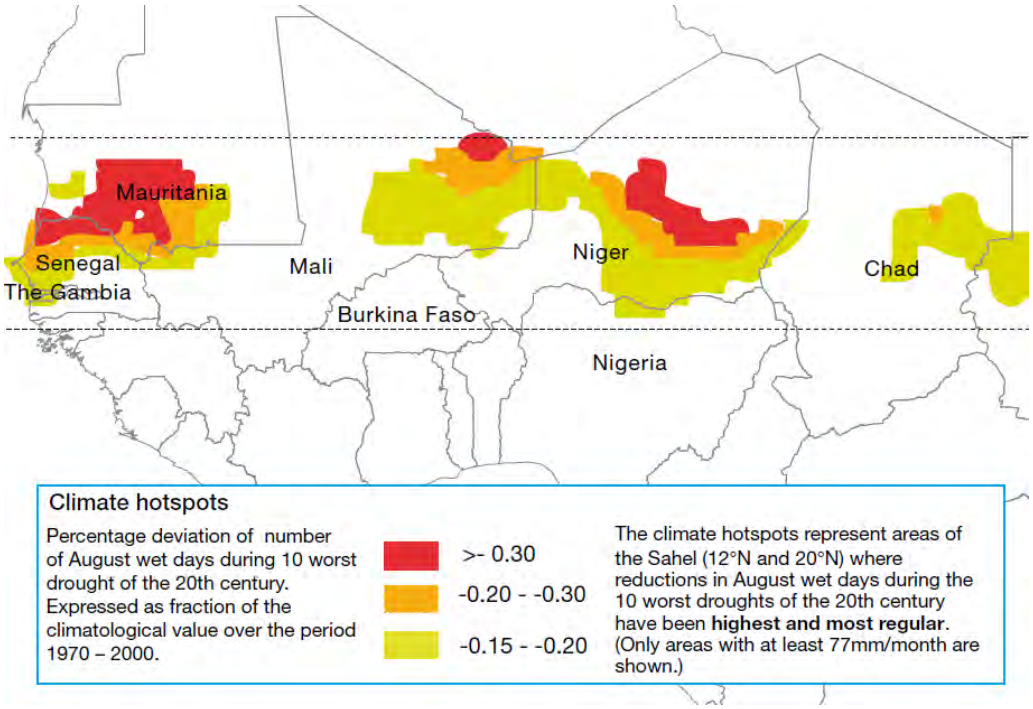
Source: de Sherbinin, A.; Chai-Onn, T.; Giannini, A.; Jaiteh, M.; Levy, M.; Mara, V.; Pistolesi, L.; Trzaska, S. (2014): Mali Climate Vulnerability Mapping. *USAID.* http://community.eldis.org/.5b9bfce3/Mali-CV-Mapping-Revised-CLEARED.pdf

Map set 5: Average annual rainfall over 1951-1970 (left) and 1971-2000 (right)



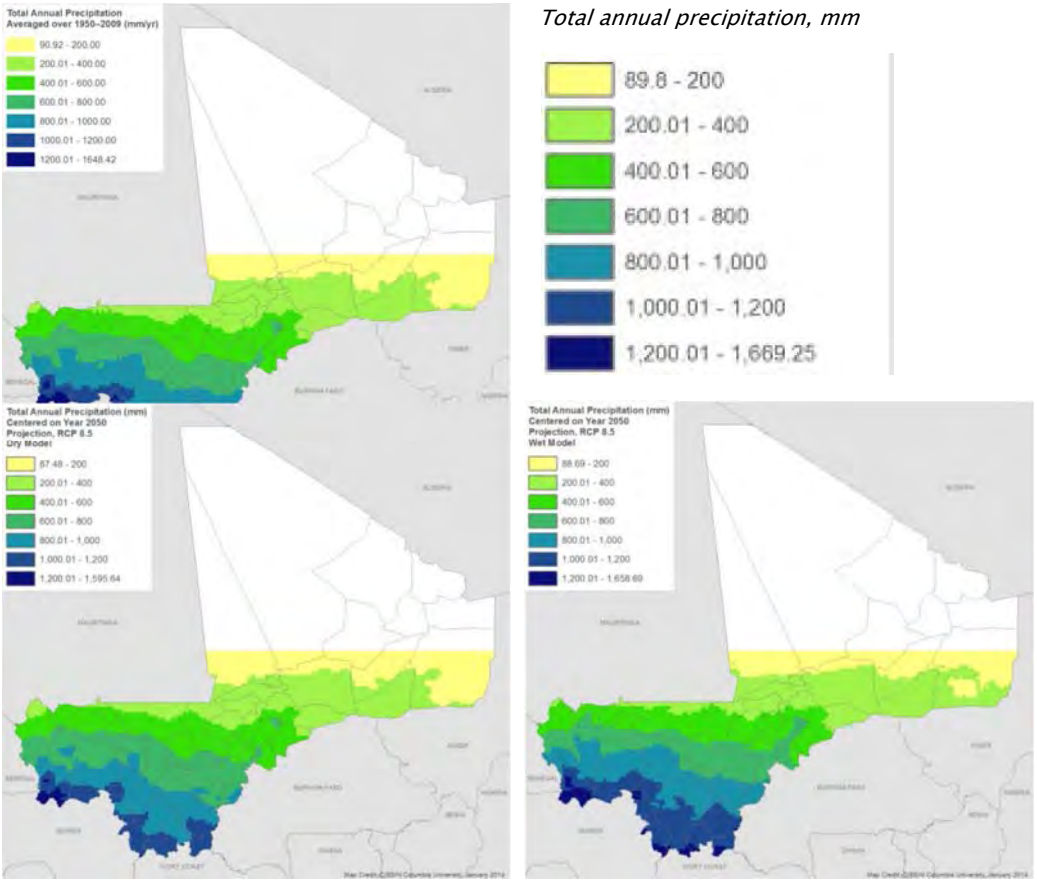
Source: Diallo, M.M.A. (2011) : Evolution du Climat. *Direction Nationale de la Météorologie du Mali.* http://www.cifal-ouaga.org/new11/mali.pdf

Map 6: Current climate hotspots in the Sahel: worst droughts during the 20th century



Source: Heinrigs, P. (2011): Security Implications of Climate Change in the Sahel Region: Policy considerations. *OECD.* http://www.oecd.org/swac/publications/47234320.pdf

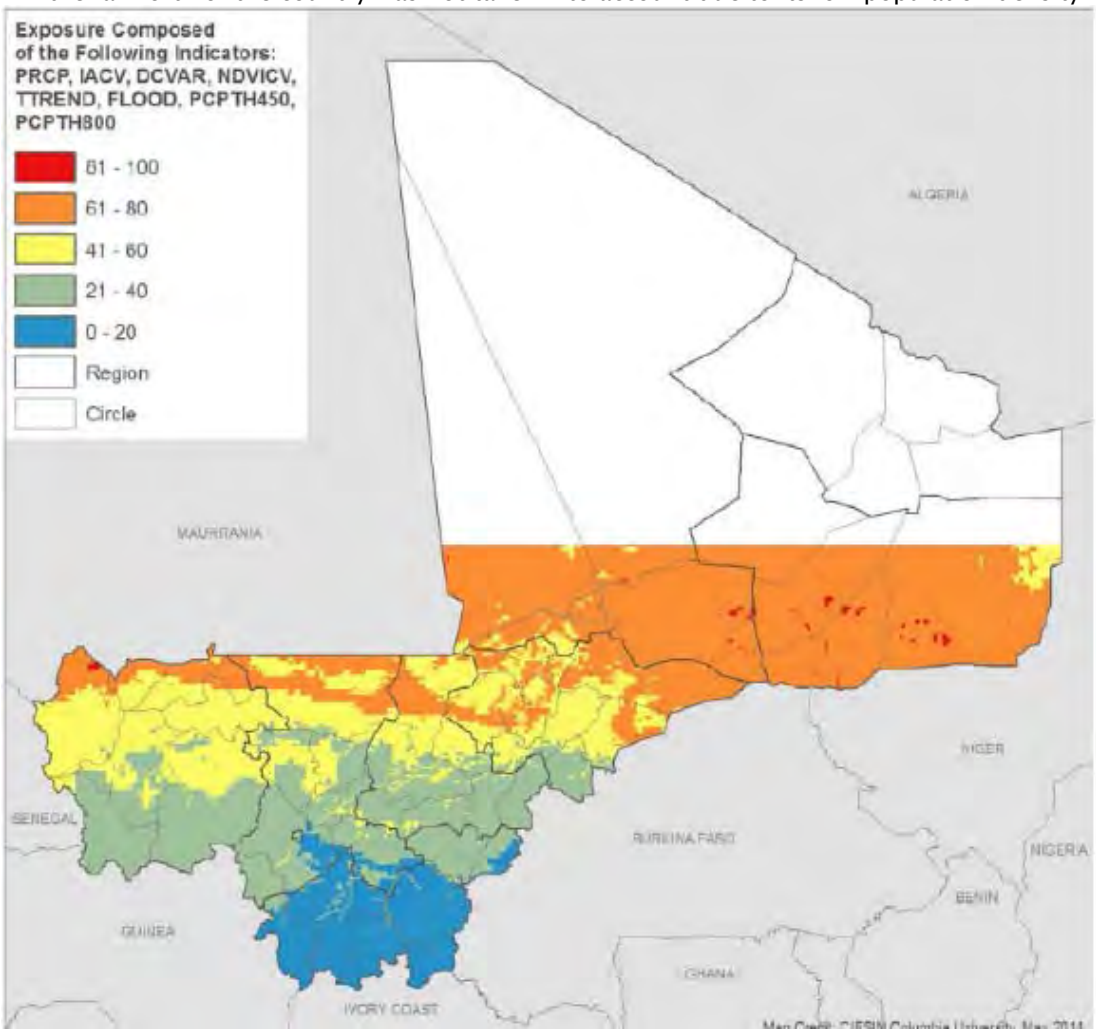
Map set 7: Current total annual rainfall (top), rainfall by 2050 under the driest scenario (bottom left) and under the wettest scenario (bottom right)



Source: de Sherbinin, A.; Chai-Onn, T.; Giannini, A.; Jaiteh, M.; Levy, M.; Mara, V.; Pistolesi, L.; Trzaska, S. (2014): Mali Climate Vulnerability Mapping. *USAID. http://community.eldis.org/.5b9bfce3/Mali-CV-Mapping-Revised-CLEARED.pdf*

Map 8: Biophysical exposure to climate change effects

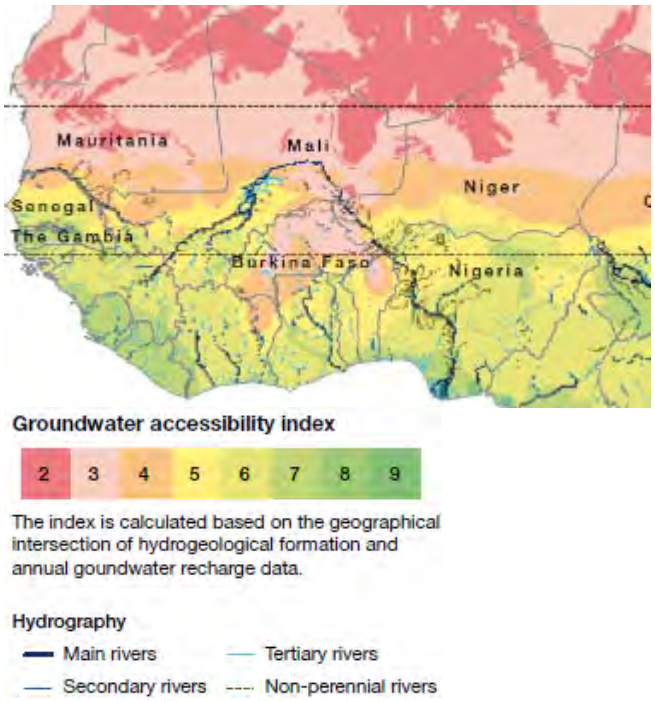
NB: the far north of the country was not taken into account due to its low population density.



NB: a higher number signifies higher exposure to climate change, measured by a number of indicators (including total precipitation and variation, temperature, and flood frequency).

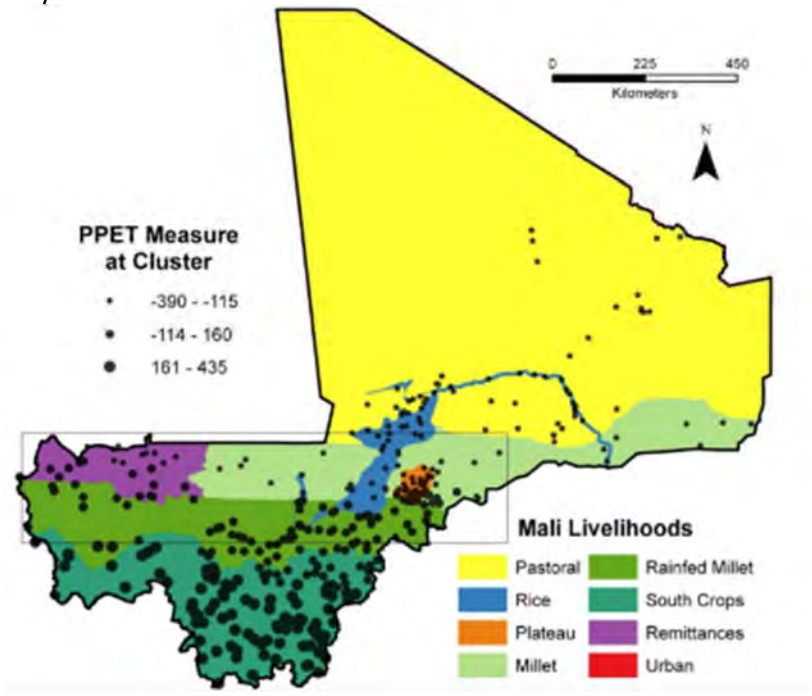
Source: De Sherbinin et al. (2014)

Map 9: Groundwater access and renewable water resources in the Sahel



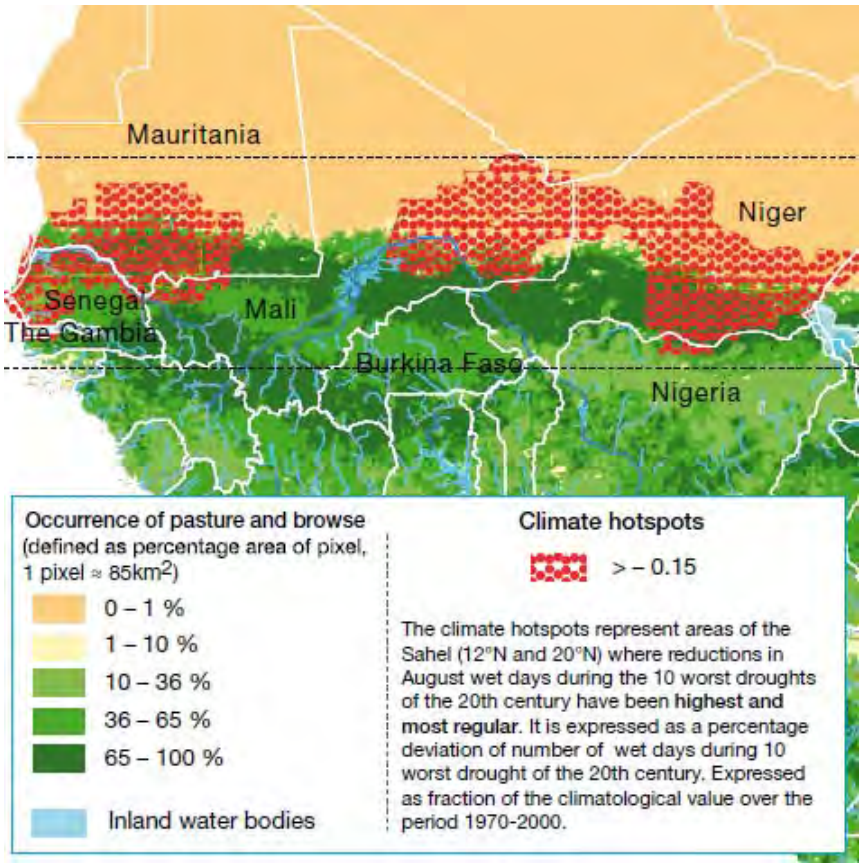
Source: Heinrigs, P. (2011): Security Implications of Climate Change in the Sahel Region: Policy considerations. *OECD.* http://www.oecd.org/swac/publications/47234320.pdf

Map 10: Livelihood zones in Mali



Source: Jankowska, M.S.; Lopez-Carr, D.; Funk, C.; Husak, G.J.; Chafe, Z.A. (2012): Climate Change and Human Health: Spatial Modeling of Water Availability, Malnutrition, and Livelihoods in Mali, Africa

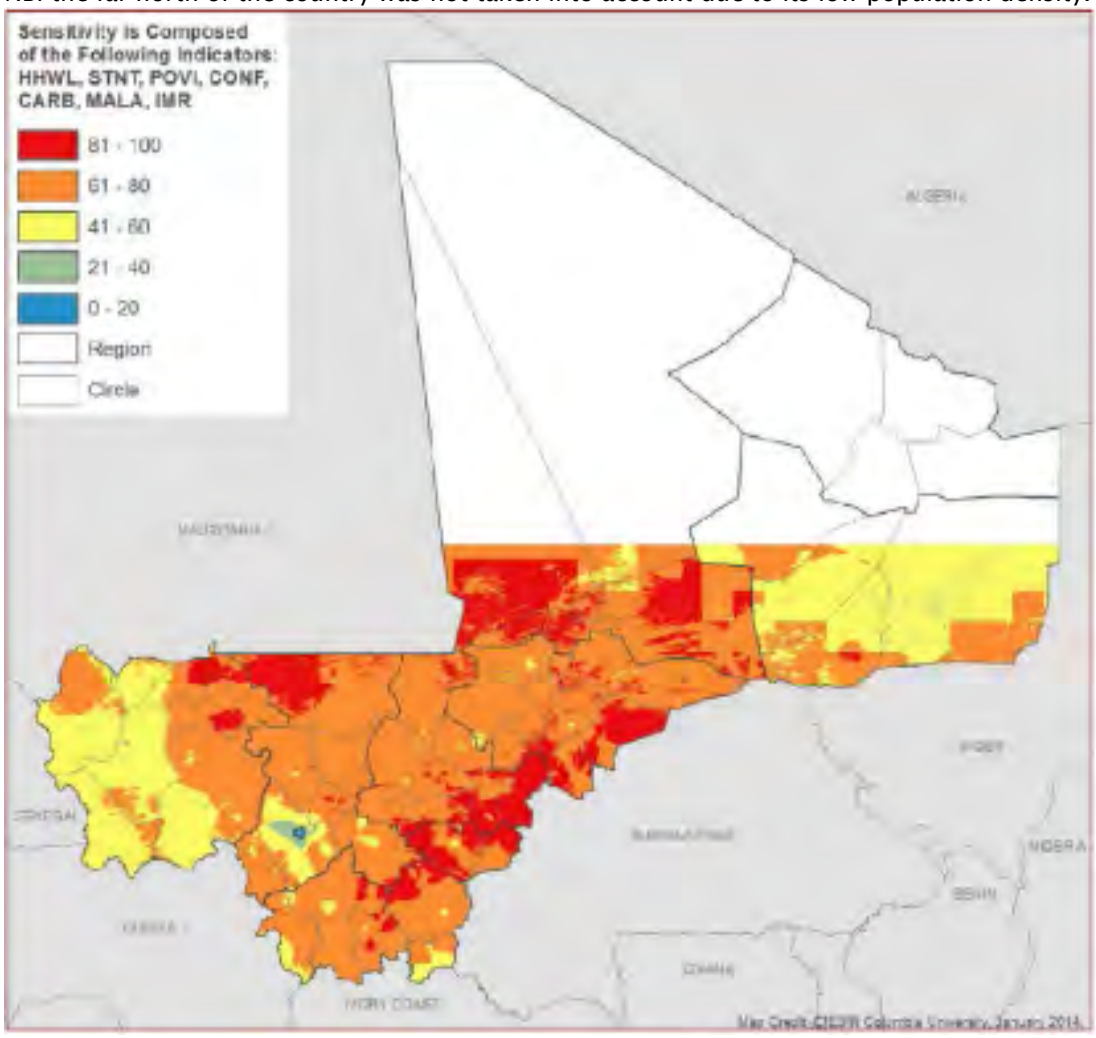
Map 11: Climate hotspots and pastures



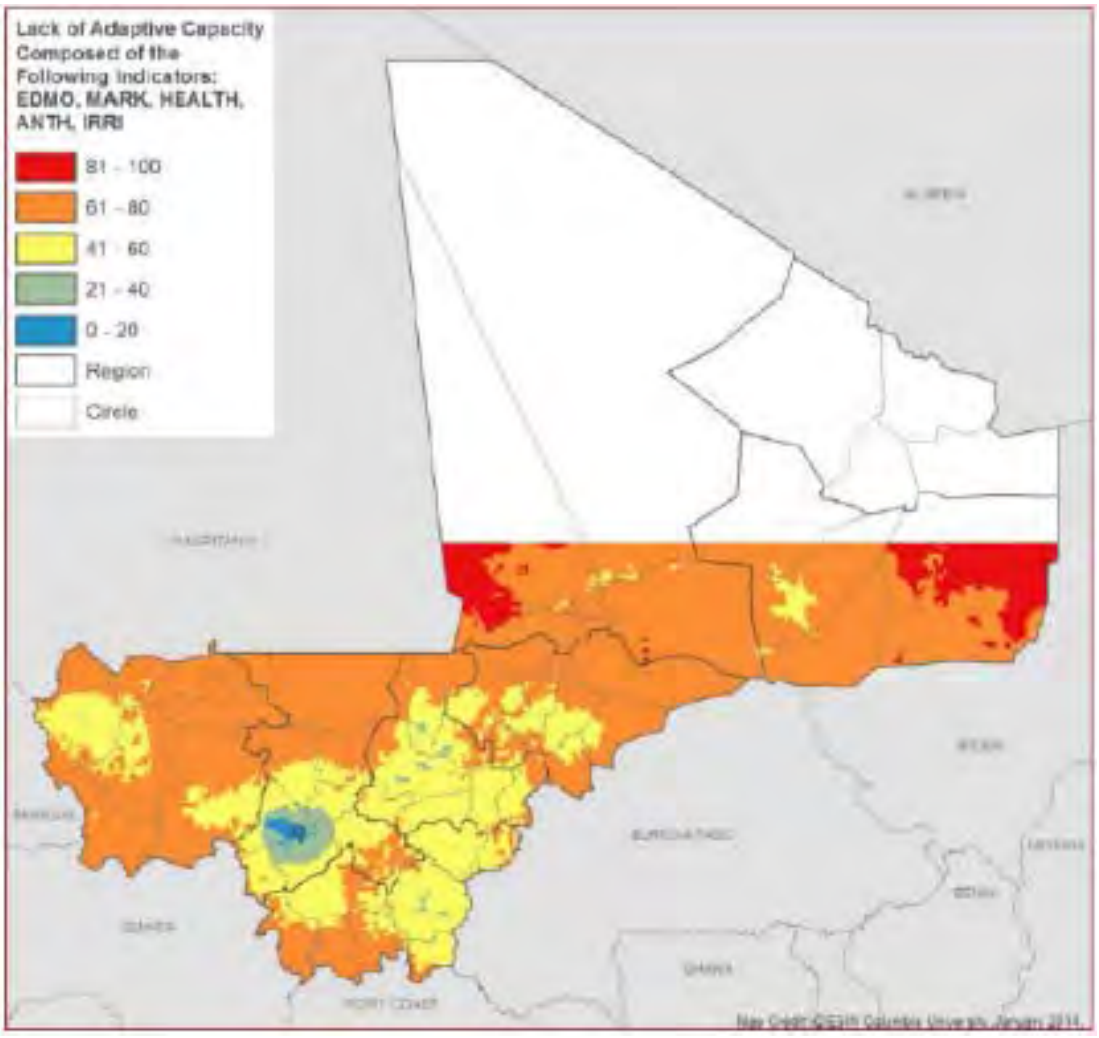
Source: Heinrigs, P. (2011): Security Implications of Climate Change in the Sahel Region: Policy considerations. *OECD.* http://www.oecd.org/swac/publications/47234320.pdf

Map set 12: Socio-economic sensitivity to climate change (top) and lack of adaptive capacity to climate change effects (bottom)

NB: the far north of the country was not taken into account due to its low population density.



NB: a higher number signifies *higher* sensitivity to climate change, measured by a number of indicators (including wealth, infant mortality, stunting, poverty, conflicts, soil quality, and malaria).



NB: a higher number signifies *lower* adaptive capacity to climate change, measured by a number of indicators (including education, market accessibility, health infrastructure, and irrigated area).

Annex: List of projects in Mali under bilateral and multilateral climate funds

Primary Source: Climate Funds Update (2016): http://www.climatefundsupdate.org/data

Name of Project	Fund	Funding Approved (USD millions)	Disbursed (USD millions)	Fund Type
Enhancing Adaptive Capacity and Resilience to Climate Change in the Agriculture Sector in Mali	Least Developed Countries Fund (LDCF)	3.1	3.1	Multilateral
Integrating Climate Resilience into Agricultural Production for Food Security in Rural Areas	Least Developed Countries Fund (LDCF)	2.2	2.2	Multilateral
Strengthening Resilience to Climate Change through Integrated Agricultural and Pastoral Management in the Sahelian zone in the Frame-work of the Sustainable Land Management Approach	Least Developed Countries Fund (LDCF)	2.3	2.3	Multilateral
Flood Hazard and Climate Risk Management to Secure Lives and Assets in Mali	Least Developed Countries Fund (LDCF)	9.1		Multilateral
Preparation of a National Action Plan for Adaptation in Mali	Least Developed Countries Fund (LDCF)	0.2	0.2	Multilateral
Strengthening the Resilience of Women Producer Groups and Vulnerable Communities in Mali	Least Developed Countries Fund (LDCF)	5.6	5.6	Multilateral
Readiness program support	Green Climate Fund (GCF)	0.3		Multilateral
Strengthening Climate Resilience in Sub-Saharan Africa: Mali Country Project [Africa Hydromet Program]	Green Climate Fund	22.8		Multilateral
Programme Support for Climate Change Adaptation in the vulnerable regions of Mopti and Timbuktu	Adaptation Fund (AF)	8.5		Multilateral

Name of Project	Fund	Funding Approved (USD millions)	Disbursed (USD millions)	Fund Type
Fostering agricultural productivity project	Adaptation for Smallholder Agriculture Programme (ASAP)	10	2.4	Multilateral
GCCA in Mali: CC integration in the development strategies and management of forestry sector	Global Climate Change Alliance (GCCA)	6.6	4.9	Multilateral
Promotion of the Use of Agrofuels from the Production and Use of Jatropha Oil in Mali	Global Environment Facility (GEF4)	0.95	0.95	Multilateral
Promoting Sustainable Electricity Generation in Malian Rural Areas through Hybrid Technologies	Global Environment Facility (GEF5)	1.2		Multilateral
Project for Scaling up Renewable Energy in Mali	Scaling-Up Renewable Energy Program for Low Income Countries (SREP)	1.5		Multilateral
Investment Plan Preparation Grant	Scaling-Up Renewable Energy Program for Low Income Countries (SREP)	0.2	0.2	Multilateral
MALI First Biennial Update Report	Global Environment Facility (GEF6)	0.4	0.4	Multilateral
Third National Communication to the UNFCCC	Global Environment Facility (GEF5)	0.5	0.5	Multilateral
Rural Electrification Hybrid Systems	Scaling-Up Renewable Energy Program for Low Income Countries (SREP)	14.9		Multilateral
Innovative development planning for climate change adaptation	Germany's international Climate Initiative	3.9		Bilateral
Supporting the national strategy for adaptation to climate change[70]	SIDA and Government of Norway	5,8		Multilateral
Natural resources management in a changing climate in Mali	World Bank	8.4		Multilateral

[70] https://www.giz.de/en/worldwide/31402.html

Name of Project	Fund	Funding Approved (USD millions)	Disbursed (USD millions)	Fund Type
Fostering agricultural productivity Project	World Bank IFAD	70 41.9		Multilateral
Mali Sustainable Land Management	Word Bank	6.2		Multilateral
Energy Support Project	World Bank	120		Multilateral
Great Green Wall[71]	World Bank, GEF	USD 1 billion for 12 projects in 12 countries		Multilateral
Feed the Future[72]	US Aid			Bilateral

[71] http://terrafrica.org/great-green-wall/

[72] https://www.usaid.gov/mali/agriculture-and-food-security